Volume 1
Architectural & Structural

PROJECT

New Modular Police Building

Ahtahkakoop, Saskatchewan

PROJECT No.	SET No.
S-35-2014	
DATE	
August 12, 2016	

Volume 2
Mechanical & Electrical

PROJECT

New Modular Police Building

Ahthahkakoop, Saskatchewan

PROJECT No.	SET No.
S-35-2014	
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PART 1 General

1.1 GEOTECHNICAL REPORT

.1 A copy of a detailed geotechnical investigation report with respect to the building site is included as follows:

.1 Title: “Royal Canadian Mounted Police Geotechnical Investigation, New Detachment, Ahtahkakoop, Saskatchewan. File No. S2068”

.2 Date: January 30, 2015

.3 Prepared by: Clifton Associates Ltd., 340 Maxwell Crescent, Regina, SK, S4N 5Y5.

.2 This report records properties of the soils and recommendations for the design of foundations, prepared primarily for the use of the Consultant. The recommendations given shall not be construed as a requirement of this Contract unless also contained in the Contract Documents.

.3 The geotechnical report, by its nature, cannot reveal all conditions that exist or can occur on the site. Should subsurface conditions, in the opinion of the Consultant, be found to vary substantially from the report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Price accruing to the Owner.

.4 Direct all questions pertaining to the geotechnical investigation report to the Departmental Representative.

PART 2 Products

2.1 NOT USED

.1 Not used.

PART 3 Execution

3.1 NOT USED

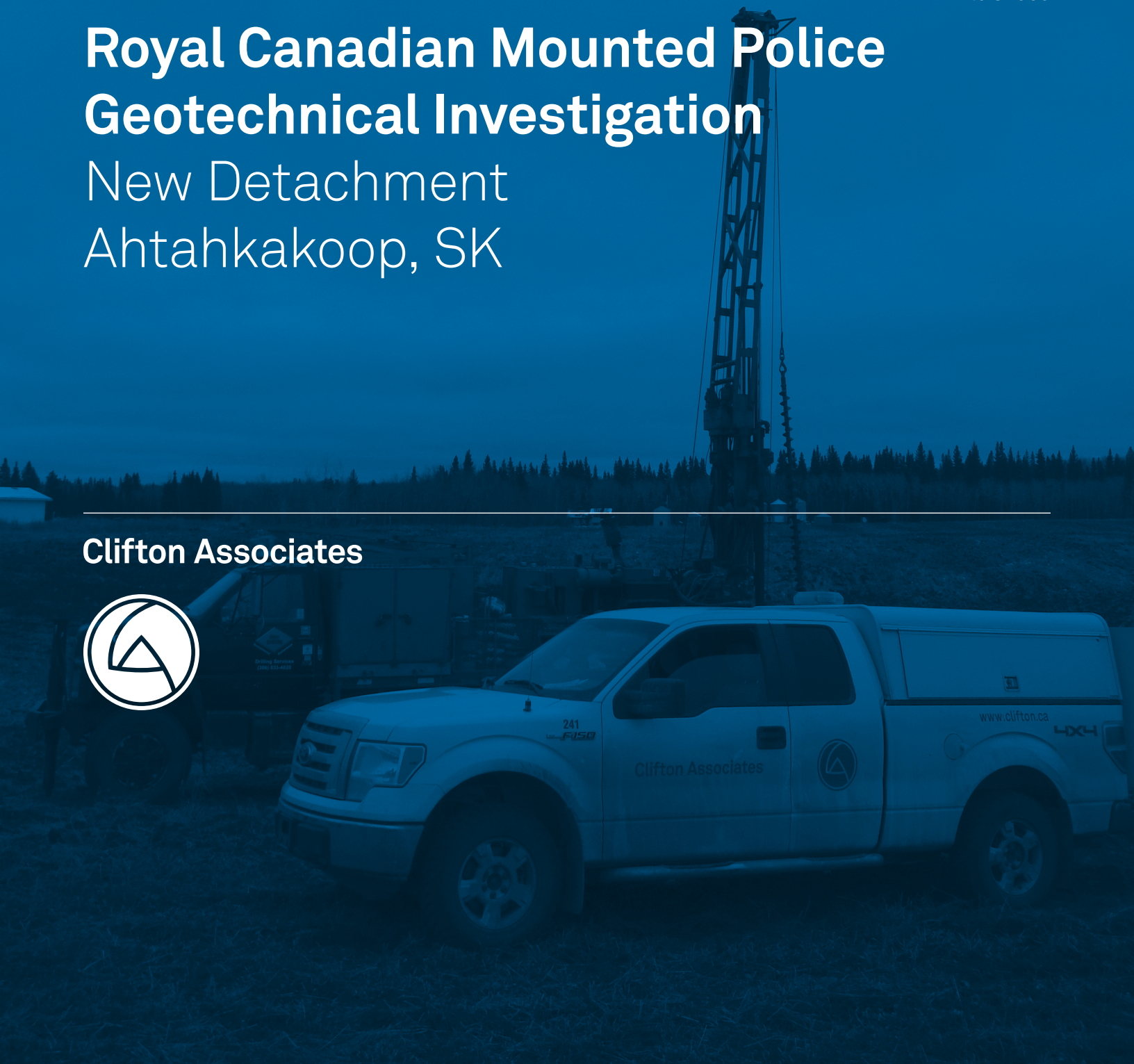
.1 Not used.

END OF SECTION

File S2068

Royal Canadian Mounted Police
Geotechnical Investigation

New Detachment
Ahtahkakoop, SK



Clifton Associates

Clifton Associates

30 January 2015

Attention: Mr. Corey Schneider
Company: RCMP
Address: National Project Delivery Office
PO Box 6500
5600 11th Avenue
Regina, SK S4P 3J7

Geotechnical Report **S2068**
RCMP Detachment
Ahtahkakoop, SK

We are pleased to present to you our geotechnical report regarding the above subject.

We thank you for the opportunity to work with you on this project. If you have any questions regarding this report, please contact me.

Yours truly,

Clifton Associates Ltd.

Jon Osback PEng
Geotechnical Engineer
JO/hd

Distribution: RCMP - 2 hardcopies and 1 electronic (PDF) copy
Clifton - 1 copy

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1.0 Introduction

This report presents results of a geotechnical investigation conducted for the new RCMP Detachment Facility to be constructed in Ahtahkakoop, Saskatchewan. The legal address of the Site is Lot 12, Plan 103353 CLSR SK, Ahtahkakoop I.R. No. 104, Saskatchewan, as shown on Drawing No. S2068-01. Authorization to proceed was received by RCMP Purchase Order No. 7199231 dated 16 September 2014, via email from Tania Sentes, Procurement and Contracting Services, RCMP.

In general, the objectives of this work were:

- To define the subsurface soil strata and groundwater conditions in the area of the proposed development.
- To provide recommendations for suitable methods of foundation support for proposed structures.
- To provide pavement structure recommendations.
- To provide recommendations for excavations, backfill and drainage.
- To provide general site development criteria.
- To provide commentary on pertinent geotechnical issues identified during the subsurface investigation.

2.0 Description of the Site and Proposed Structures

It is our understanding that the facility will consist of a one storey structure with a footprint of about 820 m^2, and a separate 70 m^2 storage building. The detachment building is expected to have a crawl space with a footprint smaller than the main floor. Highway 790 borders the Site on the north, and an overhead powerline runs along the highway ditch. The areas immediately to the west and south are undeveloped. There is a private residence located to the east, and a small residential subdivision to the southeast. There are no utilities on this site.

The Site is currently undeveloped agricultural cropland that had been recently ploughed, leaving no vegetation. The local topography is hummocky/rolling, and is nearly level in the northern portions of the Site. It slopes gently towards the south in the middle section of the Site. It then droops approximately 2 m into a linear east to west lowland near the south end of the site before quickly rising again off site. Surficial drainage is directed south to the lowland, and off site to the east.

General foundation recommendations contained herein are provided for the proposed structures. These recommendations can be revised for specific loadings or configurations, if required, once additional details are known. This office must be advised of any changes so that the applicability of these recommendations can be assessed.

3.0 Field and Laboratory Investigation

Subsurface conditions were investigated by five boreholes drilled at the site as shown on Drawing No. S2068-02. Boreholes were drilled on 30 October 2014 using a truck mounted CME 75 drill rig using 150 mm diameter solid stem auger and 200 mm hollow stem auger. The boreholes were drilled to a maximum depth of 12.2 m below surface.

Representative disturbed and undisturbed samples were recovered for laboratory analysis. Sampling was started at a depth of 0.75 m and continued at a 0.75 m interval to 4.6 m. After this depth, the sampling interval was increased to 1.5 m. Standard Penetration Test (SPT) samples were collected in four boreholes, with disturbed cutting samples being collected in the remaining two boreholes. Poor standup conditions including significant groundwater prevented the collection of any thin walled tube (Shelby) samples.

Standpipe piezometers were installed in Boreholes BH101, BH103 and BH105 to monitor groundwater levels. The piezometers were constructed using 50 mm diameter Schedule 40 PVC pipe with a machined screen. Filter sand was placed around the screen, and a bentonite seal placed on top of the sand. The remainder of the annulus was filled with cuttings.

Borehole locations were recorded using a handheld GPS unit. The accuracy of the measurements is not known. Borehole elevations were measured relative to a temporary benchmark, which was the top of the southern most power pole anchor near the northwest corner of the lot with an assumed elevation of 100.000 m.

The natural water content of each sample was determined. Other testing included determination of Atterberg limits, water soluble sulphate content and maximum dry density of selected representative samples. SPT data collected in the field was used to estimate the in situ density of non cohesive soils. The undrained shear strength of cohesive soils was estimated using field pocket penetrometer data as well as correlation with SPT data.

Observations made during the field investigation, visual descriptions and the results of laboratory tests are recorded in the Borehole Logs, and the Summary of Sampling and Laboratory Test Data which are appended to this report. An explanation of the symbols and terms used in the borehole logs is included in the Symbols and Terms section of this report.

Laboratory testing was conducted in accordance with procedures and methodologies described in ASTM standards. The determination of the Unified Soil Classification in accordance with ASTM D2487 includes the measurement of grain size distribution with respect to gravel, sand and silt and clay sized particles. It also includes the laboratory measurement of plasticity, including plastic limit and liquid limit in accordance with ASTM D4318. Atterberg limits and determination of the plasticity of soil provides more useful information on the effect of the clay sized fraction on soil behaviour. The Standard Proctor test (ASTMD698) was used to determine the maximum dry density and optimum water content of soil

4.0 Analysis

4.1 Stratigraphy

Stratigraphy generally consisted of sand overlying glacial till to the depth of exploration. The thickness of organic topsoil varied from 150 mm to 250 mm. Frozen soil was encountered in some boreholes within the upper 1 m.

Fine to coarse grained sand with varying amounts of silt and gravel and occasional cobbles and boulders was encountered to a depth of 5.4 m to 10 m below ground surface. Sand varied from dark brown to yellowish brown to very dark gray in colour and was moist to wet. Standard penetration test (SPT) N values in the sand ranged from 14 to 29 blows for 300 mm penetration, indicating a compact in situ density. The average and median value was 19.5 blows.

Standard Proctor tests were conducted to determine the maximum dry density and optimum water content of the sand. Composite samples were collected in Boreholes BH103 and BH105 in the upper 3 m. The maximum dry densities and optimum water contents were 1,808 kg/m^3 at 13.2% and 1,809 kg/m^3 at 14.9%.

Glacial till was encountered below the sand to the depth of exploration, with the exception of Borehole BH104 where sand was encountered below the till from about 10 m to 12.2 m. The till matrix varied in texture from silty sand and clay to clayey sandy silt, and generally had trace gravel, cobbles and boulders. Till was moist and dark gray in colour. Its consistency was estimated on the basis of observation of cuttings and inferred from SPT blow counts. Consistency ranged from firm to very hard, with an estimated undrained shear strength of 100 to 200 kPa. Cobbles and boulders are common within glacial till and were encountered during drilling, and should be expected in excavations and during piling.

4.2 Groundwater Regime

Seepage was noted during drilling as high as 3 m below ground surface, below which depth the sand was wet. Significant sloughing was observed. Standpipe piezometers were installed in Boreholes BH101, BH103 and BH105, with the tips placed at a depth of 4.8 m, 8.8 m and 8.2 m, respectively. Groundwater levels were measured on 27 November 2014, which was approximately three weeks after installation. Groundwater levels varied from 3 m below ground surface in Borehole BH101 to 6.1 m in Borehole BH103, corresponding to elevation 93.6 m to 93.7 m.

Groundwater levels are expected to fluctuate with the level of development in the area, as well as seasonal changes in precipitation, infiltration and evaporation. It is not possible to predict increases in groundwater levels with precision; however, it is not unusual for groundwater levels to increase over time after development. Groundwater levels may rise temporarily due to irrigation or snowmelt as water infiltrates the surface and flows vertically and horizontally through the upper sand. This water may report to excavations or crawlspaces with time.

5.0 General Discussion

The major geotechnical issues associated with this project are:

- Seismic site characterization and design parameters.
- Frost susceptibility and heave.
- Foundations to support the proposed structures.
- Site development criteria, including stable cut and fill slopes.
- Roadway surfacing.
- Excavations.

5.1 Seismic Site Response

The site classification for seismic site response, as described in NBCC 2010 (Table 4.1.8.4A), can be based on the average estimated undrained shear strength or average standard penetration test blow count in the upper 30 m. Shear wave velocity was not measured for this site. SPT blow counts averaged about 20 in the upper 10 m, and more than 50 below that depth in glacial till. The weighted average was less than 50. On this basis, design can assume Site Class D conditions for seismic response.

For Site Class C conditions, the acceleration based site coefficient, F_a = 1.0 and the velocity based site coefficient, F_v = 1.0. The peak ground acceleration (PGA) and the 5% damped spectral response acceleration values for 0.2, 0.5, 1.0, and 2.0 second periods, $S_a(T)$, for the site are summarized in Table 5.1. Values of F_a and F_v as a function of site class have been summarized in Tables 5.2 and 5.3.

Table 5.1 Seismic Data

$S_a(0.2)$	$S_a(0.5)$	$S_a(1.0)$	$S_a(2.0)$	PGA
0.095	0.057	0.026	0.008	0.036

Table 5.2 Values of F_a as a Function of $S_a(0.2)$

$S_a(0.2) \leq 0.25$	$S_a(0.2)=0.50$	$Sa(0.2)=0.75$	$S_a(2.0)=1.00$	$S_a(0.2) \geq 1.25$
1.3	1.2	1.1	1.1	1.0

Table 5.3 Values of F_v as a Function of $S_a(1.0)$

$S_a(1.0) \leq 0.1$	$S_a(1.0) = 0.2$	$S_a(1.0) = 0.3$	$S_a(1.0) = 0.4$	$S_a(1.0) \geq 0.5$
1.4	1.3	1.2	1.1	1.1

5.2 Frost

Sand with silt and clay sized particles will be frost susceptible. The depth of freezing in this area will vary, depending on air temperature, ground cover, the type of any fill material utilized during development, and other factors. The depth of freezing will be greatest for sand with low water content. Where groundwater is not present or is present at great depth, the risk of ice segregation and associated heave is reduced. Frost heave can be an issue for unheated structures. The depth to groundwater is dependent upon the ground elevation. Groundwater levels were determined to be at about elevation 93.7 m, which was from 3 m to 6 m below ground surface. In general, frost heave will be a potential issue for foundations constructed less than about 4 m from surface, which is the estimated depth of freezing. At this Site, the risk can be minimized by constructing footings below the depth of freezing, or supporting structures on deep foundations.

The depth of the foundation can be reduced if the foundation is insulated. This will only apply to a structure without a crawlspace or a heated crawlspace. Insulation can be incorporated into an unheated structure, although the amount of insulation required can be substantial.

The depth of burial for water lines or other lines that cannot be allowed to freeze should consider local practice. In general, it is recommended that water lines be buried at least 4 m to 5 m below ground surface or finished grade to reduce the risk of freezing. Shallower lines can be protected using heat trace or closed cell extruded polystyrene insulation. The amount and extent of insulation required will be dependent on several factors, particularly the thermal regime around the pipe, including the depth of burial, surface conditions and fluid temperature, if present.

5.3 Foundation Alternatives

The selection of a suitable foundation will depend on the magnitude of loading and the required performance. Foundation alternatives at this site include:

- Spread footings.
- Driven steel or timber piles.
- Helical piles.

Issues related to foundation construction will include:

- Potential for seepage and poor standup conditions in excavations.
- Cobbles and boulders within the sand stratum.
- Frost penetration.

Shallow spread footings can be supported on the surficial sand stratum. Foundations should be constructed below the anticipated depth of freezing to minimize the risk of frost heave. Foundations may incorporate insulation to limit heat loss and the depth of freezing. Potential heave associated with freezing of sand with a water content of about 4.5% is estimated to be about 8 mm per metre depth of soil below the foundation and to the estimated depth of freezing, which is based on the void ratio of sand and the volumetric increase as water freezes. Heave may be greater if ice segregation occurs.

Settlement of shallow spread footings constructed on compact sand will be predominantly elastic. The magnitude of settlement can be controlled by adjusting footing to limit settlement, and by ensuring good subgrade preparation. The amount of settlement will increase as the size of the footing increases for a constant bearing pressure. The bearing pressure utilized will be controlled by settlement rather than bearing failure.

Augered cast-in-place concrete piles are not considered to be a suitable alternative at this site. Standup conditions in small diameter boreholes were poor below about 3 m, and similar conditions are expected for pile excavations. This would, at a minimum, require the use of temporary sleeving to ensure that excavations were free of sloughing soil and water prior to concreting.

Continuous flight auger (CFA) piles are not considered to be a suitable alternative because of generally high mobilization costs and the need to specify concrete with specific aggregate and admixture requirements.

Driven steel or timber piles are a foundation alternative, although moderately difficult driving conditions are anticipated due to the random presence of cobbles or boulders. Driven piles may be designed on the basis of skin friction and end bearing. It is possible that driven piles will refuse on cobbles or boulders. Steel pipe piles may be driven open ended and filled with concrete after they have been driven to final depth. A soil plug will form while driving, which will increase the effective end bearing area to the gross cross section of the pipe. The box area of an H section pile, defined as the width times the depth, may be used to calculate the end bearing of an H section steel pile. Settlement of piles driven to refusal in the sand is expected to be less than 5 mm to 8 mm.

Helical piles developing their capacity on the basis of skin friction and end bearing may be a suitable alternative. Skin friction along the pile shaft is generally considered to contribute to capacity for a shaft diameter greater than 100 mm. The lateral load carrying capacity of helical piles should be verified as part of the structural design where significant moment associated with lateral loading is present.

5.4 Coefficient of Earth Pressure

Active and passive earth pressure can be calculated using active earth pressure coefficients. Table 5.4 provides a summary of these properties.

Table 5.4 Earth Pressure Coefficients

Material	Angle of Internal Friction	Total Unit Weight	Earth Pressure Coefficients		
	(°)	(kN/m^3)	Active	At-Rest	Passive
Sand	33	18.0	0.29	0.46	3.4
Granular fill	38	20.0	0.24	0.38	4.2

5.5 Coefficient of Friction for Sliding

The friction angle between concrete and soil for concrete poured directly on soil can be assumed to be equal to the angle of internal friction for soil provided in Table 5.3. This assumes a rough contact surface between soil and concrete. For smooth concrete against soil, the tangent of the angle of internal friction should be reduced by 20 percent.

5.6 Modulus of Subgrade Reaction

The modulus of subgrade reaction, k_s (MPa), was estimated on the basis of correlation with SPT N values. On this basis, a value of 35 MN/m^3 may be assumed. The value for the modulus of subgrade reaction should be varied over a range of about ±50% to assess the sensitivity of performance to the assumed value.

5.7 Permeability

The permeability or hydraulic conductivity of sand has been estimated to be about 10^{-2} m/s to 10^{-3} m/s, based on the measured grain size distribution.

5.8 Potential for Liquefaction

Factors influencing liquefaction include soil type, relative density, confining pressure, soil drainage conditions, and seismic conditions. Sand can be susceptible to liquefaction if it is loose and has poor drainage, and if ground accelerations associated with an earthquake or other event is sufficient.

An assessment of liquefaction compares the cyclic shear stress developed by the design earthquake (cyclic stress ratio, CSR) and the resistance to liquefaction possessed by the soil due to its density (cyclic resistance ratio, CRR). The factor of safety against liquefaction is assumed to be the ratio, CRR/CSR.

In simplified terms, the cyclic shear stress caused by an earthquake is assumed to be proportional to the peak ground surface acceleration, which is 0.036 for Ahtahkakoop. For this Site, CSR is calculated to be about 0.005. As a comparison, the CSR for Richmond, British Columbia would be at least about 15 times higher, or about 0.075, depending on factors such as depth and effective stress.

For this site, sand was compact, with an estimated SPT N blow count of about 20. This suggests a CRR of about 0.4 to 0.5. As a comparison, the estimated CRR for loose Fraser River sand is about 0.085.

On this basis, the estimated factor of safety against liquefaction for the site is about 80 or higher. This suggests that it is unlikely that sufficient seismic activity is present that would result in liquefaction.

5.9 Floors

Sand will provide a suitable subgrade for grade supported floor slabs. It is important to understand that the groundwater regime will undergo changes during and after construction. This can affect the performance of floors. Construction of grade supported floor slabs should avoid fill material of unknown composition and condition. If significant fill is contemplated, adequate compaction control and material selection criteria will be crucial to ensure suitable performance. Commentary regarding compaction is provided in a subsequent section. Granular fill is preferred considering strength and the potential for vertical movement; in situ sand will be a suitable fill material with proper control of section and placement. A minimum 150 mm of compacted, crushed base course material should be placed under any floor slab. The thickness of the base course material can be increased as required to provide adequate support for the applied loading.

Any organic or soft material should be removed and the subgrade should be proof rolled to determine the location of any soft areas. These areas should be excavated and filled with a well graded, compacted granular fill. The subgrade should be compacted to at least 98% of the maximum dry density as determined in accordance with the standard Proctor test.

5.10 Excavations

Significant seepage and potentially dewatering is expected for excavations below about elevation 93.7 m, which can be from about 3 m to 6 m below ground surface. This may change seasonally or as a result of precipitation and infiltration.

Soil in this area will be a type 3 soil as defined by Occupational Health and Safety regulations. In general, excavations should be no steeper than about 1 horizontal to 1 vertical (1:1). Although excavations through these materials may stand in the short term at steeper angles, over steepened slopes will slough and collapse if they are left open for long periods of time or if water is allowed to infiltrate. Groundwater seepage may lead to ravelling or erosion of cut slopes in sand. Excavation conditions must be carefully monitored, and slopes flattened during construction if conditions warrant. Failure may be sudden and may endanger personnel and equipment working in the vicinity.

5.11 Roadway Surfacing Structures

The subgrade soil available at this Site is predominantly sand with trace silt and gravel. A design CBR value of 16.0 for this subgrade soil has been assumed.

The existing sand subgrade at this Site will perform similarly to a roadway sub base material. For a gravel surface, 100 mm to 150 mm thickness of crushed base course or traffic gravel can be placed on the existing subgrade in order to prepare driving surfaces in the area of the detachment and housing. This type of structure will require periodic maintenance, including blading and reapplication of a gravel surface.

5.12 General Site Development

5.12.1 Construction Equipment

Standard excavation equipment may be used for site development; no unusual excavation conditions are anticipated. Large vibratory smooth steel drum compacting equipment should be used to compact sand and granular soil.

5.12.2 Topsoil, Cobbles, and Boulders

The thickness of topsoil varied from about 600 mm in Borehole BH101, but appeared to be more typically between 100 mm and 200 mm. Any organic topsoil that is present should be removed prior to placement of any fill to minimize the potential for settlement.

Cobbles were occasionally encountered during drilling. Cobbles and boulders can be expected in excavations.

5.12.3 Groundwater

Groundwater seepage should be expected in excavations below about elevation 93.7 m, which was from 3 m to 6 m below ground surface. Groundwater levels are expected to fluctuate seasonally and with precipitation.

5.12.4 Suitability of On-Site Soil for Compacted Fill

Sand at this Site should be an acceptable material for construction of embankments or fills, although it may be sensitive to small changes in water content when compacting.

5.12.5 Shrinkage Factors

For estimates of earthwork volumes, a shrinkage factor of 15% to 20% may be used for sand.

5.12.6 Engineered Fill

If required, engineered fills supporting important structures should utilize local sand or pit run gravel. Specifications for pit run gravel and sand, and crushed base course material, are appended to this report.

5.12.7 Cut or Fill Slopes

Cut or fill slopes in sand will possess long term stability at slopes of 2 horizontal to 1 vertical (2:1), but may be subject to increased rates of erosion. Flatter slopes are preferred for landscaping purposes. Vegetation can be used to maintain slopes.

Where vegetation is not desirable, a gravel surface with a minimum thickness of 150 mm is recommended on these slopes to reduce the potential for erosion.

Drainage swales and ditches should be constructed with gentle slopes, if possible, as the soil will be easily eroded, particularly if water velocities are greater than 2 m/s.

It is desirable to have road subgrades at least 1.0 m above natural ground on fill sections or to have at least a 1.0 m ditch in cut-fill sections. The surface of the subgrade should have enough cross-slope to ensure positive surface drainage prior to surfacing, nominally 5%.

5.12.8 Site Grading

The Site should be graded to ensure positive drainage throughout the construction phase. Grades should be created to direct water away from excavations and trenches. Within excavations, the subgrade should be graded with a cross slope so that any accumulated water can be removed by pumping.

Proper site grading design is critical to ensure good long term performance of shallow footings. Grades should ensure that water from precipitation or snowmelt does not accumulate near structures. A positive slope away from structures of at least 5% for about 3 m is recommended. Infiltration rate into the sand is expected to be high.

5.13 Compaction Specifications

Compaction specifications must consider the desired properties of the fill. Specifications will typically require compaction to a percentage of the maximum dry density, determined in accordance with the standard Proctor test, and may include a range of water contents that are desirable. Depending on the desired properties for the compacted soil, the water content is often provided as a guide to the contractor, since the compactive effort will usually be minimized if the soil is compacted close to the optimum water content determined in accordance with the standard Proctor test. If the soil is wet of optimum, it will be possible to attain a specified density if greater compactive effort or more work is applied to the soil.

The compaction water content will have an impact on the properties of the compacted soil. Soil strength and compressibility is better if the water content is lower than optimum. Soil compacted wet of optimum to the necessary density may be more compressible under low pressure and may have reduced strength.

The following recommendations are provided for compaction:

- The excavated subgrade should be uniformly compacted to 95% of its maximum dry density, determined in accordance with ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort [12,400 ft-lbf/ft^3 (600 kN-m/m^3)]. The water content of the subgrade should be close to optimum water content.

- Soft areas in the subgrade should be subcut and backfilled with local sand or well graded pit run gravel that is uniformly compacted to at least 100% of its maximum dry density, determined in accordance with ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort [12,400 ft-lbf/ft^3 (600 kN-m/m^3)].

- If considered, granular pads for shallow spread footings should be constructed with local sand or a well graded pit run gravel that conforms to the recommended gradations for granular materials appended to this report. The material should be compacted to a minimum average 98% of maximum dry density for four (4) consecutive tests, with no single test less than 96%, determined in accordance with the standard Proctor test. Lift thickness should not exceed 200 mm.

- Crushed base course that will be under a floor slab, spread footing, or paved area should be compacted to a minimum 98% of its maximum dry density, determined in accordance with the standard Proctor test.

- Fill material that will be under a parking area or roadway should be compacted to a minimum 98% of maximum dry density, determined in accordance with the standard Proctor test, in lifts no thicker than 150 mm in compacted thickness. Fill under landscaped areas does not generally require high density, although some compaction is required to reduce the amount of settlement. A suggested level of compaction is a minimum 90% of maximum dry density, determined in accordance with the standard Proctor test.

- Backfill of trenches in areas that already have been compacted should be with new subbase material as specified previously, and compacted to a minimum 98% of maximum dry density, determined in accordance with the standard Proctor test.

- Backfill and compact simultaneously each side of walls in layers of 300 mm to ensure that excessive pressure is not applied to one side of the wall.

5.14 Potential for Sulphate Attack

Water soluble sulphate contents were less than 0.10% by dry weight of soil in the upper few metres. According to CSA A23.1, the potential for sulphate attack is low. On this basis, sulphate resistant cement (Type HS) would not be required for concrete in contact with the native soil. Additional recommendations regarding sulphate resistant cement may be found in CSA A23.1.

5.15 Corrosion Potential

Sample numbers CD47 and CD49 from Borehole BH105 were submitted to ALS Laboratory Group in Saskatoon for determination of pH. The pH was 9.05 for CD47 and 9.19 for CD49. Corrosive conditions are considered to be present if the pH is less than 5.5; therefore, corrosive conditions are not expected. The laboratory Certificate of Analysis for the pH testing is included in Appendix D.

6.0 Discussion of Foundations

Foundation alternatives at this Site include shallow spread footings constructed on sand, driven steel or timber piles, or helical piles. Some construction difficulties should be expected for deep foundations due to the presence of cobbles and boulders.

6.1 Shallow Spread Footings

Generally, spread footings must be constructed below the anticipated depth of freezing, which in this area could be about 4 m. There is a risk of frost heave associated with ice segregation since groundwater will be close to the freezing front.

6.1.1 Design

Compact sand possesses relatively high bearing capacity. The estimated net ultimate bearing capacity of sand in the upper 5 m is 600 kPa. Resistance factors for shallow foundations from NBCC 2010 have been summarized in Table 6.1.

Table 6.1 Resistance Factors for Shallow and Deep Foundations

Case	Resistance Factor
Shallow Foundations: vertical resistance by semi-empirical analysis using laboratory and in situ test data	0.5
Deep Foundation: bearing resistance to axial load based on semi-empirical analysis using laboratory and in situ test data	0.4
Deep Foundation: analysis using dynamic monitoring results	0.5
Deep Foundation: analysis using static loading test results	0.6
Uplift Analysis: by semi-empirical analysis	0.3
Uplift Analysis: using load test results	0.4
Horizontal Load Resistance	0.5

For a spread footing, the geotechnical resistance calculated using the ultimate bearing capacity and appropriate resistance factor is utilized to ensure that a gross failure of the foundation does not occur. Settlement considerations will typically govern the selection of an appropriate bearing pressure. Consideration of serviceability utilizes working or services loads and unfactored geotechnical properties for soil strata. The estimated serviceability limit pressure for a spread footing is 300 kPa.

6.1.2 Settlement

The amount of settlement will be dependent on factors such as the foundation size and applied pressure. The amount of settlement will increase for a larger foundation with no change in the bearing pressure. The estimated settlement for a spread footing with a width of about 450 mm to 1,000 mm will be less than about 25 mm.

6.1.3 Subgrade Preparation

The width of excavations for major foundations should extend a minimum 1.5 m plus the depth of excavation beyond the edge of the foundation to ensure that the subgrade can be prepared and fill can be properly placed and compacted.

Although the base of large excavations can be level, it is desirable to create a cross slope on the subgrade to encourage the flow of water away from structures during construction and after placement of fill.

The subgrade should be prepared by excavating to the design grade and proof rolling with a heavy roller or other equipment to verify uniformity of the subgrade. Soft material should be excavated an additional 600 mm, minimum and the area backfilled with compacted pit run gravel. Pit run gravel should be compacted to a minimum 100% of its maximum dry density to minimize the potential for differential settlement.

6.2 Driven Steel or Timber Piles

Driven steel or timber piles are a suitable option for this site. Driven steel or timber piles may be designed to develop their capacity on the basis of skin friction and end bearing as the end bearing resistance is fully mobilized by the driving process.

6.2.1 Design

Ultimate values for skin friction have been provided in Table 6.2. Geotechnical resistance factors are provided in Table 6.1. For H-section piles, the box area calculated as the flange width times the depth may be used in the calculation of end bearing. It is assumed that a plug of soil will form between the flanges as the pile is driven. Closed end pipe piles can be utilized. For open end piles, the creation of a soil plug can be assumed, which allows the use of the plugged end area for calculation of end bearing.

Table 6.2 Summary of Ultimate Pile Design Parameters

Depth (m)		Soil	Ultimate Skin Friction		Ultimate End Bearing
from	to		Driven Steel, (kPa)	Driven Timber, (kPa)	(kPa)
0	2	Sand	0	0	-
2	7	Sand	50	60	-
7	12.2	Till	100	110	3,000

* Minimum pile depth is 8 m.

As much as 75% to 85% of the pile capacity will be developed in skin friction. This proportion will vary with the length of the pile, since the skin friction component will increase with increased pile length, while the end bearing component remains relatively constant.

The skin friction contribution of the upper 2 m of pile below finished grade or of any fill material should be ignored in the determination of pile capacity. The minimum length of pile is 8.0 m.

As the pile is struck with a hammer with a quantity of kinetic energy, the pile will penetrate the soil a distance referred to as the set. The size of the set for a given quantity of energy is related to the soil resistance; the smaller the set, the greater the soil resistance. Thus, for a fixed energy in a hammer blow, a smaller set implies a greater pile capacity.

The length of a pile required to support the desired load can be estimated using skin friction and end bearing capacity for a specific pile type with a known cross section. A hammer and driving system must then be selected so that the pile can be driven to the design depth.

The tensile and compressive stresses in the pile during driving must then be analyzed to ensure that the pile is capable of being driven with the selected hammer to the required depth without failing the pile. If analyses indicate that compressive or tensile stresses are excessive, the hammer energy can be reduced.

Additionally, if the predicted blow count to achieve the desired penetration is excessive, defined to be more than about 400 blows/m, a more powerful hammer will be required.

If both the blow count and the compressive stresses are excessive, a pile with a larger section should be selected.

A refusal criteria can be selected to reduce the risk of damage to the pile during driving. However, unless confirmed by dynamic load testing, the pile must be driven to the design depth so that it will possess adequate capacity. 'Refusal' is dependent on the hammer energy. If the hammer selected does not possess adequate energy to drive the pile to the design depth, the pile may be observed to 'refuse'. This will not be an indication that the pile will possess adequate capacity. Practical refusal can be considered to be 400 blows/m, or 2.5 mm/blow.

In general, the hammer energy required to drive a pile will depend on the required pile capacity. As an approximate guide, the hammer-rated energy for driving steel H and pipe piles should be limited to a value of 6×10^6 J times the cross sectional area of the pile to reduce the risk of damage, or about 1.6×10^5 J times the pile head diameter (in metres) for timber.

Piles should be driven continuously once started, since setup, which is generally associated with dissipation of excess pore water pressures with time, may unnecessarily increase the driving effort. In some circumstances, it may be impossible to remobilize a pile that has been left for a few hours. The ratio of the mobilized skin friction while driving to the long term mobilized skin friction of 0.5 will be appropriate for clay soil. No reduction factor is required when considering the end bearing component.

For pile groups, a minimum centre to centre spacing of 2.5 times the pile diameter is recommended. A group efficiency of 1.0 is recommended for the determination of group capacity.

Uplift capacity of a driven steel or timber pile can be calculated on the basis of the ultimate skin friction values provided in Table 6.2 and the geotechnical resistance factors in Table 6.1. The weight of the pile can be included in the calculation. The end bearing component should not be included in the calculation of uplift capacity. The uplift capacity of a pile group will be the lesser of the sum of the uplift resistance of the piles in the group or the sum of the resistance mobilized on the surface perimeter of the group using the ultimate skin friction values provided in Table 6.2 and the geotechnical resistance factors in Table 6.1, plus the effective weight of the soil and piles enclosed within this perimeter.

6.2.2 Settlement

Settlement of a driven steel or timber pile is expected to be less than 5 mm to 10 mm.

6.2.3 Quality Assurance Testing

Load testing of piles is the most positive method to determine load carrying capacity and can form a fundamental part of the pile design process. Load testing can be conducted as part of the design process, during construction as proof tests, or as part of the quality assurance program for construction of the foundation.

The results of a pile load test can be used to evaluate the ultimate load carrying capacity of a pile and its load-settlement behaviour. It also provides a means to verify design assumptions.

Pile load tests may be conducted on production or prototype piles. The design pile capacity may influence the selection of the type of pile tested. If the design capacity of the production pile is high, it may be more economical to test a lower capacity prototype pile to confirm design parameters since it is desired to fail the pile during testing to assess ultimate design parameters.

If dynamic load testing is incorporated into the quality assurance testing program, the design pile capacity can be confirmed for the design pile length or depth of installation. Piles that cannot be driven to the design depth considering a practical refusal criteria of about 2.5 mm/blow should not be accepted unless it can be demonstrated by analysis that the pile has adequate capacity considering the hammer energy and pile set.

The number of pile load tests conducted will depend on the number of piles being driven and the variability of results obtained during construction. Additional pile load tests are suggested if test results indicate variable driving conditions due to the equipment used or subsurface conditions. Piles should be restruck to assess set. In general, the acceptance criterion can be an average capacity of no less than 85% of the estimated ultimate capacity for the tested piles.

6.2.4 Lateral Loads on Piles

The lateral load carrying capacity and deflection of a pile subjected to a lateral load is dependent on the stiffness of the pile and soil strength. The stiffness of a pile can be calculated using well defined properties of steel or concrete, or both; however, the response of soil under loading is subject to some variability. The best method to evaluate the performance of a pile subjected to a lateral load is a well designed and executed lateral load test based on ASTM D3966-07, Standard Test Methods for Deep Foundations Under Lateral Loads.

The performance of laterally loaded piles may be analyzed using the software application LPILE. This program computes deflection, shear, bending moment and soil response with respect to depth in a nonlinear soil. Soil behaviour is modelled with *p-y* curves that are generated by the software following published recommendations for various types of soils. These relationships consider the relationship between undrained shear strength and soil modulus, as well as strain at 50% of the maximum stress.

The lateral load carrying capacity of pile groups will depend on the pile spacing and orientation of the piles. In general, pile spacing should be at least 2.5 pile diameters. For preliminary analyses, an efficiency of 0.70 may be used for a group loaded parallel to the piles. This can be increased to 0.90 for loading perpendicular to the piles.

Pile behaviour may be approximated using analysis that incorporates a coefficient of horizontal subgrade reaction, k_s. The coefficient of horizontal subgrade reaction is a rough approximation at best and includes a high degree of uncertainty due to the influence of stress level, pile geometry and empirical nature of expressions used to derive these values. Values for k_s are summarized in Table 6.3.

Table 6.3 Coefficient of Horizontal Subgrade Reaction, k_s

Soil	Depth (m)	k_s (kN/m^3)
Sand	0 to 1	0
Sand	1 +	2,000z/B to 3,500z/B

z = depth (m)
B = pile diameter (m)

6.3 Helical Piles

Helical piles may be a suitable foundation for this Site. The lateral load carrying capacity of the helical pile should be assessed by a structural consultant.

6.3.1 Design

The basis for design of helical piles considers a component of end bearing and skin friction for the shaft of the pile for a single helix pile or skin friction for a cylinder of soil between helixes for a multiple helix pile. The bottom of the pile should be installed below the depth of freezing, and preferably at least 6 m below ground surface to resist potential frost heave. The minimum depth of penetration is reduced when compared to a driven pile due to the presence of the helix that will provide resistance in uplift. The skin friction component of capacity is typically ignored for a pile shaft diameter less than 100 mm.

The installation torque will be dependent on soil conditions, the ultimate capacity of the pile and its shaft diameter. The installation torque can be estimated using the equation:

$$T = Q_{all} / K_T$$

where: Q_{all} = allowable capacity of the pile in N or lb,
T = torque in N-m or ft-lb, and
K_T = empirical factor.

Values for K_T will likely range from 3/ft to 20/ft for capacity in lb and torque in ft-lb, or 10/m to 33/m for T in N-m. For shafts of about 90 mm diameter, the value for K_T will be about 7/ft (23/m), with K_T decreasing to about 3/ft (10/m) for shaft diameters approaching 200 mm.
For a single helix pile installed into the sand stratum, the ultimate pile capacity, Q_{ult} (kN) can be estimated using the following equation:

$$Q_{ult} = q_{end,ult}\ A + \pi\ d\ q_{skin,\ ult}\ (H - 2)$$

where: $q_{end,ult}$ = ultimate bearing capacity as shown in Table 6.2,
$q_{skin,\ ult}$ = ultimate skin friction as shown in Table 6.2,
A = area of helix (m^2),
d = shaft diameter (m), and
H = depth from ground surface to helix (m).

6.3.2 Settlement

Settlement of a properly designed and installed helical pile is expected to be less than 5 mm to 10 mm.

7.0 General Foundation Recommendations

7.1 Shallow Spread Footing

The following recommendations are made for a shallow spread footing:

- Footings constructed above a depth of about 3 m to 4 m may be prone to frost heave. Insulation may be incorporated into footing design to minimize frost related issues. In general, the bearing surface for a footing should be prepared by removing any pockets of soft soil or soft fill to a uniform bearing surface. The surface must be maintained in an undisturbed state. The excavated surface can be protected with a mudslab placed within 24 hours of completion of excavation.

- Seepage and sloughing should be expected in footing excavations, especially below a depth of about 3 m. Flat cutback angles or shoring may be required. The requirement for pumping of water from excavations should be expected.

- Overexcavated areas may be filled with a lean concrete mix or with a well graded pit run gravel that conforms to the Recommended Specifications for Granular Materials appended to this report. The material must be compacted to 100% of its maximum dry density determined in accordance with ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort [12,400 ft lbf/ft^3 (600 kN m/m^3)].

- The foundation must be adequately reinforced to distribute the applied loads and also have sufficient stiffness to distribute local overstresses.

- The minimum footing width is 450 mm.

- A shallow spread footing constructed as specified above may be designed on the basis of an ultimate bearing capacity of 600 kPa, using the geotechnical resistance factors shown in Table 6.1. For serviceability criteria, bearing capacity can be selected on the basis of settlement or differential settlement as described in previous sections.

7.2 Driven Steel or Timber Piles

Driven piles consisting of steel or timber may be considered to support the proposed structure. For preliminary purposes, our specific design recommendations for a driven pile foundation system are as follows:

- If practical, we recommend that test piles be driven and tested prior to the ordering of construction piles. The test should at least consist of driving the piles, allowing it to sit overnight, and then redriving it the following day. Piles should also be restruck at least two weeks after installation. The pile should not have any further penetration. Group action must be considered when evaluating the results of the test.

- The capacity of the piles may be estimated on the basis of skin friction and end bearing.

- For preliminary design, ultimate values for skin friction and end bearing are summarized in Table 6.2. Geotechnical resistance factors have been provided in Table 6.1. The skin friction contribution of the upper 2 m of pile below finished grade and any fill material should be ignored in the determination of pile capacity.

- Required pile lengths may vary greatly, particularly in pile groups; therefore, the need for qualified inspection, testing of piles and suitable specifications is paramount. The minimum recommended pile spacing for pile groups is 2.5 times the nominal pile width.

- Piles should be driven continuously, once started, to ensure that setup associated with dissipation of excess pore water pressure does not unnecessarily increase the driving effort.

- As an approximate guide, the hammer-rated energy for driving steel H and pipe piles should be limited to a value of 6×10^6 J times the cross sectional area of the pile for steel, or 1.6×10^5 J times the pile head diameter for timber. Practical refusal can be considered to be 400 blows/m, or 2.5 mm/blow.

8.0 Floor Considerations

8.1 Grade Supported Floors

Our recommendations for a grade supported floor slab are as follows:

- The subgrade soil below the proposed floor slab should be excavated to undisturbed soil. Construction on fill material of unknown quality and composition can result in uneven settlement or heave. All topsoil must be removed from the site during subgrade preparation for the grade supported floor slab. Care must be exercised to remove all loose soil and debris. Soft, wet areas, which do not have sufficient trafficability for construction purposes, may be further excavated and replaced with a pit run sand or gravel which complies with the attached specifications.

- The excavated subgrade should be uniformly compacted to 98% of its maximum dry density determined in accordance with ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort [12,400 ft-lbf/ft^3 (600 kN-m/m^3)]. The water content of the subgrade should be adjusted to optimum water content ±2%.

- Place a crushed base course which complies with the specifications given in the Recommended Specifications for Granular Materials appended to this report for Type 32 or 33 base course.

- Compact the base course to a minimum average 98% of its maximum dry density for four (4) consecutive tests, with no single test less than 96%, as determined in accordance with ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort [12,400 ft-lbf/ft^3 (600 kN-m/m^3)]. Water may be used as an aid to compaction and vibratory compaction equipment is recommended.

- A layer of polyethylene sheeting 150 µm (minimum) thick should be placed between the granular base and the concrete slab to deter the migration of moisture through the floor and loss of moisture from freshly placed concrete.

- The floor must be structurally isolated from other building elements, service lines and appurtenant structures to prevent stresses caused by floor movement from being transmitted to these elements.

- Positive site drainage around the building and control of roof drainage away from the building reduces the risk of volume change in grade supported floors.

8.2 Structurally Supported Floor

The following procedures are recommended for the construction of a structurally supported floor:

- The subgrade should be positively graded to a sump to remove water, which may inadvertently pond beneath the floor.
- Migration of moisture from the soil should be prevented by installing 150 m (minimum) thick polyethylene vapour barrier covered with 50 mm of sand.
- Floors designed as a structurally supported system with a crawl space between the floor and the subgrade should have some provision to ventilate the crawl space, particularly during the summer months.
- As an alternative to a crawl space, the floor may be cast upon waxed cardboard carton 'void form' that is designed to degrade following the placement of the concrete. The cardboard cartons must have a strength sufficient to support the fresh concrete until it has sufficient strength to be self-supporting. Great care is required during construction of such floor systems to ensure that the collapse of the cartons does not take place, resulting in a grade supported slab. Careful inspection of these floors during construction is required to ensure that the void does not collapse during the placement of the floor. Further, care must be taken during selection of 'void form' used. Materials which depend upon biologic degradation should be avoided.

9.0 Excavation Considerations

The stability of cut slopes and the stability of any adjacent structure must be considered for any excavations on the Site. The anticipated sideslopes for the excavation will depend on the soil texture, water content, and length of time that the excavation is left open.

Seepage and sloughing should be expected in excavations. Shoring or relatively flat cutback angles will likely be required. Although infiltration rates are expected to be high in sand, the potential requirement for pumping of water from excavations should be considered.

Excavations should be performed in compliance with provincial safety regulations. Soil in this area will be a type 3 soil as defined by Occupational Health and Safety regulations. In general, excavations should be no steeper than about 1 horizontal to 1 vertical (1:1). Although excavations through these materials may stand in the short term at steeper angles, over steepened slopes will slough and collapse if they are left open for long periods of time or if water is allowed to infiltrate. Groundwater seepage may lead to ravelling or erosion of cut slopes in sand. Excavation conditions must be carefully monitored, and slopes flattened during construction if conditions warrant. Failure may be sudden and may endanger personnel and equipment working in the vicinity.

Sideslopes may have to be adjusted in the field as excavation progresses, depending upon conditions encountered. Seepage could contribute to ravelling or sloughing of the sand, and slopes should be monitored and cut back as required during construction. Continuous inspection is recommended since slope failure could be sudden.

All loose material on the sides of the excavation should be trimmed. The excavation should be left open for the minimum amount of time required for construction. Some loss of strength in the soil can be expected with the passing of time, resulting in sloughing and local slope failures.

As described in Occupational Health and Safety Regulations, a competent worker should be stationed on the surface to alert any worker in the excavation about the development of any potentially unsafe conditions. Machinery and heavy equipment should not be allowed closer to the excavation than one half of the depth of the excavation, unless precautions are implemented to ensure that workers in the excavation are safe. Spoil material should not be piled closer than 3 m from the edge of the excavation and with sideslopes no steeper than 1:1.

Infiltration of water into the soil around the excavation can result in loss of strength and collapse of the excavation walls. It is recommended that workers not be in the excavation during rainfall and that excavation walls be carefully inspected for cracking, sloughing, and potential failures after rainfall before work continues in the excavation.

10.0 Underground Walls

It is recommended that the underground walls should be designed to withstand the lateral earth pressure (p) at any depth (H) as estimated by the following expression:

$$p = K(\gamma H + q)$$

where: γ = unit weight of the wall backfill, provided in Table 5.4
q = the vertical pressure of any surcharge acting at ground surface near the wall
K = the active earth pressure coefficient provided in Table 5.4 for a wall that is allowed to rotate, and the at rest earth pressure coefficient for a rigid wall

This expression assumes that the wall will be backfilled with a free draining granular backfill and will not be subject to build up of water pressure behind the wall. If effective wall drainage cannot be guaranteed, full hydrostatic pressure, which may act on the wall, must be considered in the design.

Free draining backfill materials should be placed adjacent to the exterior underground walls. Free draining means that the granular material should be well graded and have less than 3% passing the 75 µm sieve. The upper 0.6 m of backfill should consist of local compacted soil or the surface must be covered with some other suitable impermeable material. The ground surface should be contoured away from the building to further discourage the entry of surface runoff into the backfill. Regardless of the type of backfill used behind the wall, it is recommended that the wall be effectively damp-proofed to prevent migration of moisture through the concrete. Damp-proofing also aids in reducing the rate of deterioration of the concrete due to chemical attack and weathering.

11.0 Closure

This report was prepared by Clifton Associates Ltd. for the use of the RCMP and their agents for specific application to the proposed RCMP Detachment to be located at Lot 12, Plan 103353 CLSR SK, Ahtahkakoop I.R. No. 104, Saskatchewan. The material in it reflects Clifton Associates Ltd. best judgment available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Clifton Associates Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

This report has been prepared with generally accepted engineering practices common to the local area. No other warranty, expressed or implied, is made.

Our conclusions and recommendations are preliminary and based upon the information obtained from the referenced subsurface exploration. The borings and associated laboratory testing indicate subsurface and groundwater conditions only at the specific locations and times investigated, only to the depth penetrated and only for the soil properties tested. The subsurface and groundwater conditions may vary between the boreholes and with time. The subsurface interpretation provided is a professional opinion of conditions and not a certification of the site conditions. The nature and extent of subsurface variation may not become evident until construction or further investigation. If variations or other latent conditions do become evident, Clifton Associates Ltd. should be notified immediately so that we may re-evaluate our conclusions and recommendations. Although subsurface conditions have been explored, we have not conducted analytical laboratory testing on samples obtained nor evaluated the site with respect to the potential presence of contaminated soil or groundwater.

The enclosed report contains the results of our investigation as well as certain recommendations arising out of such investigations. Our recommendations do not constitute a design, in whole or in part, of any elements of the proposed work. Incorporation of any or all of our recommendations into the design of any such element does not constitute us as designers or co-designers of such elements, nor does it mean that the design is appropriate in geotechnical terms. The designers of such elements must consider the appropriateness of our recommendations in light of all design criteria known to them, many of which may not be known to us. Our mandate has been to investigate and recommend which we have completed by means of this report. We have had no mandate to design, or review the design, of any elements of the proposed work and accept no responsibility for such design or design review.

Clifton Associates Ltd.

Jon Osback PEng

Richard T. Yoshida PEng

Association of Professional
Engineers and Geoscientists of Saskatchewan
Certificate of Authorization No. C0238

Appendix A

Clifton Associates
Drawings

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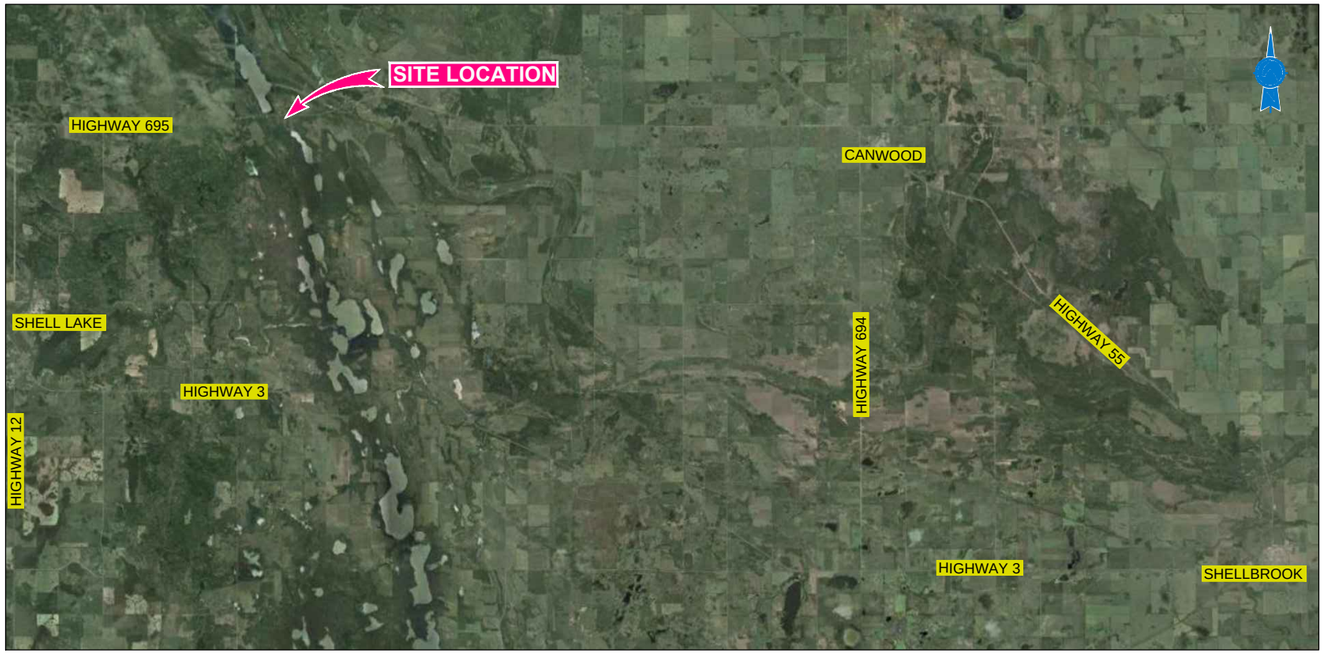
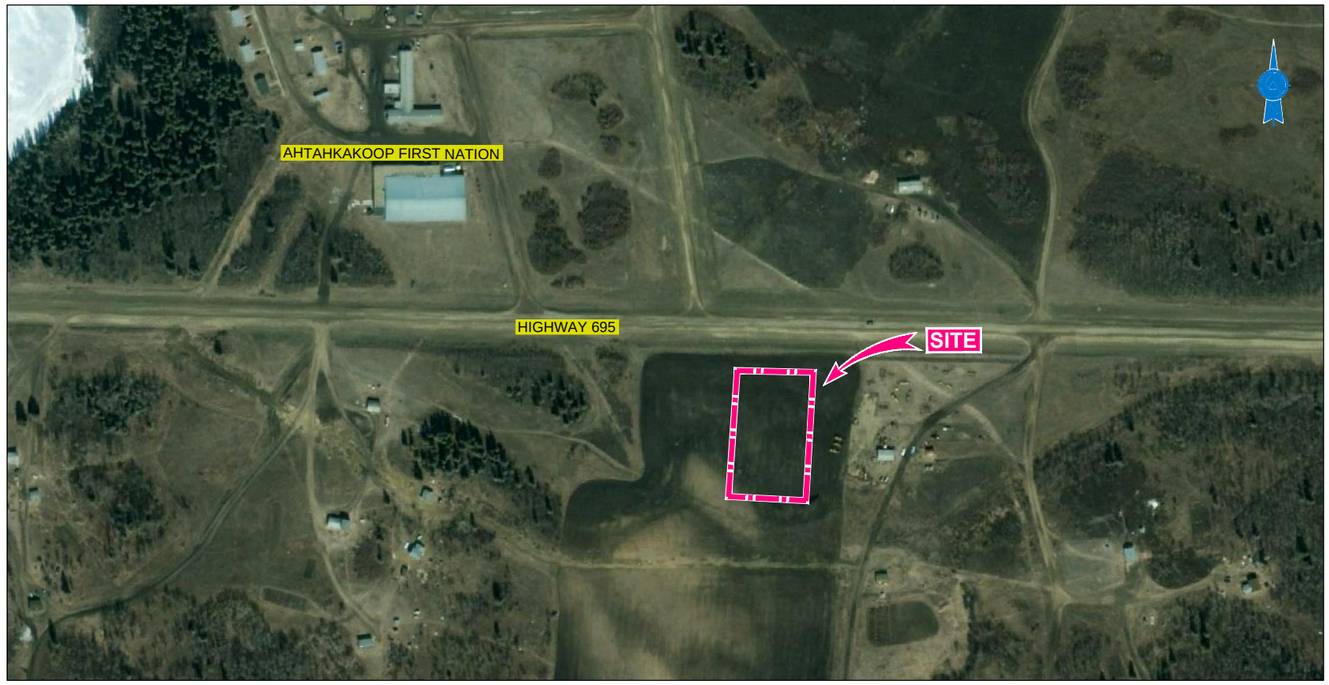
KEY PLAN

SCALE 1:7,500,000



LOCATION PLAN

SCALE: NTS



SITE PLAN

SCALE: 1:5,000

LEGEND

SITE LOCATION

NOTES:
1. IMAGES FROM GOOGLE EARTH PRO, 2002.

DRAWING REVISIONS

REV	DESCRIPTION	BY	DATE

ENGINEER

Clifton Associates

CLIENT

ROYAL CANADIAN MOUNTED POLICE

PROJECT

AHTAHKAKOOP DETACHMENT
GEOTECHNICAL INVESTIGATION

TITLE

SITE LOCATION PLAN

DESIGNED	CD	SCALE	AS SHOWN
DRAWN	SP	PROJECT NO.	S2068
CHECKED	JLO	FILE NO.	S2068-01
		DATE	2014-11-25
		DWG NO.	S2068-01
		SHEET NO.	

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LEGEND

BOREHOLE

GROUNDWATER MONITORING WELL

BENCHMARK
TOP OF SOUTHERN POWER POLE ANCHOR
(100.00m ASSUMED)

SITE LOCATION

NOTES:
1. IMAGES FROM GOOGLE EARTH PRO, 2002.
2. LEGAL DESCRIPTION:
SE 02-57-07 W3M,
AHTAHKAKOOP I.R. NO. 104

DRAWING REVISIONS

REV	DESCRIPTION	BY	DATE

ENGINEER

Clifton Associates

CLIENT
ROYAL CANADIAN MOUNTED POLICE

PROJECT
AHTAHKAKOOP DETACHMENT
GEOTECHNICAL INVESTIGATION

TITLE
BOREHOLE LOCATION PLAN

DESIGNED CD	SCALE 1:2000	DATE 2014-11-25
DRAWN SP	PROJECT NO. S2068	DWG NO. S2068-02
CHECKED JLO	FILE NO. S2068-02	SHEET NO.

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Appendix B

Clifton Associates
Borehole Logs and Laboratory Test Data

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Soil Descriptive Terms

A soil description for geotechnical applications includes a description of the following properties:

- texture
- color, oxidation
- consistency and condition
- primary and secondary structure

Texture

The soil texture refers to the size, size distribution and shape of the individual soil particles which comprise the soil. The Unified Soil Classification System (ASTM D2487-00) is a quantitative method of describing the soil texture. The basis of this system is presented on the following page. The following terms are commonly used to describe the soil texture.

Particle Size (ASTM D2487-00)	
Boulder	300 mm plus
Cobble	75 – 300 mm
Gravel	4.75 – 75 mm
Coarse	19 – 75 mm
Fine	4.75 – 19 mm
Sand	0.075 – 4.75 mm
Coarse	2 – 4.75 mm
Medium	0.425 – 2 mm
Fine	0.075 – 0.425 mm
Silt and Clay	Smaller than 0.075 mm

Relative Proportions (CFEM, 4th Ed., 2006)	
Trace	1 – 10 %
Some	10 - 20 %
Gravelly, sandy, silty, clayey, etc.	20 – 35 %
And	>35 %
Gravel, Sand, Silt, Clay, etc.	35% and main fraction

Gradation	
Well Graded	Having a wide range of grain sizes and substantial amount of all intermediate sizes.
Uniform or Poorly Graded	Possessing particles of predominatly one size.
Gap Graded	Possessing particles of two distinct sizes.

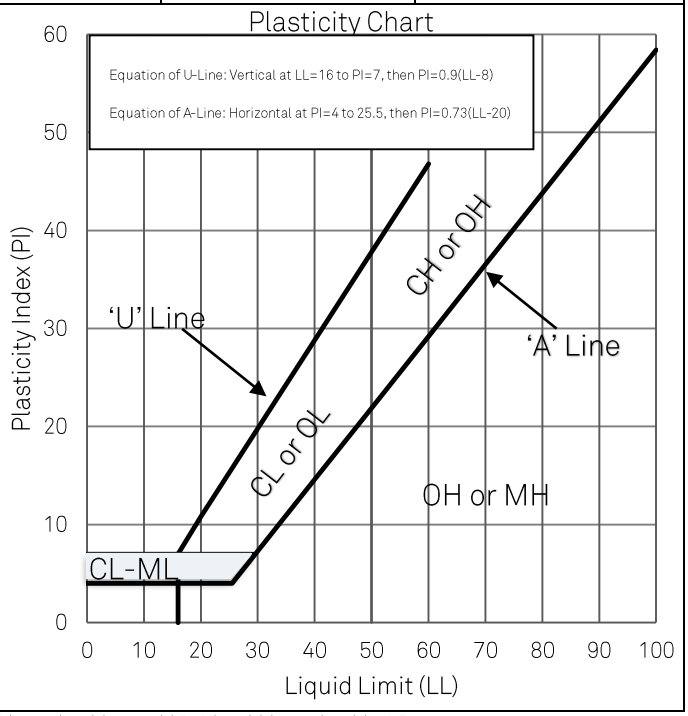
Particle Shape	
Angular	Sharp edges and relatively plane sides with unpolished face.
Subangular	Similar to 'angular' but have rounded edges.
Subrounded	Well-rounded corners and edges, nearly plane sides.
Rounded	No edges, has smoothly curved sides.
Also may be flat, elongated, or both.	

The term "TILL" may be used as a textural term to describe a soil which has been deposited by glaciers and contains an unsorted, wide range of particle sizes.

Colour and Oxidation

The soil color at its natural moisture content is described by common colors and, quantitatively, in terms of the Munsell color notation; (eg. 5Y 3/1). The notation combines three variables, hue, value and chroma to describe the soil color. The hue indicates its relation to red, yellow, green, blue and purple. The value indicates its lightness. The chroma indicates its strength of departure from a neutral of the same lightness. Departure of the soil color from a neutral color indicates the soil has been oxidized. Oxidation of a soil occurs in a oxygen rich environment where most commonly metallic iron, oxidizes and turns a neutral colored soil 'rusty' or reddish brown. Oxidized manganese gives a purplish tinge to the soil. Oxidation may occur throughout the entire soil mass or on fracture/joint/fissure surfaces.

Classification of Soils for Engineering Purposes
ASTM Designation D 2487-00 (Unified Soil Classification System)

Major divisions			Group Symbol	Typical Names	Classification Criteria			
Coarse-grained soils More than 50% retained on No. 200 sieve* (>0.075 mm)	Gravels More than 50% of coarse fraction retained on No. 4 sieve(4.75 mm)	Clean gravels <5% fines	GW	Well-graded gravel	If 15% sand add "with sand" to group name.	Classification on basis of percentage of fines: Less than 5% pass No. 200 sieve - GW, GP, SW, SP More than 12% pass No. 200 sieve - GM, GC, SM, SC 5 to 12% pass No. 200 sieve - Borderline classifications, use of dual symbols	$C_u = \frac{D_{60}}{D_{10}} \geq 4$; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravel			Not meeting either Cu or Cc criteria for GW	
		Gravels with >12% fines	GM	Silty gravel			Atterberg limits below "A" line or PI less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravel			Atterberg limits on or above "A" line and PI > 7	If fines are organic add "with orgnic fines" to group name
	Sands 50% or more of coarse fraction passes No. 4 sieve(<4.75 mm)	Clean sands <5% fines	SW	Well-graded sand	If 15% gravel add "with gravel to group name		$C_u = \frac{D_{60}}{D_{10}} \geq 6$; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sand			Not meeting either Cu or C ccriteria for SW	
		Sands with >12% fines	SM	Silty sand			Atterberg limits below "A" line or PI less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sand			Atterberg limits on or above "A" line and PI > 7	If fines are organic add "with orgnic fines" to group name
Fine-grained soils50% or more passes No. 200 sieve* (<0.075 mm)	Silts and Clays Liquid Limit <50%	Inorganic	ML	Silt	If 15 to 29% coarse-grained, add "with sand" or "with gravel" as appropriate. If > 30% coarse-grained, add "sandy" or "gravelly" as appropriate. Class as organic when oven dried liquid limit is < 75% of undried liquid limit.			
			CL	Lean Clay -low plasticity				
		Organic	OL	Organic clay or silt (Clay plots above 'A' Line)				
	Silts and Clays Liquid Limit >50%	Inorganic	MH	Elastic silt				
			CH	Fat Clay -high plasticity				
		Organic	OH	Organic clay or silt (Clay plots above 'A' Line)				
	Highly Organic Soils		PT	Peat, muck and other highly organic soils				

*Based on the material passing the 3 in.(75 mm) sieve, if field samples contain cobbles or boulders, add "with cobbles or boulder`s" to group name

Consistency and Condition

The consistency of a cohesive soil is a qualitative description of its resistance to deformation and can be correlated with the undrained shear strength of the soil. The condition of a coarse grained soil qualitatively describes the soil compactness and can be correlated with the standard penetration resistance (ASTM D1586-99).

Consistency of Ceohesive Soil (CFEM, 4th Edit., 2006)		
Consistency	Undrained Shear Strength (kPa) (CFEM, 4th Edit., 2006)	Field Identification (ASTM D2488-00)
Very Soft	<12	Thumb will penetrate soil more than 25 mm.
Soft	12 – 25	Thumb will penetrate soil about 25 mm.
Firm	25 – 50	Thumb will indent soil about 6 mm.
Stiff	50 – 100	Thumb will indent, but penetrate only with great effort (CFEM).
Very stiff	100 – 200	Readily indented by thumbnail (CFEM).
Hard	>200	Thumb will not indent soil but readily indented with thumbnail.
Very Hard	N/A	Thumbnail will not indent soil.

Consistency of Coarse Grained Soil (CFEM, 4th Edit., 2006)	
Compactness Condition	SPT N – Index (Blows/300mm)
Very Loose	0 – 4
Loose	4 – 10
Compact	10 – 30
Dense	30 – 50
Very Dense	Over 50

Moisture Conditions (ASTM D2488-00)	
Description	Criteria
Dry	Absence of moisture, dusty, dry to touch.
Moist	Damp but no visible water.
Wet	Visible, free water, usually soil is below water table.

Structure

The soil structure is the manner in which the individual soil particles are assembled to form the soil mass. The primary soil structure is the arrangement of soil particles as originally deposited. The secondary soil structure refers to any rearrangement of the soil such as deformation and cracking which has taken place since deposition.

Primary Soil Structure (Depositional)

Geometry

Stratum	- A single sedimentary 'layer', greater than 10 mm in thickness, visibly separable from other strat by a discrete change in lithology and/or sharp physical break.
Homogeneous	- Same colour and appearance throughout.
Stratified	- Consisting of a sequence of layers which are generally of contrasting texture or colour.
Laminated	- Stratified with layer thickness between 2 – 10 mm.
Thinly Laminated	- Stratified with layer thickness less than 2 mm.
Bedded	- Stratified with layer thickness greater than 10 mm.
Very Thinly Bedded (Flaggy)	- Stratified with layer thickness between 10 – 50 mm.
Thinly Beddy (Slabby)	- Stratified with layer thickness between 50 – 600 mm.
Thickly Beddy (Blocky)	- Stratified with layer thickness between 600 – 1200 mm.
Thick-Bedded (Massive)	- Stratified with layer thickness greater than 1200 mm.
Lensed	- Inclusions of small pockets of different soil, such as small lenses of sand material throughout a mass of clay.

Bedding Structures

Cross-bedding	- Internal 'bedding' inclined to the general bedding plane.
Ripple-bedding	- Internal 'wavy bedding'.
Graded-bedding	- Internal gradation of grain size from coarse at base to finer at top of bed.
Horizontal bedded	- Internal bedding is parallel and flat lying.

Secondary Soil Structure (Post-Depositional)

Accretionary Structures

Includes nodules, concretions, crystal aggregates, veinlets, color banding, and:

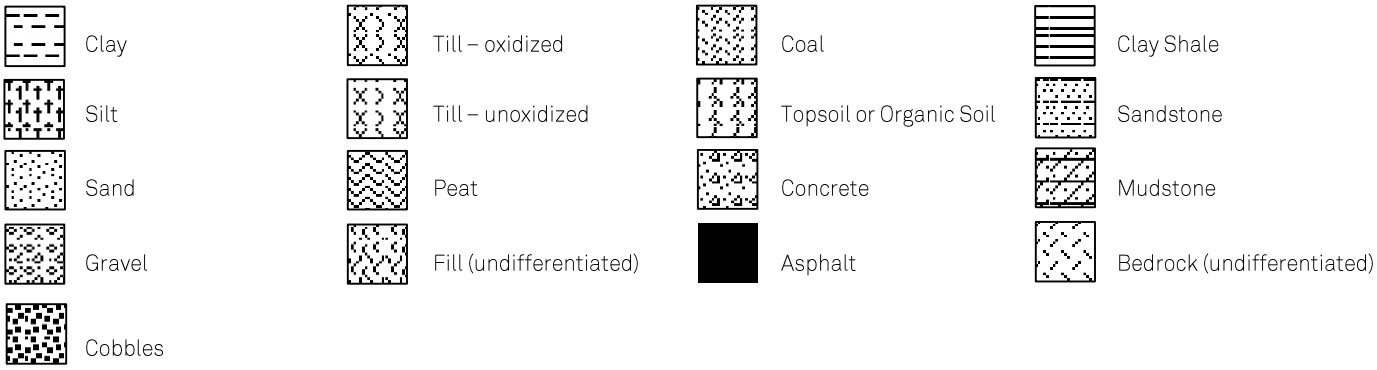
Cementation	- Chemically precipitated material, commonly calcite ($CaCO_3$), binds the grains of soil, usually sandstone. Described as weak, moderate, or strong (ASTM D2488-00).
Salt Crystals	- Groundwater flowing though the soil/rock often precipitates visible amounts of salts. Calcite ($CaCO_3$), glauber salts ($Na_2Ca(SO_4)_2$), and gypsum ($CaSO_4*2H_2O$) are common.

Fracture Structures

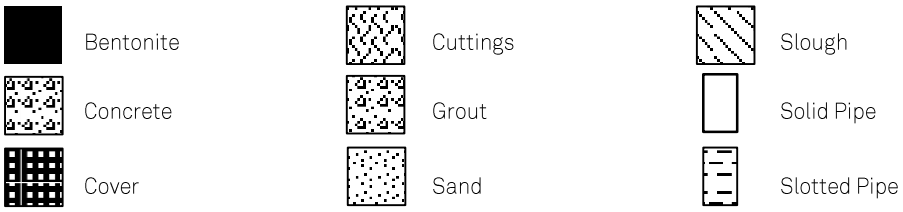
Fracture	- A break or discontinuity in the soil or rock mass caused by stress exceeding the materials strength.
Joint	- A fracture along which no displacement has occurred.
Fissure	- A gapped fracture, which may open and close seasonally. Usually an extensive network of closely spaced fractures, giving the soil a 'nuggetty' structure.
Slickensides	- Fractures in clay that are slick and glossy in appearance, caused by shear movements.
Brecciated	- Contains randomly orientated angular fragments of a finer mass, usually associated with shear displacement in soils.
Fault	- A fracture or fracture zone along with displacement has occurred.
Blocky	- A cohesive soil that can be broken down into small angular lumps which resist further break down.

Symbols Used on Borehole Logs

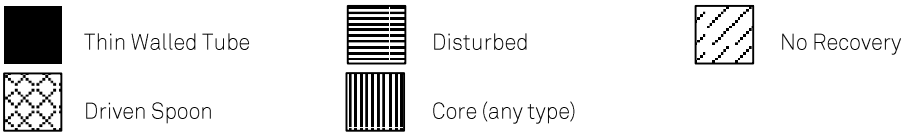
Lithology Type



Borehole Completion and Backfill Materials



Soil Sample Type



Groundwater Symbols

Piezometric elevation as determined by a piezometer installation.

Water levels measured in borings at time and under the conditions noted.

Geotech BH m Elev CAL v08.ldf

Clifton Associates

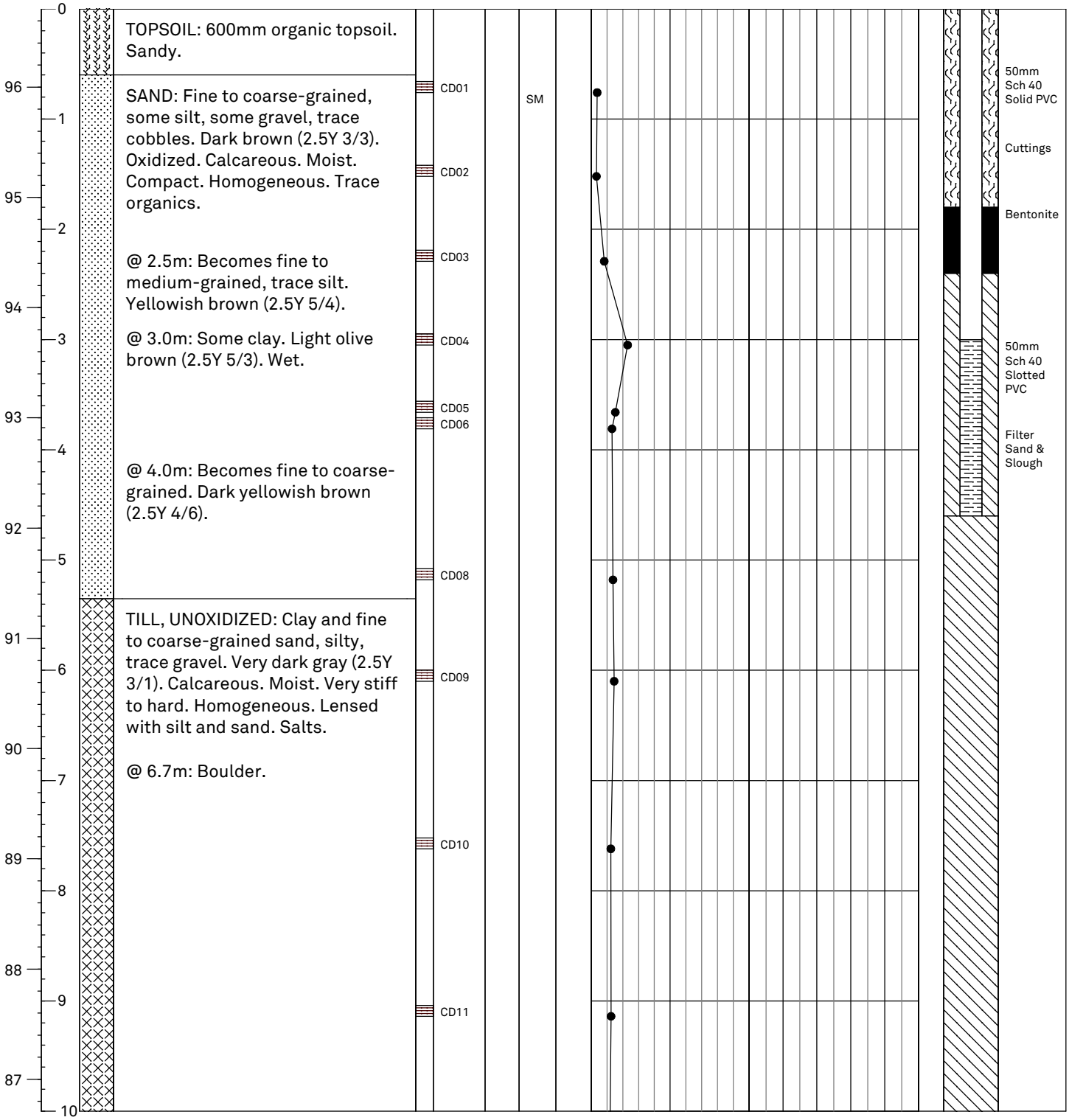
BOREHOLE LOG

Borehole: 101

Page: 1 of 2

Client:	RCMP	Northing:	5915001	Date Drilled:	30 October 2014
Project:	Ahtahkakoop Detachment	Easting:	371860	Drill:	CME 75
Location:	Ahtahkakoop, SK	Ground Elev.:	96.71	Drilling Method:	Solid Stem Auger
Project No.:	S2068	Top Casing Elev.:	97.65	Logged by:	CJD

Elev (m) Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	SPT 'N'	USC	% Sulphate	Moisture Content percent: Plastic Limit / Natural Moisture / Liquid Limit (0 – 50 – 100)	Dry Density - kg/m3 (1800 – 2200); Shear Strength - kPa: Unconf. / Pocket Pen. / Lab Vane (100 – 200 – 300 – 400)	Piezometer Construction Detail



Geotech BH m Elev CAL v08.ldf

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BOREHOLE LOG

Borehole: 101

Page: 2 of 2

Client:	RCMP	Northing:	5915001	Date Drilled:	30 October 2014
Project:	Ahtahkakoop Detachment	Easting:	371860	Drill:	CME 75
Location:	Ahtahkakoop, SK	Ground Elev.:	96.71	Drilling Method:	Solid Stem Auger
Project No.:	S2068	Top Casing Elev.:	97.65	Logged by:	CJD

Elev (m) Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	SPT 'N'	USC	% Sulphate	Moisture Content percent: Plastic Limit ▲ / Natural Moisture ● / Liquid Limit ◆ (0 – 50 – 100)	Dry Density - kg/m3 (1800 – 2200) / Shear Strength - kPa: Unconf. ■ / Pocket Pen. ● / Lab Vane ◆ (100 – 200 – 300 – 400)	Piezometer Construction Detail
10 / 86		NOTES: End of hole at 10.7m. Drilled using 125mm continuous flight solid stem auger. Slough to 3.0m immedietely after drilling.		CD12						
11 / 85										
12 / 84										
13 / 83										
14 / 82										
15 / 81										
16 / 80										
17 / 79										
18 / 78										
19 / 77										
20										

Summary of Sampling and Laboratory Test Data

Sample				Water Content	Consistency				Gradation				Sulphate Content	Shear Strength			Dry Density
Depth	Number	Type	Recovery		Plastic Limit	Liquid Limit	Plasticity Index	USC	Gravel	Sand	Silt	Clay		Compression Test	Lab Vane	Pocket Penetrometer	
meters			mm	%	%	%	%		%	%	%	%	%	kPa	kPa	kPa	kg/m^3
0.76	CD01	Bag		3.8	Non-Plastic			SM	15.7	66.0	18.3						
1.52	CD02	Bag		3.3													
2.29	CD03	Bag		8.2													
3.05	CD04	Bag		23.0													
3.66	CD05	Bag		15.2													
3.81	CD06	Bag		13.2													
5.18	CD08	Bag		13.7													
6.10	CD09	Bag		14.5													
7.62	CD10	Bag		12.4													
9.14	CD11	Bag		12.5													
10.67	CD12	Bag		11.5													

Remarks

Approved by

Clifton Associates

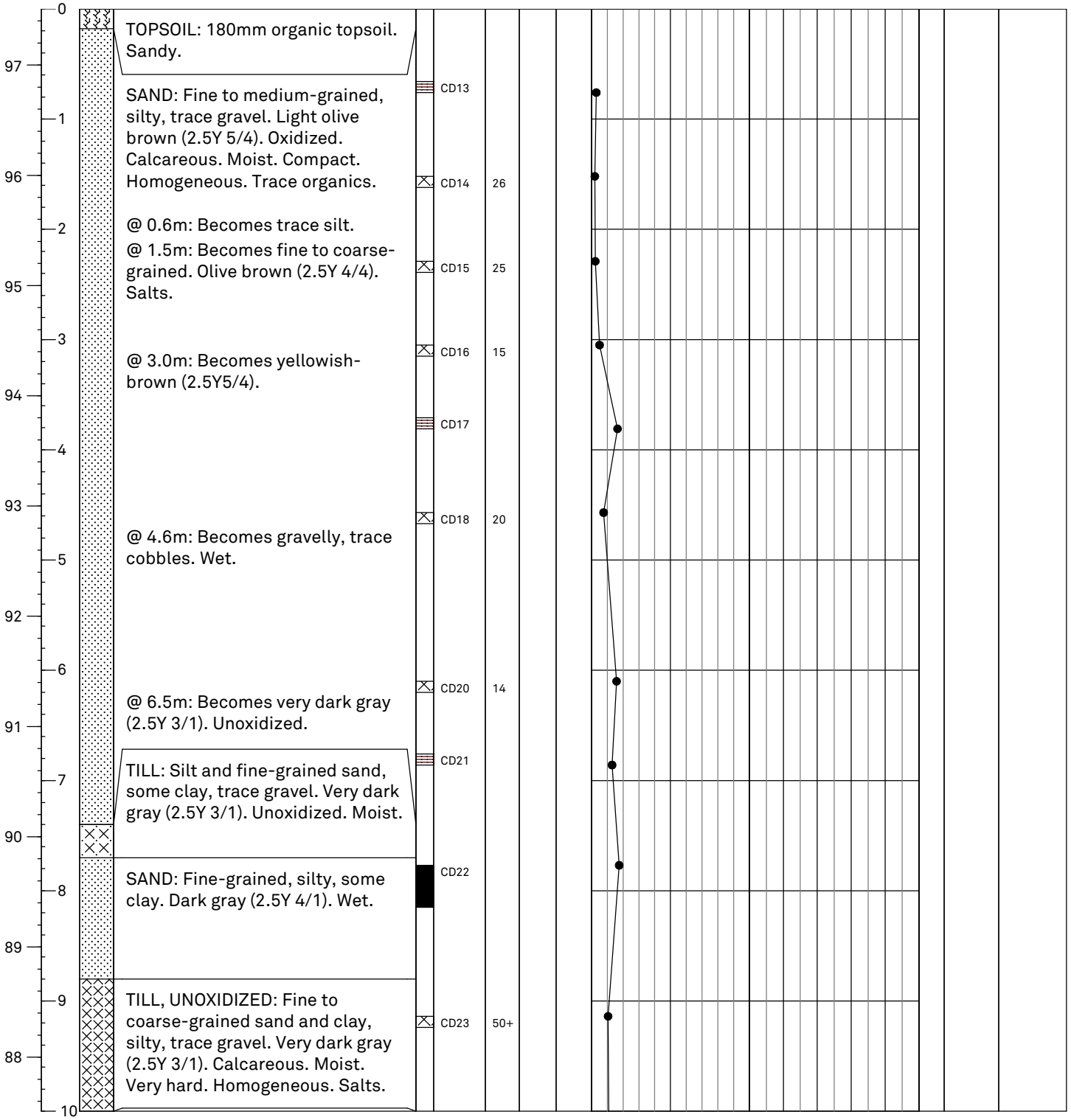
Project No. S2068
Client RCMP
Project Ahtahkakoop Detachment Geotech
Location Ahtahkakoop, SK
Borehole No. 101

Clifton Associates

BOREHOLE LOG

Borehole: 102

Client:	RCMP	Northing:	5915004	Date Drilled:	30 October 2014
Project:	Ahtahkakoop Detachment	Easting:	371897	Drill:	CME 75
Location:	Ahtahkakoop, SK	Ground Elev.:	97.51	Drilling Method:	Auger
Project No.:	S2068	Top Casing Elev.:		Logged by:	CJD



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Clifton Associates

BOREHOLE LOG

Borehole: 102

Page: 2 of 2

Client:	RCMP	Northing:	5915004	Date Drilled:	30 October 2014
Project:	Ahtahkakoop Detachment	Easting:	371897	Drill:	CME 75
Location:	Ahtahkakoop, SK	Ground Elev.:	97.51	Drilling Method:	Auger
Project No.:	S2068	Top Casing Elev.:		Logged by:	CJD

Elev (m) / Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	SPT 'N'	USC	% Sulphate	Moisture Content (percent): Plastic Limit ▲ / Natural Moisture ● / Liquid Limit ◆ (0 – 50 – 100)	Dry Density - kg/m3 (1800 – 2200) / Shear Strength - kPa: Unconf. ■ / Pocket Pen. ● / Lab Vane ◆ (100 – 200 – 300 – 400)	Piezometer Construction Detail
87 / 10		TILL, UNOXIDIZED: Fine to coarse-grained sand and clay, silty, trace gravel. Very dark gray (2.5Y 3/1). Calcareous. Moist. Very hard. Homogeneous. Salts.	⊠	CD24	50+					
86 / 11		NOTES: End of hole at 11.0m. Drilled to 7.6m using 200mm continuous flight solid stem auger. Drilled 7.6m to 11.0m using continuous flight hollow stem auger. Hollow stem auger refusal at 11.0m. Slough to 4.3m immediately after hollow stem removal.								
85 / 12										
84 / 13										
83 / 14										
82 / 15										
81 / 16										
80 / 17										
79 / 18										
78 / 19										
20										

Summary of Sampling and Laboratory Test Data

Sample				Water Content	Consistency				Gradation				Sulphate Content	Shear Strength			Dry Density
Depth	Number	Type	Recovery		Plastic Limit	Liquid Limit	Plasticity Index	USC	Gravel	Sand	Silt	Clay		Compression Test	Lab Vane	Pocket Penetrometer	
meters			mm	%	%	%	%		%	%	%	%	%	kPa	kPa	kPa	kg/m^3
0.76	CD13	Bag		3.0													
1.52	CD14	Spt		2.1													
2.29	CD15	Spt		2.4													
3.05	CD16	Spt		5.1													
3.81	CD17	Bag		16.5													
4.57	CD18	Spt		7.6													
6.10	CD20	Spt		15.8													
6.86	CD21	Bag		13.0													
7.77	CD22	SY	380	17.5											-	-	
9.14	CD23	Spt		10.5													
10.67	CD24	Spt		11.2													

Remarks

Approved by

Clifton Associates

Project No.	S2068
Client	RCMP
Project	Ahtahkakoop Detachment Geotech
Location	Ahtahkakoop, SK
Borehole No.	102

Geotech BH m Elev CAL v08.tdf

Clifton Associates

BOREHOLE LOG

Borehole: 103

Page: 1 of 2

Client:	RCMP	Northing:	5915084	Date Drilled:	30 October 2014
Project:	Ahtahkakoop Detachment	Easting:	371897	Drill:	CME 75
Location:	Ahtahkakoop, SK	Ground Elev.:	99.7	Drilling Method:	Solid Stem Auger
Project No.:	S2068	Top Casing Elev.:	100.73	Logged by:	CJD

Elev (m) Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	SPT 'N'	USC	% Sulphate	Moisture Content percent: Plastic Limit / Natural Moisture / Liquid Limit (0 – 50 – 100)	Dry Density - kg/m3 (1800 – 2200); Shear Strength - kPa: Unconf. / Pocket Pen. / Lab Vane (100 – 200 – 300 – 400)	Piezometer Construction Detail

Elev (m)	Depth (m)	Soil Description	Sample No.	SPT 'N'	USC	% Sulphate	Piezometer Construction Detail
99	0	TOPSOIL: 100mm organic topsoil. Sandy.					
	1	SAND: Fine to coarse-grained, some gravel, trace silt, trace cobbles. Olive brown (2.5Y 3/3). Oxidized. Calcareous. Moist. Compact. Homogeneous. Trace organics.	CD25		SW/SM		50mm Sch 40 Solid PVC
98	2	@ 1.5m: Becomes fine to medium-grained. Light olive brown (2.5Y 5/3). Iron staining. Salts.	CD26	16			Cuttings
97	3		CD27	18		0.01	
			CD28	14			
96	4	@ 3.8m: Becomes some silt, trace gravel. Yellowish-brown (2.5Y 5/4).	CD29	24			
95	5		CD30	21			
94	6	@ 6.1m: Wet. Rock in sampler.	CD31				
93	7						Filter Sand & Slough
92	8	@ 7.6m: Becomes fine to coarse-grained, trace cobbles. Dark gray (2.5Y 4/1). Unoxidized.	CD32				50mm Sch 40 Slotted PVC
91	9						
90	10	@ 9.4m: 300mm silt and sand bed.	CD33				

Geotech BH m Elev CAL v08.ldf

Clifton Associates

BOREHOLE LOG

Borehole: 103

Page: 2 of 2

Client:	RCMP	Northing:	5915084	Date Drilled:	30 October 2014
Project:	Ahtahkakoop Detachment	Easting:	371897	Drill:	CME 75
Location:	Ahtahkakoop, SK	Ground Elev.:	99.7	Drilling Method:	Solid Stem Auger
Project No.:	S2068	Top Casing Elev.:	100.73	Logged by:	CJD

Elev (m) Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	SPT 'N'	USC	% Sulphate	Moisture Content percent: Plastic Limit / Natural Moisture / Liquid Limit (0 – 50 – 100)	Dry Density - kg/m3 (1800 – 2200); Shear Strength - kPa: Unconf. / Pocket Pen. / Lab Vane (100 – 200 – 300 – 400)	Piezometer Construction Detail
10 / 89		TILL, UNOXIDIZED: Silty, clayey, sandy, fine-grained, trace gravel. Dark gray (2.5Y 4/1). Calcareous. Moist. Homogeneous.		CD34						
11 / 88		@ 10.4m: Becomes silt and sand, fine to medium-grained.		CD35						
12 / 87		NOTES: End of hole at 12.2m. Drilled using 125mm continuous flight solid stem auger. Slough to 5.8m immediately after drilling.		CD36						
13 / 86										
14 / 85										
15 / 84										
16 / 83										
17 / 82										
18 / 81										
19 / 80										
20										

Summary of Sampling and Laboratory Test Data

Sample				Water Content	Consistency				Gradation				Sulphate Content	Shear Strength			Dry Density
Depth	Number	Type	Recovery		Plastic Limit	Liquid Limit	Plasticity Index	USC	Gravel	Sand	Silt	Clay		Compression Test	Lab Vane	Pocket Penetrometer	
meters			mm	%	%	%	%		%	%	%	%	%	kPa	kPa	kPa	kg/m^3
0.76	CD25	Bag		2.1	Non-Plastic			SW/SM	11.6	81.6	6.8						
1.52	CD26	Spt		1.9													
2.29	CD27	Spt		2.1									0.01				
3.05	CD28	Spt		2.0													
3.81	CD29	Spt		2.8													
4.57	CD30	Spt		2.2													
6.10	CD31	Spt		14.8													
7.62	CD32	Bag		12.6													
9.14	CD33	Bag		15.5													
10.06	CD34	Bag		16.8													
11.28	CD35	Bag		17.4													
12.19	CD36	Bag		16.0													

Remarks: Prcotor BH103 (0 to 3.0m): Maximum Dry Density: 1858; Optimum Water Content: 13.8%

Approved by:

Clifton Associates

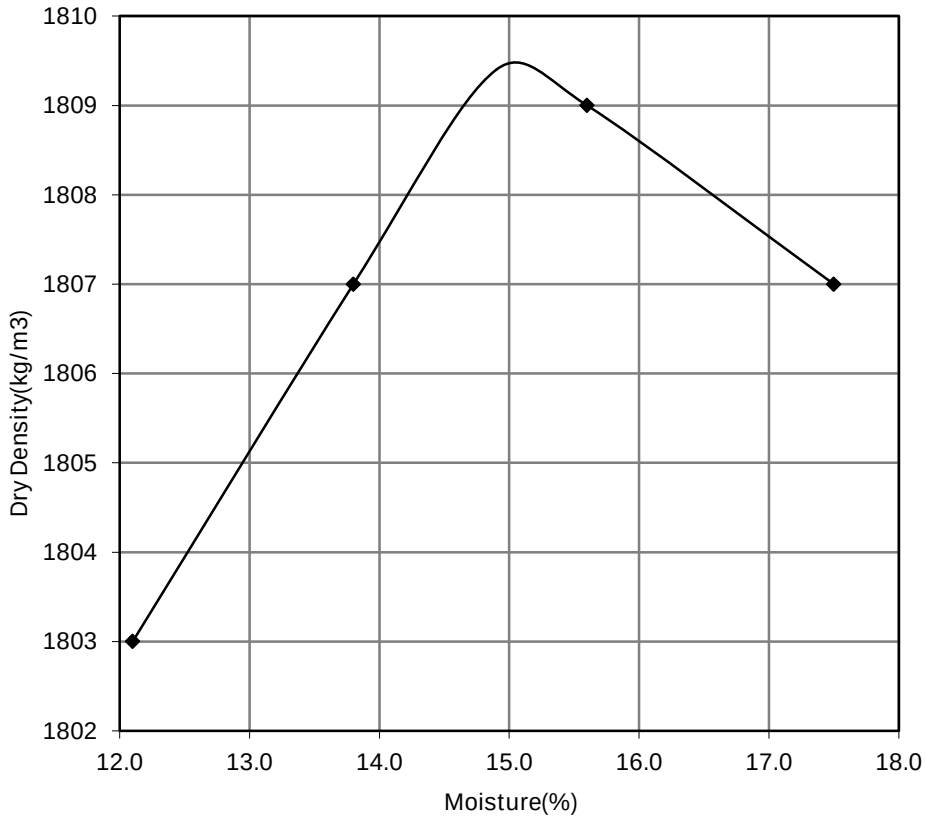
Project No. S2068
Client RCMP
Project Ahtahkakoop Detachment Geotech
Location Ahtahkakoop, SK
Borehole No. 103

Standard Effort Laboratory Compaction Test (Proctor Test)

ASTM D698, Method C

Sample No.	A3101	Date Received	10-Nov-14
Date Sampled	30-Oct-14	Date Tested	13-Nov-14
Time Sampled		Sampled By	CD
Supplied By	Client	Tested By	SAB
Sample Location	BH103 0-10'		
Sample Description	Olive brown sand trace fine to course gravel		

Maximum Dry Density	1809	kg/m^3	Point 1	1803	@	12.1
Optimum Water Content	14.9	%	Point 2	1807	@	13.8
Rock Corrected Dry Density	1858	kg/m^3	Point 3	1809	@	15.6
Rock Corrected Water Content	13.8	%	Point 4	1807	@	17.5
Water Content as Received	6.6	%	LL		PL	
Retained on 4.75mm Sieve	8.2	%	PI		USC	



Approved By

Clifton Associates

Project No.	S2068
Client	RCMP
Project	Ahtahkakoop Detachment
Location	Ahtahkakoop, SK

Geotech BH m Elev CAL v08.tdf

Clifton Associates

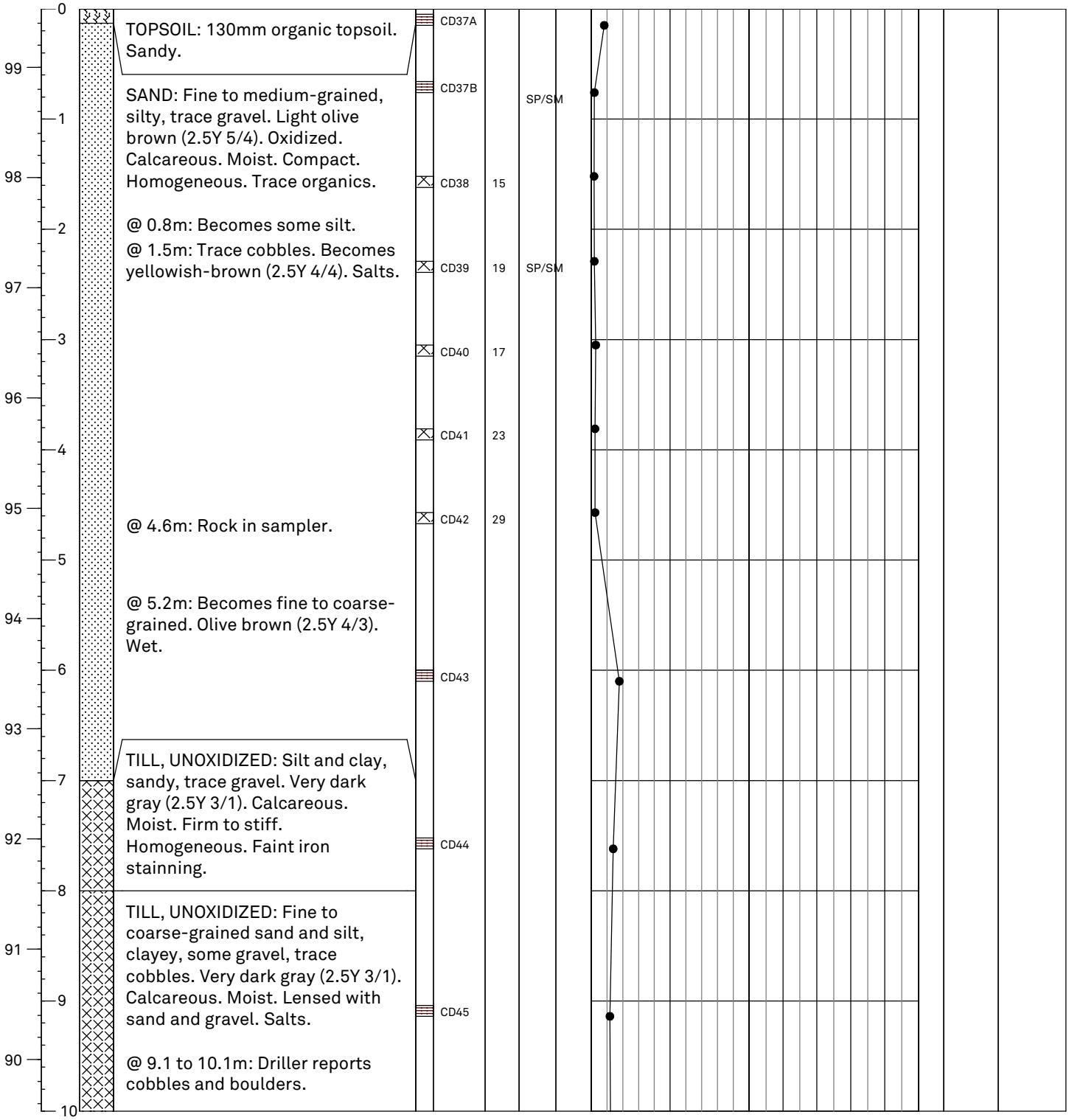
BOREHOLE LOG

Borehole: 104

Page: 1 of 2

Client:	RCMP	Northing:	5915084	Date Drilled:	30 October 2014
Project:	Ahtahkakoop Detachment	Easting:	371860	Drill:	CME 75
Location:	Ahtahkakoop, SK	Ground Elev.:	99.53	Drilling Method:	Solid Stem Auger
Project No.:	S2068	Top Casing Elev.:		Logged by:	CJD

Elev (m) Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	SPT 'N'	USC	% Sulphate	Moisture Content percent: Plastic Limit / Natural Moisture / Liquid Limit (0 – 50 – 100)	Dry Density - kg/m3 (1800 – 2200); Shear Strength - kPa: Unconf. / Pocket Pen. / Lab Vane (100 – 200 – 300 – 400)	Piezometer Construction Detail



Clifton Associates

BOREHOLE LOG

Borehole: 104

Client:	RCMP	Northing:	5915084	Date Drilled:	30 October 2014
Project:	Ahtahkakoop Detachment	Easting:	371860	Drill:	CME 75
Location:	Ahtahkakoop, SK	Ground Elev.:	99.53	Drilling Method:	Solid Stem Auger
Project No.:	S2068	Top Casing Elev.:		Logged by:	CJD

Elev (m) Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	SPT 'N'	USC	% Sulphate	Moisture Content percent: Plastic Limit / Natural Moisture / Liquid Limit (0 – 50 – 100)	Dry Density - kg/m3 (1800 – 2200); Shear Strength - kPa: Unconf. / Pocket Pen. / Lab Vane (100 – 200 – 300 – 400)	Piezometer Construction Detail
10 / 89		SAND: Fine-grained sand, silty, some clay, some gravel, trace cobbles. Very dark gray (2.5Y 3/1). Calcareous. Wet. Homogeneous.		CD46						
11 / 88										
12 / 87		@ 12.0m: Becomes fine to coarse-grained sand, silty, some gravel.								
13 / 86		NOTES : End of hole at 12.2m. Drilled using 125mm continuous flight solid stem auger. Slough to 5.2m immediately after drilling.								
14 / 85										
15 / 84										
16 / 83										
17 / 82										
18 / 81										
19 / 80										
20										

Summary of Sampling and Laboratory Test Data

Sample				Water Content	Consistency				Gradation				Sulphate Content	Shear Strength			Dry Density
Depth	Number	Type	Recovery		Plastic Limit	Liquid Limit	Plasticity Index	USC	Gravel	Sand	Silt	Clay		Compression Test	Lab Vane	Pocket Penetrometer	
meters			mm	%	%	%	%		%	%	%	%	%	kPa	kPa	kPa	kg/m^3
0.15	CD37A	Bag		8.2													
0.76	CD37B	Bag		1.9	Non-Plastic			SP/SM	3.6	90.7	5.7						
1.52	CD38	Spt		1.8													
2.29	CD39	Spt		2.0	Non-Plastic			SP/SM	5.4	88.7	5.9						
3.05	CD40	Spt		2.8													
3.81	CD41	Spt		2.4													
4.57	CD42	Spt		2.4													
6.10	CD43	Bag		17.8													
7.62	CD44	Bag		13.9													
9.14	CD45	Bag		11.8													
12.19	CD46	Bag		13.0													

Remarks

Approved by

Clifton Associates

Project No. S2068
Client RCMP
Project Ahtahkakoop Detachment Geotech
Location Ahtahkakoop, SK
Borehole No. 104

Geotech BH m Elev CAL v08.ldf

Clifton Associates

BOREHOLE LOG

Borehole: 105

Page: 1 of 2

Client:	RCMP	Northing:	5915040	Date Drilled:	30 October 2014
Project:	Ahtahkakoop Detachment	Easting:	371877	Drill:	CME 75
Location:	Ahtahkakoop, SK	Ground Elev.:	99.05	Drilling Method:	Solid Stem Auger
Project No.:	S2068	Top Casing Elev.:	100.17	Logged by:	CJD

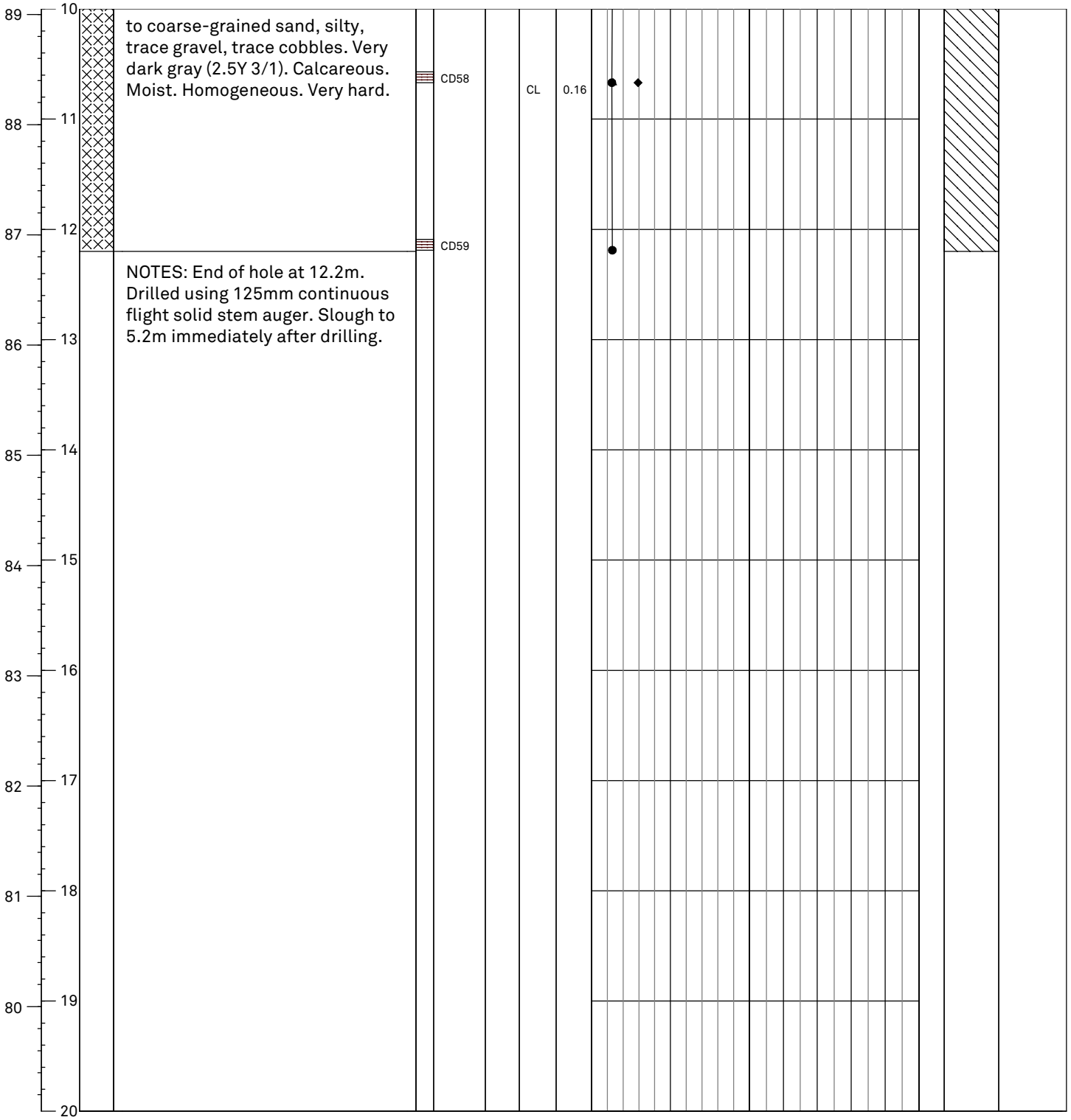
Elev (m) / Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	SPT 'N'	USC	% Sulphate	Moisture Content (percent): Plastic Limit / Natural Moisture / Liquid Limit (0 – 50 – 100)	Dry Density - kg/m3 (1800 – 2200); Shear Strength - kPa: Unconf. / Pocket Pen. / Lab Vane (100 – 200 – 300 – 400)	Piezometer Construction Detail
99 / 0		TOPSOIL: 100mm organic topsoil. Sandy.		CD47						
98 / 1		SAND: Fine to medium-grained, trace silt, trace gravel. Dark yellowish brown (10Y 4/4). Oxidized. Calcareous. Moist. Compact. Homogeneous. Trace organics.		CD48	20	SP/SM	0.01			Cuttings
97 / 2		@ 1.5m: Becomes fine to coarse-grained.		CD49		SP				50mm Sch 40 Solid PVC
96 / 3				CD50	23					
				CD51						
95 / 4										
				CD52	16					
94 / 5		@ 4.6m: Becomes fine to coarse-grained, trace cobbles. Llight olive brown (2.5Y 5/4).								
93 / 6		@ 6.0m: Wet. Very dark gray (2.5Y 3/1).		CD53	20					Filter Sand & Slough
				CD54						
92 / 7										50mm Sch 40 Slotted PVC
		TILL, UNOXIDIZED: Silt, sandy, some fine to medium-grained, some clay, some gravel. Very dark gray (2.5Y 3/1). Calcareous. Moist. Homogeneous.		CD55	18					
91 / 8				CD56						
		SAND: Fine to coarse-grained, silty, trace clay, trace gravel, trace cobbles. Dark gray (2.5Y 4/1). Calcareous. Moist. Very dense. Homogeneous.								
90 / 9				CD57	50					
89 / 10		TILL, UNOXIDIZED: Clay and fine								

Clifton Associates

BOREHOLE LOG

Borehole: 105

Client:	RCMP	Northing:	5915040	Date Drilled:	30 October 2014
Project:	Ahtahkakoop Detachment	Easting:	371877	Drill:	CME 75
Location:	Ahtahkakoop, SK	Ground Elev.:	99.05	Drilling Method:	Solid Stem Auger
Project No.:	S2068	Top Casing Elev.:	100.17	Logged by:	CJD



Summary of Sampling and Laboratory Test Data

Sample				Water Content	Consistency				Gradation				Sulphate Content	Shear Strength			Dry Density
Depth	Number	Type	Recovery		Plastic Limit	Liquid Limit	Plasticity Index	USC	Gravel	Sand	Silt	Clay		Compression Test	Lab Vane	Pocket Penetrometer	
meters			mm	%	%	%	%		%	%	%	%	%	kPa	kPa	kPa	kg/m^3
0.15	CD47	Bag		1.8													
1.52	CD48	Spt		1.9	Non-Plastic			SP/SM	1.9	93.0	5.0		0.01				
2.29	CD49	Bag		3.0	Non-Plastic			SP	1.4	94.8	3.8						
3.05	CD50	Spt		2.9													
3.81	CD51	Bag		3.2													
4.57	CD52	Spt		3.1													
6.10	CD53	Bag		7.3													
6.86	CD54	Bag		14.0													
7.62	CD55	Spt		9.3													
8.38	CD56	Bag		11.8													
9.14	CD57	Spt		13.4													
10.67	CD58	Bag		12.9	13.6	29.5	15.8	CL	2.4	42.0	55.6		0.16				
12.19	CD59	Bag		13.2													

Remarks: Proctor BH105 (0-3.0m): Maximum Dry Density: 1861; Optimum Water Content: 12.3%

Approved by:

Clifton Associates

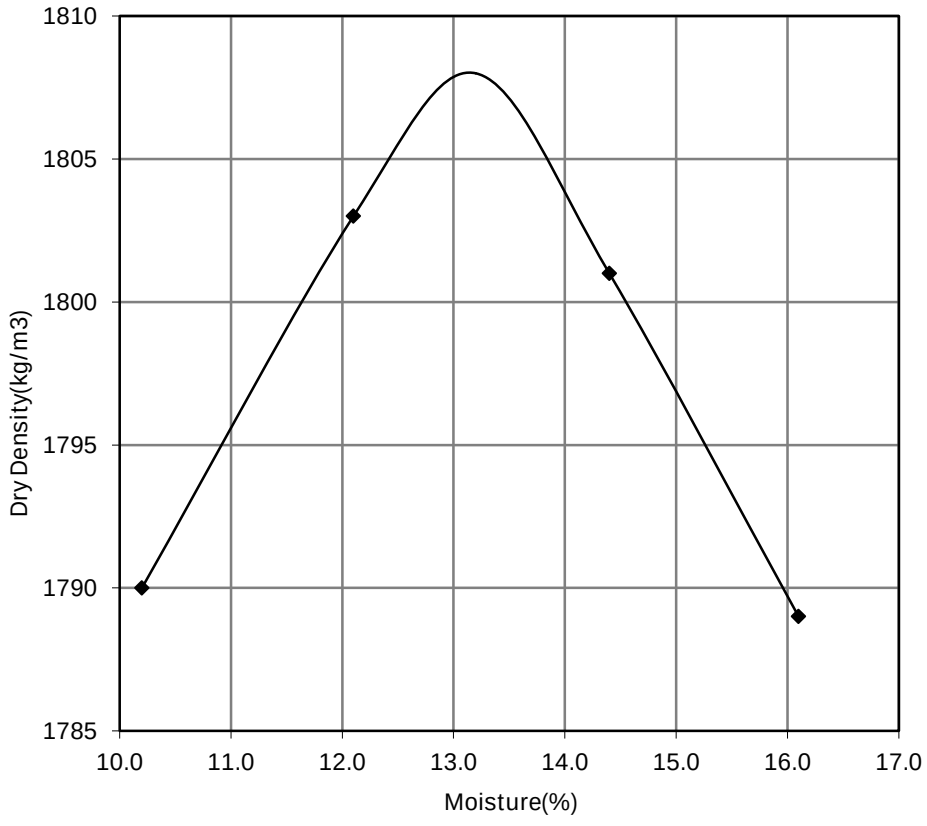
Project No. S2068
Client RCMP
Project Ahtahkakoop Detachment Geotech
Location Ahtahkakoop, SK
Borehole No. 105

Standard Effort Laboratory Compaction Test (Proctor Test)

ASTM D698, Method C

Sample No.	A3100	Date Received	10-Nov-14
Date Sampled	30-Oct-14	Date Tested	12-Nov-14
Time Sampled		Sampled By	CD
Supplied By	Client	Tested By	SAB
Sample Location	BH105 0-10'		
Sample Description	Medium brown sand, trace clay, trace fine to course gravel, trace organics		

Maximum Dry Density	1808	kg/m^3	Point 1	1790	@	10.2
Optimum Water Content	13.2	%	Point 2	1803	@	12.1
Rock Corrected Dry Density	1861	kg/m^3	Point 3	1801	@	14.4
Rock Corrected Water Content	12.3	%	Point 4	1789	@	16.1
Water Content as Received	7.0	%	LL		PL	
Retained on 4.75mm Sieve	8.9	%	PI		USC	



Approved By

Clifton Associates

Project No.	S2068
Client	RCMP
Project	Ahtahkakoop Detachment
Location	Ahtahkakoop, SK

Appendix C

Clifton Associates
Recommended Specifications for Granular Materials

Clifton Associates

Regina Office
340 Maxwell Crescent
Regina, SK S4N 5Y5

T (306) 721-7611
F (306) 721-8128

regina@clifton.ca
www.clifton.ca

Recommended Specifications for Granular Materials

1. Granular materials shall be composed of fragments of durable rock free from undesirable quantities of soft or flaky particles, topsoil, organic matter, clay or silt lumps, lumps of frozen granular soil, ice, snow or construction rubble.

2. The Pit Run Fill shall have a plasticity index less than 10 percent. The Crushed Base Course shall have a plasticity index less than 6 percent.

3. For Pit Run Sand, $\frac{D_{60}}{D_{10}} > 6$, and $1 < \frac{(D_{30})^2}{D_{10} \times D_{60}} < 3$. For Pit Run Gravel, $\frac{D_{60}}{D_{10}} > 4$, and $1 < \frac{(D_{30})^2}{D_{10} \times D_{60}} < 3$.

4. Granular materials shall be excavated, loaded, hauled, placed and levelled in such a manner to prevent contamination with undesirable materials described in Point 1 above and to prevent excessive segregation of coarse and fine particles.

5. Granular material shall conform to the following gradation specifications:

Percent by Weight Passing U.S. Standard Sieve Series							
Sieve	Pit Run Gravel Fill	Pit Run Sand Fill	Crushed Base Course				
			32	33	34	35	36
50.0 mm	100						
25.0 mm	85 – 100		100				
18.0 mm	80 – 100		87 – 100	100	100	100	100
12.5 mm	70 – 100	100	79 – 93	81 – 100	91 - 100	81 - 100	91 – 100
5.0 mm	50 – 85	75 – 100	47 – 77	50 – 80	70 - 85	50 - 85	70 – 85
2.0 mm	35 – 75	50 – 90	29 – 56	32 – 52	45 - 65	32 - 65	45 – 70
900 µm	25 – 50	30 – 75	18 – 39	20 – 35	28 - 43	20 - 43	28 – 51
400 µm	15-35	15 – 50	13 – 26	15 – 25	20 - 30	15 - 30	20 – 35
160 µm	8 – 22	5 – 30	7 – 16	8 – 15	11 - 18	8 - 18	11 – 21
71 µm	0 - 13	0 – 15	6 - 11	7 – 10	8 - 12	7 - 12	8 – 13

Appendix D

Clifton Associates
pH Test Results

Clifton Associates

Regina Office
340 Maxwell Crescent
Regina, SK S4N 5Y5

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F (306) 721-8128

regina@clifton.ca
www.clifton.ca

Clifton Associates Ltd.
ATTN: Catlan Dallaire
4 - 1925 1st Ave N
Saskatoon SK S7L 6M6

Date Received: 12-NOV-14
Report Date: 19-NOV-14 13:11 (MT)
Version: FINAL

Client Phone: 306-975-0401

Certificate of Analysis

Lab Work Order #: L1545572

Project P.O. #: NOT SUBMITTED
Job Reference: S2068
C of C Numbers:
Legal Site Desc:

Brian Morgan
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1545572-1 CD47 @2.5'							
Sampled By: CD on 12-NOV-14							
Matrix: SOIL							
Miscellaneous Parameters							
pH (1:2 soil:water)	9.05		0.10	pH	14-NOV-14	14-NOV-14	R3076671
L1545572-2 CD49 @7.5'							
Sampled By: CD on 12-NOV-14							
Matrix: SOIL							
Miscellaneous Parameters							
pH (1:2 soil:water)	9.19		0.10	pH	14-NOV-14	14-NOV-14	R3076671

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
PH-1:2-SK	Soil	pH (1:2 Soil:Water Extraction)	CSSC 3.13

1 part dry soil and 2 parts de-ionized water (by volume) is mixed. The slurry is allowed to stand with occasional stirring for 30 - 60 minutes. After equilibration, pH of the slurry is measured using a pH meter.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

L1545572-COFC

Chain of Custody (COC) / Analytical Request Form

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 14 - 423607

Page ____ of ____

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)	
Company:	Clifton Associates Ltd	Select Report Format:	☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)	R ☑	Regular (Standard TAT if received by 3pm)
Contact:	Catlan Dallaire	Quality Control (QC) Report with Report	☐ Yes ☐ No	P ☐	Priority (2-4 business days if received by 3pm)
Address:	1925 1st Ave N Saskatoon, SK S7K6W5	☐ Criteria on Report - provide details below if box checked		E ☐	Emergency (1-2 business days if received by 3pm)
Phone:	306 975-0401	Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX	E2 ☐	Same day or weekend emergency if received by 10am – contact ALS for surcharge.
		Email 1 or Fax	catlan_dallaire@clifton.ca	Specify Date Required for E2,E or P:	
		Email 2	michael_storey@clifton.ca		

Invoice To		Invoice Distribution	
	Same as Report To ☑ Yes ☐ No	Select Invoice Distribution:	☐ EMAIL ☐ MAIL ☑ FAX
	Copy of Invoice with Report ☐ Yes ☐ No	Email 1 or Fax	
Company:		Email 2	
Contact:			

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:		Approver ID:	Cost Center:
Job #:	S2068	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	

ALS Lab Work Order # (lab use only)	ALS Contact:	Sampler: CD

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	I	A	Number of Containers
	CD47 @ 2.5'	12-Nov-14		bag		X	
	CD49 @ 7.5'	12-Nov-14		bag		X	

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☐ No	
Are samples for human drinking water use? ☐ Yes ☐ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No	☑
Ice packs	Yes ☐	No ☐	Custody seal intact	Yes ☐	No ☐
Cooling Initiated	☐				

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
					11

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date	Time	Received by:	Date:	Time:
			41	D/16/14	2:30			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326a v08 Front/03 October 2013

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

Clifton Associates

Calgary Office
2222 30th Avenue NE
Calgary, AB T2E 7K9
T (403) 263-2556
F (403) 234-9033

Edmonton Office
4409 94th Street NW
Edmonton, AB T6E 6T7
T (780) 432-6441
F (780) 432-6271

Lloydminster Office
#10 – 6309 43rd Street W
Lloydminster, AB T9V 2W9
T (780) 872-5980
F (780) 872-5983

Regina Office
340 Maxwell Crescent
Regina, SK S4N 5Y5
T (306) 721-7611
F (306) 721-8128

Saskatoon Office
#4 – 1925 1st Avenue N
Saskatoon, SK S7K 6W1
T (306) 975-0401
F (306) 975-1076

North Battleford Office
#2 – 9802 27th Avenue
North Battleford, SK S9A 1K5
T (306) 445-1621
F (306) 937-3731

www.clifton.ca

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises:

.1 The construction, delivery and erection of a new single storey wood framed modular police building on a new greenfield site in Ahtahkakoop, Saskatchewan. All associated site work is included. Site construction of a single storey wood framed outbuilding on the site is also required. The modular police building is approximately 1054m² in area. The outbuilding is approximately 75 m² in area.

1.2 WORK BY OTHERS FOR COORDINATION BY THIS CONTRACT

.1 The supply and installation of office systems furniture will be completed by others. Connections of systems furniture to building electrical system is to be completed under this contract.

1.3 WORK SEQUENCE

.1 The General Contractor will be responsible for the coordination of all work.

.2 While the buildings are being constructed in modules, complete as much of the site work as practically possible so that once the building is assembled on site, minimal site work remains to be completed.

1.4 CONTRACTOR USE OF PREMISES

.1 Coordinate use of premises under direction of Departmental Representative.

.2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.3 Obtain and pay for power and propane as necessary.

.4 Cooperate with other contractors employed by the Departmental Representative for other work on site.

.5 Coordinate all site activities with local Ahtahkakoop First Nation.

1.5 EXISTING SERVICES

.1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services carry out work at times as directed by governing authorities with minimum disturbance to pedestrian and vehicular traffic.

.3 Establish location and extent of service lines in area of work before starting Work. Locations of utilities shown on drawings are approximate. Notify Departmental Representative of findings.

.4 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.

.5 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

.6 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

.7 Record locations of maintained, re-routed, and abandoned service lines.

.8 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.6 PERMITS AND FEES

.1 The Contractor shall obtain and pay for all building permits. Obtain and pay for all other permits, licences, certificates, fees and governmental inspections or notices required for the performance of the work. Note: Permit drawings are the property of the owner. Contractor to forward “approved” permit drawings and a copy of the building permit to the Departmental Representative prior to the submission of the first request for progress payment.

END OF SECTION

Part 1 General

1.1 SPECIAL REQUIREMENTS

.1 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.2 Keep within limits of work and avenues of ingress and egress.

.3 Maintain services and access to the Ahtahkakoop First Nation community at all times.

.4 Refer to Section 13 42 00 for additional requirements.

1.2 RCMP SECURITY CLEARANCE REQUIREMENTS (LAW ENFORCEMENT CHECKS)

.1 Security forms and documents are appended at the end of this Section.

.2 After interim completion of the project, all personnel engaged in the execution of the work on the interior of an RCMP occupied and/or unoccupied building shall have at a minimum, the requisite RCMP Reliability (RRS) clearance.

.3 A minimum of four months prior to interim completion of the project, the Contractor shall prepare and submit the following attached requisite forms and documents for an RRS clearance, for each Contractor employee and sub-contractor employee to be engaged in the work on the interior of an occupied and/or unoccupied building after interim completion of the project:

.1 RCMP Contractor/Consultant Information Sheet

.2 TBS 330-23e – Personnel Screening, Consent and Authorization Form

.3 TBS 330-60e – Security Clearance Form

.4 Security/Reliability Interview Pre-Interview Questionnaire

.4 Also, contractor's employees and sub-contractor employees must include with their completed requisite forms, the following documents:

.1 Valid government issued photo identification: photocopy of front and back of document (photo must be clear), certified to be a true copy by their supervisor or colleague. Examples of government issued photo identification include Driver's License, Passport or Treaty card.

.2 Birth certificate: photocopy of front and back of document, certified to be a true copy by their supervisor or colleague.

.3 Two sets of roll and ink fingerprints on Form C-216 (Contractor cost): Fingerprints must be taken/obtained from a Corp of Commissionaires office.

.4 Two current Passport Style Photographs (Contractor cost).

.5 In addition to the requirements noted in .3 above, Contractor employees and sub-contractor employees must undertake the following additional clearance requirements to obtain the RCMP Reliability Status clearance:

.1 Undertaking of a Reliability interview as scheduled by the RCMP.

.6 To eliminate delays in the clearance process, all clearance forms/documents completed by the Contractor's employees and sub-contractor employees **MUST** be reviewed by the Contractor to ensure that all requested information has been provided, prior to submitting documents to the RCMP. The RCMP will not accept/cannot process documents with ANY requested information missing as per instruction sheets provided – NO EXCEPTIONS (ie. no abbreviations on documents anywhere ie. "AB", "CA"). *All incomplete forms will be returned to the Contractor (ensure instructions for completion of documents noted in .2 above are read and followed by each applicant, prior to submitting to the RCMP).*

.7 The Contractor should batch the fully completed submissions, based on priority work on site and allow for a minimum eighty (80) working days processing time in the project schedule for the review to occur (from the date the "fully completed" documents are received by the RCMP). The inability to submit the fully completed requisite forms and documents will not be reason for an extension to the project schedule or additional compensation.

.8 After interim completion of the project, the Contractor's employees and sub-contractor employees shall only mobilize in the interior of an occupied and/or unoccupied building, once the requisite RCMP RRS clearance has been granted.

1.3 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. No smoking will be allowed in or around the building. Smoking is allowed only in areas indicated by Departmental Representative.

END OF SECTION

Properly completed packages will ensure clearances are issued in a timely manner.

Form TBS-330-23 (customized version): ensure section B is properly completed and all 5 boxes in section C (consent and verification) are initialed by applicant

NOTE: Line 5 of the consent and verification section must read "Other Law Enforcement Records Checks". As the document is a Treasury Board form, we cannot post a modified version on the Infoweb. You can handwrite the information PRIOR to the applicant initialing/signing the document. You can also contact us and we will provide you with the modified version.

Form TBS 330-60 (2006/02) Common Errors:

Section D: Marital Status:

- applicant's spouse or common law partner (no time limit is set by the RCMP in regards to a common law relationship); if the applicant is in a relationship with someone and they are living together, than the individual needs to be included on the forms
- if the individual has been in a past relationship which ended in the past 5 years, our unit will require the applicant's ex-spouse, ex-common law partner's name to be included on the forms

Section E: Immediate Family members (individuals to be included in this area):

- applicant's parents, step parents
- in-laws (parents) if the individual is married or in a common law relationship; this also includes ex-in laws (if relationship ended in the past 5 years)
- siblings includes the following: step siblings, half siblings, brother and sisters
- any children 18+ years old
- even deceased immediate family members need to be listed on the forms

Section H: Residence:

- last 10 years of residential information (no time gaps)

Section I: Employment:

- last 10 years of employment information (no time gaps)
- employment information can include the following: periods of unemployment, travel, leave, casual, and education

Section M: Character references:

- the 3 character references should not be family members, or relatives
- should have known the applicant for 3 + years, and they should be individuals whom the applicant spends time with in a social setting (friends or colleagues)
- should be over the age of 18
- should not be listed as an employment contact in Section I

General information:

- missing maiden names
- missing dates of birth
- missing phone numbers

If any of the above mentioned information is not provided, the forms will be returned for follow up. Note that our Personnel Security Unit will not begin processing an incomplete security clearance package.

Government of Canada / Gouvernement du Canada

PROTECTED (when completed)

PERSONNEL SCREENING, CONSENT AND AUTHORIZATION FORM

OFFICE USE ONLY		
Reference number	Department/Organization number	File number

NOTE: For *Privacy Act* Statement refer to Section C of this form and for completion instructions refer to attached instructions.
Please typewrite or print in block letters.

A ADMINISTRATIVE INFORMATION (To be completed by the Authorized Departmental/Agency/Organizational Official)

☐ **New** ☐ **Update** ☐ **Upgrade** ☐ **Transfer** ☐ **Supplemental** ☐ **Re-activation**

The requested level of reliability/security check(s)

☐ Reliability Status ☐ Level I (CONFIDENTIAL) ☐ Level II (SECRET) ☐ Level III (TOP SECRET)

☐ Other _____

PARTICULARS OF APPOINTMENT/ASSIGNMENT/CONTRACT

☐ Indeterminate ☐ Term ☐ Contract ☐ Industry ☐ Other (specify secondment, assignment, etc.) _____

Justification for security screening requirement

Contractor

Position/Competition/Contract number	Title		Group/Level (Rank if applicable)
Employee ID number/PRI/Rank and Service number (if applicable)	If term or contract, indicate duration period ▶	From	To
Name and address of department / organization / agency	Name of official	Telephone number ( )	Facsimile number ( )

B BIOGRAPHICAL INFORMATION (To be completed by the applicant)

Surname (Last name)	Full given names (no initials) underline or circle usual name used	Family name at birth

All other names used (i.e. Nickname)	Sex ☐ Male ☐ Female	Date of birth Y M D	Country of birth	Date of entry into Canada if born outside Canada Y M D

RESIDENCE (provide addresses for the last five years, starting with the most current)
Home address

	Daytime telephone number ( )	E-mail address

	Apartment number	Street number	Street name	Civic number (if applicable)	From Y M	To present
1						
	City	Province or state	Postal code	Country	Telephone number ( )	

	Apartment number	Street number	Street name	Civic number (if applicable)	From Y M	To Y M
2						
	City	Province or state	Postal code	Country	Telephone number ( )	

Have you previously completed a Government of Canada security screening form? ☐ Yes ☐ No	If yes, give name of employer, level and year of screening. Y

CRIMINAL CONVICTIONS IN AND OUTSIDE OF CANADA (see instructions)

Have you ever been convicted of a criminal offence for which you have not been granted a pardon? ☐ Yes ☐ No	If yes, give details. (charge(s), name of police force, city, province/state, country and date of conviction) ▼	
Charge(s)	Name of police force	City
Province/State	Country	Date of conviction ▶ Y M D

Government of Canada / Gouvernement du Canada

PERSONNEL SCREENING, CONSENT AND AUTHORIZATION FORM

PROTECTED (when completed)

Surname and full given names	Date of birth Y M D

C CONSENT AND VERIFICATION (To be completed by the applicant and authorized Departmental/Agency/Organizational Official)

Checks Required (See Instructions)	Applicant's initials	Name of official (print)	Official's initials	Official's Telephone number
1. ☑ Date of birth, address, education, professional qualifications, employment history, personal character references				( )
2. ☑ Criminal record check				( )
3. ☑ Credit check (financial assessment, including credit records check)				( )
4. ☑ Loyalty (security assessment only)				
5. ☑ Other (specify, see instructions) Law Enforcement Records Checks				( )

The Privacy Act Statement

The information on this form is required for the purpose of providing a security screening assessment. It is collected under the authority of subsection 7(1) of the *Financial Administration Act* and the Government Security Policy (GSP) of the Government of Canada, and is protected by the provisions of the *Privacy Act* in institutions that are covered by the *Privacy Act*. Its collection is mandatory. A refusal to provide information will lead to a review of whether the person is eligible to hold the position or perform the contract that is associated with this Personnel Screening Request. Depending on the level of security screening required, the information collected by the government institution may be disclosed to the Royal Canadian Mounted Police (RCMP) and the Canadian Security Intelligence Service (CSIS), which conduct the requisite checks and/or investigation in accordance with the GSP and to entities outside the federal government (e.g. credit bureaus). It is used to support decisions on individuals working or applying to work through appointment, assignment or contract, transfers or promotions. It may also be used in the context of updating, or reviewing for cause, the reliability status, security clearance or site access, all of which may lead to a re-assessment of the applicable type of security screening. Information collected by the government institution, and information gathered from the requisite checks and/or investigation, may be used to support decisions, which may lead to discipline and/or termination of employment or contractual agreements. The personal information collected is described in Standard PIB PSU 917 (Personnel Security Screening) which is used by all government agencies, except the Department of National Defence PIB DND/PPE 834 (Personnel Security Investigation File), RCMP PIB CMP PPU 065 (Security/Reliability Screening Records), CSIS PIB SIS PPE 815 (Employee Security), and PWGSC PIB PWGSC PPU 015 (Personnel Clearance and Reliability Records) used for Canadian Industry Personnel. Personal information related to security assessments is also described in the CSIS PIB SIS PPU 005 (Security Assessments/Advice).

I, the undersigned, do consent to the disclosure of the preceding information including my photograph for its subsequent verification and/or use in an investigation for the purpose of providing a security screening assessment. By consenting to the above, I acknowledge that the verification and/or use in an investigation of the preceding information may also occur when the reliability status, security clearance or site access are updated or otherwise reviewed for cause under the Government Security Policy. My consent will remain valid until I no longer require a reliability status, a security clearance or a site access clearance, my employment or contract is terminated, or until I otherwise revoke my consent, in writing, to the authorized security official.

Signature _____ Date (Y/M/D) _____

D REVIEW (To be completed by the authorized Departmental/Agency/Organizational Official responsible for ensuring the completion of sections A, B and C)

Name and title	Telephone number
Address	Facsimile number

E APPROVAL (To be completed by authorized Departmental/Agency/Organizational Security Official only)

I, the undersigned, as the authorized security official, do hereby approve the following level of screening.

Reliability Status

☐ Approved Reliability Status ☐ Not approved

Name and title _____

Signature _____ Date (Y/M/D) _____

Security Clearance (if applicable)

☐ Level I ☐ Level II ☐ Level III ☐ Not recommended

Name and title _____

Signature _____ Date (Y/M/D) _____

Comments

PHOTO (for Level III T.S., and/or upon request - see instructions)

Government of Canada / Gouvernement du Canada

INSTRUCTIONS FOR PERSONNEL SCREENING CONSENT AND AUTHORIZATION FORM TBS/SCT 330-23E (Rev. 2002/02)
Once completed, this form shall be safeguarded and handled at the level of Protected A.

General:
If space allotted in any portion is insufficient please use separate sheet using same format.

1. Section A (Administrative Information) Authorized Departmental/Agency/Organizational Official
The Official, based on instructions issued by the Departmental Security Officer, may be responsible for determining, based on five year background history, what constitutes sufficient verification of personal data, educational and professional qualifications, and employment history. References are to be limited to those provided on the application for employment or equivalent forms.

SUPPLEMENTAL INFORMATION REQUIREMENTS
Persons who presently hold a SECURITY CLEARANCE and subsequently marry, remarry or commence a common-law partnership, in addition to having to update sections of the *Security Clearance Form (TBS/SCT 330-60)*, are required to submit an original *Personnel Screening, Consent and Authorization Form*, with the following parts completed:

Part A - As set forth in each question
Part B - As set forth in each question, excluding CRIMINAL CONVICTIONS IN AND OUTSIDE OF CANADA.
Part C - Applicant's signature and date only are required

"Other". This should be used to identify if the security screening is for Site Access, NATO, SIGINT etc.

2. Section B (Biographical Information)
To be completed by the ***applicant***. If more space is required use a separate sheet of paper. Each sheet must be signed.

Country of Birth - For "NEW" requests, if born abroad of Canadian parents, please provide a copy of your Certificate of Registration of Birth Abroad. If you arrived in Canada less than five years ago, provide a copy of the Immigration Visa, Record of Landing document or a copy of passport.

- List only criminal convictions for which a pardon has NOT been granted. Include on a separate attached sheet of paper, if more than one conviction. Applicant must include those convictions outside Canada.
- Offences under the *National Defence Act* are to be included as well as convictions by courts-martial are to be recorded.

3. Section C (Consent and Verification)
A copy of Section "C" may be released to institutions to provide acknowledgement of consent.

Criminal record checks (fingerprints may be required) and credit checks are to be arranged through the Departmental Security Office or the delegated Officer.

Consent: may be given only by an applicant who has reached the age of majority, otherwise, the signature of a parent or guardian is mandatory.

The age of majority is:
19 years in NFLD., N.S., N.B., B.C., Yukon, Norhwest Territories and Nunavut;
18 years in P.E.I., Que., Ont., Man., Sask. and Alta.

The applicant will provide initials in the " applicant's initials box".

The official who carried out the verification of the information will print their name, insert their initials and telephone number in the required space.
- Reliability Screening (for all types of screening identified within Section A): complete numbers 1 and 2 and 3 if applicable.
- Security Clearance (for all types of screening identified within Section A): complete numbers 1 to 4 and 5 where applicable.
- Other: number 5 is used only where prior Treasury Board of Canada Secretariat approval has been obtained.

4. Section D (Review)
To be completed by authorized Departmental/Agency/Organizational Official who is responsible for ensuring the completion of sections A to C as requested.

5. Section E (Approval)
Authorized Departmental/Agency/Organizational Security Official refers to the individuals as determined by departments, agencies, and organizations that may verify reliability information and/or approve/not approve reliability status and/or security clearances. Approved Reliability Status and Level I, II and III, as well as the signature of the authorized security official or manager are added for Government of Canada use only. Applicants are to be briefed, acknowledge, and be provided with a copy of the "Security Screening Certificate and Briefing Form (TBS/SCT 330-47)".
Note: Private sector organizations do not have the authority to approve any level of security screening.

Photographs: Departments/Agencies/Organizations are responsible for ensuring that three colour photographs of passport size are attached to the form for the investigating agency. Maximum dimensions are 50mm x 70mm and minimum are 43mm x 54mm. The face length from chin to crown of head must be between 25mm x 35mm. The photographs must be signed by the applicant and an authorized security official. The photographs must have been taken within the last six months. It is required for new or upgrade Level III security clearances for identification of the applicant during the security screening investigation by the investigating agency. The investigating agency may in specific incidents request a photograph for a Level I or II clearances when an investigation is required.

Government of Canada / Gouvernement du Canada

PROTECTED (When completed)

OFFICE USE ONLY		
Reference number	Department number	File number

SECURITY CLEARANCE FORM

The Privacy Act Statement

The information on this form is required for the purpose of providing a security assessment. It is collected under the authority of subsection 7(1) of the *Financial Administration Act* and the Government Security Policy (GSP) of the Government of Canada and is protected by the provisions of the *Privacy Act* in institutions that are covered by the *Privacy Act*. Its collection is mandatory. A refusal to provide information will lead to a review of whether the person is eligible to hold the position or perform the contract that is associated with this Personnel Screening Request. The information collected by the government institution may be disclosed to the Royal Canadian Mounted Police (RCMP) and the Canadian Security Intelligence Service (CSIS), which conduct the requisite checks and/or investigation in accordance with the GSP and to entities outside the federal government (e.g. credit bureaus). It is used to support decisions on individuals working or applying to work through appointment, assignment or contract, transfers or promotions. It may also be used in the context of updating, or reviewing for cause, the reliability status, security clearance or site access, all of which may lead to a re-assessment of the applicable type of security screening. Information collected by the government institution, and information gathered from the requisite checks and/or investigation, may be used to support decisions, which may lead to discipline and/or termination of employment or contractual agreements. The personal information collected is described in Standard PIB PSU 917 (Personnel Security Screening) which is used by all government agencies, except the Department of National Defence PIB DND/PPE 834 (Personnel Security Investigation File), RCMP PIB CMP PPU 065 (Security/Reliability Screening Records), CSIS PIB SIS PPE 815 (Employee Security), and PWGSC PIB PWGSC PPU 015 (Personnel Clearance and Reliability Records) used for Canadian Industry Personnel. Personal information related to security assessments is also described in the CSIS PIB SIS PPU 005 (Security Assessments/Advice).

Please typewrite or print in block letters.

NOTE: Level I and II must complete sections A to J inclusive and P.
Level III must complete all sections.

A ADMINISTRATIVE INFORMATION (To be completed by Department/Agency/Organization)

☐ New ☐ Upgrade ☐ Supplemental
☐ Update ☐ Transfer ☐ Re-activation

Level: ☐ I (CONFIDENTIAL) ☐ II (SECRET) ☐ III (TOP SECRET) ☐ other _____

Department/Agency/Organization	Employee ID number/PRI/Rank and Service number (if applicable)	Organization number

B BIOGRAPHICAL INFORMATION (To be completed by the applicant)

1. Surname (Last name)	2. Full given names (no initials) underline or circle usual name used	3. Family name at birth

4. All other names used (i.e. Nickname)	5. Sex ☐ Male ☐ Female	6. Date of birth Y M D

7. Place of birth (city)	Province/State	Country

8. Name change (other than marriage)	From	To

9. Place of change (city, province or state, and country)	10. Method (authority)

C SECURITY SCREENING

1. Have you previously completed a Government of Canada security screening form? ☐ Yes ☐ No

If yes, give name of department/agency/organization, and the year and level of clearance. Y

D MARITAL STATUS/COMMON-LAW PARTNERSHIP

Current status
☐ Married ☐ Common-Law Partnership ☐ Separated ☐ Widowed ☐ Divorced ☐ Single

1

A) CURRENT SPOUSE/COMMON-LAW PARTNER: Surname, given names	B) Maiden Name (if applicable)	C) Present citizenship of current spouse/common-law partner

D) Date of marriage/ common-law partnership Y M D	E) City, province or state, and country of marriage/common-law partnership

F) City, province or state, and country of birth	G) Date of birth Y M D

H) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	I) If separated, widowed or divorced, specify date Y M D

J) Name and address of employer (job title)

2

A) PREVIOUS SPOUSE/COMMON-LAW PARTNER: Surname, given names (cover only the past five years)	B) Present citizenship of former spouse/common-law partner

C) Date of marriage/ common-law partnership Y M D	D) City, province or state, and country of marriage/common-law partnership

E) Date of divorce/ separation/ deceased Y M D	F) City, province or state, and country of divorce

G) Country of Birth (if known)	H) Date of birth Y M D

E IMMEDIATE RELATIVES (including those living outside Canada) (see instructions)

NOTE: Do not use initials

1

A) Full name (surname and all given names, including maiden name)	B) Relationship

C) City, province or state, and country of birth	D) Date of birth Y M D

E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	F) Date of death (if applicable) Y M D

G) Name and address of employer	H) Job title

Surname and full given names	Date of birth Y M D

E IMMEDIATE RELATIVES (continued)

NOTE: Do not use initials

2	A) Full name (surname and all given names, including maiden name)	B) Relationship
	C) City, province or state, and country of birth	D) Date of birth Y M D
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	F) Date of death (if applicable) Y M D
	G) Name and address of employer	H) Job title
3	A) Full name (surname and all given names, including maiden name)	B) Relationship
	C) City, province or state, and country of birth	D) Date of birth Y M D
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	F) Date of death (if applicable) Y M D
	G) Name and address of employer	H) Job title
4	A) Full name (surname and all given names, including maiden name)	B) Relationship
	C) City, province or state, and country of birth	D) Date of birth Y M D
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	F) Date of death (if applicable) Y M D
	G) Name and address of employer	H) Job title
5	A) Full name (surname and all given names, including maiden name)	B) Relationship
	C) City, province or state, and country of birth	D) Date of birth Y M D
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	F) Date of death (if applicable) Y M D
	G) Name and address of employer	H) Job title
6	A) Full name (surname and all given names, including maiden name)	B) Relationship
	C) City, province or state, and country of birth	D) Date of birth Y M D
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	F) Date of death (if applicable) Y M D
	G) Name and address of employer	H) Job title
7	A) Full name (surname and all given names, including maiden name)	B) Relationship
	C) City, province or state, and country of birth	D) Date of birth Y M D
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	F) Date of death (if applicable) Y M D
	G) Name and address of employer	H) Job title

F CRIMINAL CONVICTIONS IN AND OUTSIDE OF CANADA (see instructions)

Have you ever been convicted of a criminal offence for which you have not been granted a pardon? ☐ Yes ☐ No	If yes, give details. (charge(s), name of police force, city, province/state, country and date of conviction) ▼	
Charge(s)	Name of police force	City
Province/State	Country	Date of conviction ▶ Y M D

G FOR COMPLETION BY PERSONS BORN OUTSIDE CANADA OR BORN IN CANADA HOLDING DUAL CITIZENSHIP (see instructions)

1. Date of entry into Canada Y M D	2. Present citizenship	
3. If you are a naturalized Canadian, give the certificate number and date of issue Y M D Certificate No. _____	4. If you are not naturalized, have you applied for Canadian citizenship? Please provide copy of Immigrant Visa or Record of Landing documentation ☐ Yes ☐ No	Date of application Y M D
5. Do you maintain citizenship of a country other than Canada? If yes, please provide the name of the country and explain why ☐ Yes ☐ No (If yes) Name of Country: _____ Explain:	6. Have you used a passport other than a Canadian one? If yes, explain why ☐ Yes ☐ No (If yes) Explain:	

Surname and full given names	Date of birth Y M D

H RESIDENCE (there should be no gaps)

List addresses where you have lived during the last 10 years, starting with the most current. (Rural address to include lot and civic number.)

	Apartment number	Street number	Street name	Civic number (if applicable)	From Y M	To present / To Y M
1	City	Province or state	Postal code	Country	Telephone number ( )	
2						
3						
4						
5						

I EMPLOYMENT (last 10 years) (see instructions for self-employed and consultants) (there should be no gaps)

Would your employment be jeopardized if your current supervisor, below, is contacted? ☐ Yes ☐ No

If yes, provide the name of an alternate employment contact and telephone number

Were you dismissed or asked to resign from any position(s) as listed below? ☐ Yes ☐ No

If yes, give name of employer, supervisor, and date.

Name of employer	Supervisor	Position title	Date Y M

1	A) Name of employer - do not use initials (department/organization/agency, if applicable)	B) From Y M To	present
	C) Job-site address (street number, street name, city, province or state and country)		
	D) Job title/Description	E) Rank and service number (if applicable)	
	F) Supervisor's name in full	G) Supervisor's telephone number ( )	
2	A) Name of employer - do not use initials (department/organization/agency, if applicable)	B) From Y M To Y M	
	C) Job-site address (street number, street name, city, province or state and country)		
	D) Job title/Description	E) Rank and service number (if applicable)	
	F) Supervisor's name in full	G) Supervisor's telephone number ( )	
3	A) Name of employer - do not use initials (department/organization/agency, if applicable)	B) From Y M To Y M	
	C) Job-site address (street number, street name, city, province or state and country)		
	D) Job title/Description	E) Rank and service number (if applicable)	
	F) Supervisor's name in full	G) Supervisor's telephone number ( )	
4	A) Name of employer - do not use initials (department/organization/agency, if applicable)	B) From Y M To Y M	
	C) Job-site address (street number, street name, city, province or state and country)		
	D) Job title/Description	E) Rank and service number (if applicable)	
	F) Supervisor's name in full	G) Supervisor's telephone number ( )	

Surname and full given names	Date of birth Y M D

J FOREIGN EMPLOYMENT

1. Are you now or have you **ever** been employed by or acted as a consultant for a foreign government, firm, or agency? ☐ Yes ☐ No	If yes, give details (country, organization, nature of work and dates) Include military (cadets), law enforcement and security intelligence employment

SECTIONS "K" TO "O" MUST ALSO BE COMPLETED FOR LEVEL III ONLY

K TRAVEL

List countries visited within the last five years for personal travel and/or non-Government business, other than Canada, the USA and Mexico.

Country	Purpose	From Y M	To Y M

L FOREIGN ASSETS

Do you have any business, financial or personal assets outside Canada? ☐ Yes ☐ No	If yes, list the relevant countries (exclude stocks and mutual funds purchased in Canada)

M CHARACTER REFERENCES IN CANADA (see instructions)

List three character references (non-family members) and one neighbourhood reference

1	Name in full (no initials)	Relationship	Period known
	Complete home address		Telephone Number ( )
	Complete title and business address		Business Telephone Number ( )
2	Name in full (no initials)	Relationship	Period known
	Complete home address		Telephone Number ( )
	Complete title and business address		Business Telephone Number ( )
3	Name in full (no initials)	Relationship	Period known
	Complete home address		Telephone Number ( )
	Complete title and business address		Business Telephone Number ( )

Neighbourhood reference (see instructions)

Name in full (no initials)	Telephone Number ( )
Complete home address	Business Telephone Number ( )

N EDUCATION

1. Name of the last school or university you attended full time	2. Student ID number (if known)	3. Location of institution	4. Period of attendance From Y M To Y M
5. Field of study (Diploma or degree obtained)			

O MILITARY SERVICE

Military service in the Canadian Armed Forces: Regular, Reserves and Sea, Army and Air Cadets (from the period since your 16th birthday).

1. Name and last location	2. Rank and Service no	3. Period of service From Y M To Y M

P CERTIFICATION

I hereby certify that the information set out by me in this document is true and correct to the best of my knowledge and belief.

1. Signature	2. Date Y M D	3. Telephone (Home) ( )	3. Telephone (Business) ( )

ALL INFORMATION SUPPLIED IS SUBJECT TO VERIFICATION BY INVESTIGATION

Government of Canada | Gouvernement du Canada

INSTRUCTIONS FOR COMPLETION OF SECURITY CLEARANCE FORM TBS/SCT 330-60E (Rev. 2006-02)

General:

- Once completed this form shall be safeguarded and handled at the level of PROTECTED A.
- If clarification of information is required, a Canadian Government Official may contact the applicant to obtain additional information in order to complete the security screening investigation and an interview of the applicant may be requested.
- This form is to be completed using an automated system or if not available using a typewriter or printing in block letter format in black ink.
- Please read and follow these instructions carefully.
- The original signed copy must be submitted.
- It is important that a copy of the completed questionnaire be retained by the applicant for future reference.
- Incomplete or illegible forms will NOT be considered.
- All names are to be in full (no initials) (Maternal and Paternal or other names used).
- Addresses are to include, where applicable civic or township name and the lot and concession numbers.
- If information is not known or is unavailable please indicate this on the form and on a separate sheet of paper explain the cause of circumstance.
- All dates are to be entered in order of YEAR, MONTH, and DAY as applicable.
- If space allotted in any portion is insufficient please use separate sheet using same format.

Detailed Instructions:

SECTION A
- To be completed by the department, agency or organization.
- "Other" This should be used to identify if the security screening is for Site Access, NATO, SIGINT etc.

SECTION B (Remainder of the form is to be completed by the applicant)
- Complete as requested.

SECTION C
- Complete as requested.

SECTION D
"common-law partner" - in relation to an applicant, means a person who is cohabiting with the individual in a conjugal relationship, having so cohabited for a period of at least one year. This includes persons of the same sex.

- 1. includes current spouse and common-law partner as applicable.
- If any person is deceased, date of death and last address while living are to be shown.
- 2. includes previous spouse and common-law partner as applicable during the last five years.
- If a person is deceased, date of death is to be shown in 2e.
- All other questions to be answered as set forth.

SECTION E
- Questions 1 to 8 - experience has shown that incomplete answers to these questions are the most common cause of delay. Please follow the instructions carefully.
- For all security clearance requests all Immediate Relative(s) information must be provided.
- Immediate family includes the following:
- All children 18 years and over that you or your spouse or common-law partner have a parental relationship.
- Your father, mother, brothers, sisters. Include "half" or "step" relatives in this category.
- Your current spouse's or common-law partner's father and mother. Include "half" or "step" relatives in this category.

If any person is deceased, date of death and last address while living are to be shown.

SECTION F
- List only criminal convictions for which a pardon has NOT been granted. Include on a separate attached sheet of paper, if more than one conviction. Applicant must include those convictions outside Canada.
- Offences under the *National Defence Act* are to be included as well as convictions by courts-martial are to be recorded.

SECTION G
- If a naturalized Canadian, it is important to show the certificate number, date of issue. Attach a photocopy of the certificate.
- If born abroad of Canadian parents, please provide a copy of your Certificate of Registration of Birth Abroad.
- If not a Canadian Citizen indicate if application has been made for Citizenship. In this case, passport or identity card number and particulars should be recorded in box "6". Please provide copy of Immigrant Visa or Record of Landing documentation.
- Questions 5 and 6 - Attach a separate sheet of paper if more space is required. Each sheet must be signed.

SECTION H
- As set forth, ensuring current address is recorded first.
- The Postal code is mandatory for the current address, and if known, for previous addresses.
- For rural area, include civic number or lot, concession and township number.

SECTION I
- Record your present employment first.
- Please note that it may be necessary to contact your present employer.
- Time at school and periods of unemployment are also to be shown; (as well as, secondments, educational leave, and courses of over six months' duration; include supervisor or colleague's name).
- Job-site address is the address where your work is performed and may be different from your employer's address.

NOTE: If you are self-employed or a consultant, or have been self-employed or a consultant, provide the following:
a) Name of employer - give your business name; if not applicable, give your name;
b) No change;
c) Job-site address - give your permanent business address; if not applicable, give your residence address;
d) No change;
e) No change;
f) Supervisor's name - give a name of a person who can verify your employment;
g) No change.

SECTION J
- Is related to determining past employment of security concern. A security official may ask for further details.

SECTION K
- Travel record is for less than six months, if more than this period it is to be recorded as residence in part "H".
- One day visits to countries, such as cruise stopover, do not have to be recorded.
- A security official may ask for details of travel.
- An employee or contractor on Canadian Government business is not required to record details of travel in this section.

SECTION L
- A security official may ask for details in terms of the type of assets and estimated value.

SECTION M
- Character references must be colleagues, peers, and friends who have known you well for over three years and should be able to cover your non-work environment and activities.
- Character references are NOT to include relatives and MUST be residing in Canada.
- Faster processing is facilitated if references listed are in your geographic area.
- Neighbourhood reference is an individual who has known you for over six months preferably at your current address. If not, the individual has been a neighbour during the past five years.

SECTION N
- Complete as requested.

SECTION O
- Question to be answered if not covered in employment section. List last or current unit and dates of total service in the Canadian Armed Forces.
- If more space is required use a separate sheet of paper. Each sheet must be signed.

SECTION P
- Complete as requested.

SUPPLEMENTAL INFORMATION REQUIREMENTS
Persons who have previously completed a SECURITY CLEARANCE and subsequently marry, remarry or commence a common-law partnership are required to submit an original Security Clearance Form with the following parts completed:

For all Security Clearances

Part A - As set forth in each question
Part B - As set forth in each question
Part C - As set forth in each question
Part D - As set forth in each question
Part E - Provide details on parents of new spouse/common-law partner and any children (over the age of 18 years) of the new spouse/common-law partner
Part P - To be signed by person submitting the form

Note: In addition to the above, in those cases where an individual marries or commences a common-law partnership with a Non-Canadian National or Landed Immigrant who has not yet arrived in Canada, the following information is required:

Parts A-D As set forth in each question
Part E - Parents of new spouse/common-law partner, brothers, sisters (include "half and "step" relatives) and any children (over the age of 18 years) of the new spouse/common-law partner
Part H - For new spouse/common-law partnership
Part I - For new spouse/common-law partnership
Part P - To be signed by person submitting the form

CYCLICAL UPDATE REQUIREMENTS
- Levels I+II (10 year update). Complete all portions of the form as per instructions above.
- Level III (5 year update cycle)

With the exceptions of Parts H and I, where the information required is that which covers the period of time since the last submission of a questionnaire, **ALL OTHER** parts of the questionnaire must be completed **IN FULL**.

Royal Canadian Mounted Police / Gendarmerie royale du Canada

PROTECTED B
when completed
PIB CMP PPU 065

Security / Reliability Interview
Pre-Interview Questionnaire

- The Pre-Interview Security / Reliability Questionnaire and the Security / Reliability Interview are both integral parts of the RCMP recruiting and security process. They, and the subsequent field investigation, are used to assist in determining suitability and reliability and contribute to the security screening assessment of individuals who seek employment as a member, employee or volunteer of the RCMP or under a contract awarded to, or administered by, the RCMP. Verifications to issue security clearances are carried out to assess an individual's loyalty and reliability as it relates to loyalty. Reliability checks are done to assess an individual's reliability. This is being done in accordance to the Policy on Government Security (PGS) which became effective July 1, 2009.
- You are required to fill the Pre-Interview Questionnaire and return it to the RCMP Human Resources Section when completed. You will soon be contacted to meet with an interviewer to complete the Security / Reliability Interview.
- Please carefully read and follow the instructions below.

Instruction for the Applicant

- The Pre-Interview Questionnaire (Form 1020-1) is available in both official languages. You may complete the Pre-Interview Questionnaire in the language of your choice.
- Your decision to complete the Pre-Interview Questionnaire and the subsequent Security / Reliability Interview must be voluntary and be based on your desire to pursue employment with, or at, the RCMP.
- You should answer the questions contained in the Pre-Interview Questionnaire accurately, completely, thoroughly and honestly to the best of your knowledge and belief. You should answer the questions contained in the Pre-Interview Questionnaire on your own without the assistance of third parties (e.g. family or friends), considering the personal and sensitive nature of the information provided. You may withdraw from the process at any time or refuse to provide answers to any or all of the questions contained in the Pre-Interview Questionnaire. You should, however, be advised that an incomplete Pre-Interview Questionnaire may result in your disqualification from the employment process.
- You are not required to provide any information in the Pre-Interview Questionnaire that relates to a conviction for which a pardon has been received, or a matter that was processed pursuant to the *Young Offenders Act (R.S.C. 1985, c. Y-1, now repealed)* or the *Youth Criminal Justice Act (S.C. 2002, c. 1).*
- You are under no obligation to provide information about third parties, (e.g. individuals other than yourself), in the Pre-Interview Questionnaire.
- You are under no obligation to disclose any information regarding a crime where you were a victim or complainant.
- You should be aware that, in the event of significant discrepancy between the information you provide in this Pre-Interview Questionnaire and in the context of the Security / Reliability Interview, and the information that surfaces from the RCMP's background investigation, you may be asked to undergo a second interview to explain adverse information.

- Deceit, dishonesty or non-disclosure in answer to questions contained in the Pre-Interview Questionnaire are likely to result in your disqualification from the employment process.
- Should you apply for any other employment with, or at, the RCMP within the next five (5) years, the information provided in this Pre-Interview Questionnaire may be used to reassess your suitability and reliability and for security screening purposes. This may result in your disqualification from the employment process.
- If you are currently employed by, or working at, the RCMP, you should be advised that the information provided in this Pre-Interview Questionnaire may be used in reassessing your suitability and reliability, and in carrying out the security screening process. This may result in your disqualification from the employment process in question. This may also lead, where applicable, to a review for cause and possible revocation of an existing clearance or reliability status, and consequently the dismissal from your current employment with the RCMP.

Notices regarding prior serious criminal offences and serious risk to yourself or the safety of others.

- The information you provide on the Questionnaire and during the Security / Reliability Interview process is collected and used by the RCMP for the purposes of an employment application and security screening. However, if you admit to having committed a serious undetected criminal offence, or are deemed to pose a serious risk to yourself or to the safety of others, the RCMP may disclose information to entities with lawful authority to collect such information (e.g. police of jurisdiction or child protection agencies) for a law enforcement or public safety purpose. While cases of such disclosure are rare and exceptional, the RCMP strongly discourages you from completing the Pre-Interview Questionnaire or attending the Security/ Reliability Interview if you believe this Notice applies to you.

Examples of serious criminal offences include, but are not limited to:
- murder;
- sexual assault;
- child pornography: accessing, possession, distribution, or the making of;
- any crime involving children;
- arson resulting in loss of life or substantial damage;
- forcible confinement;
- robbery;
- crime committed with a facial covering and/or a weapon.

Should you be uncertain if this applies to you, you should consult a lawyer to obtain independent legal advice.

- If you nonetheless chose to pursue the process and admit, on the Pre-Interview Questionnaire or in the context of the Security / Reliability Interview, to having committed one or a number of serious criminal offence(s), be advised that the information may be disclosed to entities with lawful authority to collect such information (e.g. police of jurisdiction or child protection agencies).
- If, in light of the information provided on the Pre-Interview Questionnaire or in the context of the Security / Reliability Interview, you are deemed to pose a serious threat to yourself or to the safety of others, be advised that the information may be disclosed to the entities with lawful authority to collect such information (police of jurisdiction or child protection agencies).
- You are also advised that such disclosures could lead to incident reports being entered into police databases, which could impact future employment or volunteering opportunities, or other activities that require security screening (e.g. employment with schools, banks, etc.).
- You are further advised that such disclosures could also lead to an investigation, arrest, charge(s), criminal prosecution, conviction, and, ultimately, the imposition of a sentence.

Notice regarding the collection and use of personal information by the RCMP

- The RCMP is collecting, on a voluntary basis, the personal information you provide on the Pre-Interview Questionnaire and in the context of the Security / Reliability Interview to assist in determining your suitability and reliability and for security screening purposes. The information requested is essential for making these determinations and, should it not be provided, may result in your disqualification and/or our inability to proceed with the employment process.
- The information is collected under the authority of the *Royal Canadian Mounted Police Act, R.S.C.1985, c. R-10* and the *Financial Administration Act, R.S.C. 1985, c. F-11.* It is protected and managed in conformity with the provisions of the *Privacy Act, R.S.C. 1985, c. P-21* and the *Privacy Regulations, SOR/83-508.*
- The information collected will be stored by the RCMP in Personal Information Bank CMP PPU 065 and be disclosed in conformity with the *Privacy Act.* Under this Act, you have the right to the protection of, access to and correction of your personal information. More details regarding the collection and use of personal information can be found at www.infosource.gc.ca .

Royal Canadian Mounted Police / Gendarmerie royale du Canada

PROTECTED B when completed
PIB CMP PPU 065

Security / Reliability Interview
Pre-Interview Questionnaire

Office use only	
HRMIS number	File number

Declaration, Acknowledgement, and Consent

Name of applicant	Telephone number

Mailing address

In which Official Language would you prefer your interview to be conducted? ☐ English ☐ French

	Applicant's initials
I, the undersigned, have read and understand the previous pages of instruction and notices.	
I am completing this Pre-Interview Questionnaire voluntarily, based on my desire to volunteer, pursue work as a member or employee of the RCMP or under a contract awarded to, or administered by, the RCMP.	
I declare that the information provided in this Pre-Interview Questionnaire is up-to-date, accurate, complete and honest to the best of my knowledge and belief.	
I understand that the consequences of my not being completely honest and forthright in this Pre-Interview Questionnaire could result in me no longer being considered for employment with, or at, the RCMP.	
I understand that I do not have to include any information in this Pre-Interview Questionnaire that relates to a conviction for which a pardon has been received, or a matter that was processed pursuant to the *Young Offenders Act* or the *Youth Criminal Justice Act*.	
I understand that the information provided in this Pre-Interview Questionnaire may affect my opportunities for any other employment with, or at, the RCMP within the next five (5) years, or, where applicable, may affect my current security clearance and employment with, or at, the RCMP.	
I understand that, if I admit to having committed one or more serious undetected criminal offence(s) in this Pre-Interview Questionnaire, actions could be taken, which could lead, ultimately to the imposition of a sentence.	
I understand that, if in light of the answers provided in the Pre-Interview Questionnaire, I am deemed to pose a serious risk to myself or to the safety of others, actions could be taken, which could lead, ultimately to the imposition of a sentence.	
I understand that, in the event of significant discrepancy between the information I provide in this Pre-Interview Questionnaire and in the context of the Security / Reliability Interview and information that surfaces from the RCMP's background investigation, I may be asked to undergo a second interview to explain adverse information for verification and confirmation purposes.	
I declare that I will not divulge the contents and format of this Pre-Interview Questionnaire and of the Security / Reliability Interview to anyone.	
I consent to my personal information being collected, used and disclosed for the purposes identified above.	
I consent to my personal information being used for security screening purposes pursuant to the Treasury Board's Policy on *Government Security*.	

Signature of applicant _____ Date _____

Security / Reliability Interview
Pre-Interview Questionnaire

PROTECTED B when completed
PIB CMP PPU 065

Office use only	
HRMIS number	File number

Please complete the following information and return.This questionnaire will form part of your Security / Reliability Interview that will be completed.

Name of applicant	Telephone number

1. List the names of everyone of 18 years old or more you have lived with at each of your addresses over the past ten years? (except people who were just visiting for a few days)

2. Do you have any family* or friends** living outside Canada?

☐ No ☐ Yes: If yes, list their names and dates of birth below

* Family refers to spouse/cohabitant, parents and/or guardians, spouse's/cohabitant's parents and/or guardians, children, brothers and sisters (including step and half relative).

** Friend refers to persons with whom the interviewee have associated (e.g., person seen frequently) over the last five years, excluding relatives, former employers, supervisors.

Office use only	
HRMIS number	File number

Name of applicant	Telephone number

3. List the names of your closest friends and associates* and describe your relationship with them (include name, address, relationship and date of birth).

4. List all clubs, organizations, or associations that you belong to or have belonged to or that you have contributed financially or otherwise supported.

* Associate refers to a person who joins with others in some activity and / or keep company with, hang out with.

Office use only	
HRMIS number	File number

Name of applicant	Telephone number

5. Have you in the past five years traveled outside of Canada, including USA?

☐ No ☐ Yes, complete this section

Bring your passport(s) to the interview for verification and confirmation purposes.

Countries visited	Approx. date (yyyy-mm)	Duration	Reasons	Contact with government officials or police? Difficulties or unusual incidents? (If yes, please specify)

Office use only	
HRMIS number	File number

Name of applicant	Telephone number

6. Financial assessment

Your relationship with money may have an impact in obtaining either, a reliability status, a security clearance and/or site/facilities access. Please answer the following questions and be prepared to explain them to the interviewer.

A - Does your financial situation cause you any stress? If so, what level of stress do you feel: low, medium or high and why?

B - What is your ratio of debt versus income?

C - How has this changed over the past five years, if at all?

D - How do you expect your financial situation to evolve over the next 5 years?

E - If you are not satisfied with your finances, what are you doing to improve your situation?

Office use only	
HRMIS number	File number

Name of applicant	Telephone number

7. Have any members of your immediate family, close friends or associates been involved (to your knowledge) in criminal activity, meaning been suspected, charged or convicted of any criminal offences? This involvement should not be limited to the following offences (assault, domestic violence, theft, fraud, shoplifting, drug offenses, hack into a computer, drinking and driving, hunting without a permit.)

☐ No ☐ Yes, complete this section.

i)	Name of individual		Date of birth (yyyy-mm-dd)
	Home address	Involvement/Activity	
ii)	Name of individual		Date of birth (yyyy-mm-dd)
	Home address	Involvement/Activity	
iii)	Name of individual		Date of birth (yyyy-mm-dd)
	Home address	Involvement/Activity	
iv)	Name of individual		Date of birth (yyyy-mm-dd)
	Home address	Involvement/Activity	
v)	Name of individual		Date of birth (yyyy-mm-dd)
	Home address	Involvement/Activity	

Analyst/Interviewer/Risk manager comments/notes
(For office use only)

Office use only	
HRMIS number	File number

Name of applicant	Telephone number

8. Have you ever used or experimented with any illegal drugs and/or have you abused any pharmaceutical (prescription) drugs?

☐ No

☐ Yes, please provide the requested information for each drug and/or prescription drugs and explain circumstances of use below.

Drug	Method and frequency of use	Approximate dates of use (first time, last time)	Circumstances/ Motives for use	Means to obtain drugs	Financial outlay (How much do/did you spend on drugs on a monthly basis?)

Analyst/Interviewer/Risk manager comments/notes
(For office use only)

Office use only	
HRMIS number	File number

Name of applicant	Telephone number

9. Please provide all your email addresses and describe your online activities (most visited sites, discussion forums, social media, etc.)

10. Declaration

I, undersigned, hereby declare that the information I have provided in this Security / Reliability Interview - Pre-Interview Questionnaire is up to date, accurate, complete and honest, to the best of my knowledge and belief.

Signature of applicant

Date

Part 1 General

1.1 ADMINISTRATIVE

.1 Project meetings will be scheduled throughout the progress of the work and at the call of Departmental Representative.

.2 Provide physical space and make arrangements for meetings.

.3 The Consultant shall chair meetings.

.4 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

.1 Within 10 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Agenda to include:

- .1 Appointment of official representative of participants in the Work.
- .2 Schedule of Work: in accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Chart.
- .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Requirements for temporary facilities, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
- .5 Delivery schedule of specified equipment.
- .6 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
- .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .8 Owner provided products and work.
- .9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .10 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .12 Monthly progress claims, administrative procedures, photographs, hold backs.
- .13 Appointment of inspection and testing agencies or firms.
- .14 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

.1 During course of Work, progress meetings will be held on a regular basis. Schedule to be determined.

.2 Contractor, major Subcontractors involved in Work, Departmental Representative, Consultant and Owner's representatives are to be in attendance.

.3 Minutes of meetings will be recorded by the Consultant. Minutes will be distributed within 72 hours.

.4 Agenda to include the following:

- .1 Review, approval of minutes of previous meeting.
- .2 Review of Work progress since previous meeting.
- .3 Field observations, problems, conflicts.
- .4 Problems which impede construction schedule.
- .5 Review of off-site fabrication delivery schedules.
- .6 Corrective measures and procedures to regain projected schedule.
- .7 Revision to construction schedule.
- .8 Progress schedule, during succeeding work period.
- .9 Review submittal schedules: expedite as required.
- .10 Maintenance of quality standards.
- .11 Review proposed changes for effect on construction schedule and on completion date.
- .12 Other business.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.6 Master Plan: summary-level schedule that identifies major activities and key milestones.

.7 Milestone: significant event in project, usually completion of major deliverable.

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

.1 Ensure Project Schedule and Detail Schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.

.4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit to Departmental Representative within 7 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

1.4 PROJECT MILESTONES

.1 Project milestones form interim targets for Project Schedule.

.1 Project milestone will be identified through discussion with the Contractor and Departmental Representative at the outset of the project.

1.5 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on bi-weekly basis reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.6 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

END OF SECTION

1.1 ADMINISTRATIVE

.1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are co-ordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.

.10 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Submit where required in the specifications, shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Saskatchewan, Canada.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow 7 days for Departmental Representative's review of each submission.

.5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

.7 Accompany submissions with transmittal letter, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.8 Submissions include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.

.9 After Departmental Representative's review, distribute copies.

.10 Submit 6 copies of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.11 Submit 6 copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit 6 copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within 3 years of date of contract award for project.

.13 Submit 6 copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit 6 copies of manufacturer’s instructions for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit 6 copies of manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.16 Submit 6 copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.17 Delete information not applicable to project.

.18 Supplement standard information to provide details applicable to project.

.19 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.20 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that Departmental Represenetaive approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that

pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

.21 Electronic submission of Shop Drawings

.1 Electronic Shop Drawings (PDF format) shall not exceed 11x17 actual size. Electronic transfer of shop drawings relies on Architect and Engineering Consultants to print a record copy for their files - this can be done providing shop drawings do not exceed 11x17. Larger shop drawings would require hard copies for review.

.2 General Contractor to review shop drawing and place their electronic stamp signifying review.

.3 General Contractor to email all shop drawings to Architect with copy to Engineering Consultant as applicable.

.4 Engineering Consultant to review and place their electronic stamp / marks up, then email to Architect only (Engineering Consultant will not copy anyone else).

.5 Architect to check for coordination and transmit reviewed shop drawings by email to General Contractor.

1.3 SAMPLES

.1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Departmental Representative's business address.

.3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

.5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 MOCK-UPS

.1 Erect mock-ups in accordance with 01 45 00 - Quality Control and as specified in each applicable Section.

END OF SECTION

Part 1 General

1.1 SITE PROTECTION

.1 Prevent damage to all existing items which are to remain (e.g. fencing, signs, trees, shrubs, turf, natural features, buildings, asphalt, surface or underground utility lines). Make good any damage.

.2 Preserve and protect existing benchmarks and survey monuments. Inform Consultant immediately if benchmarks or survey monuments are encountered during construction. Make good any damage.

1.2 FINES AND PENALTIES

.1 Abuse to any plant material or unauthorized pruning or removal, in whole or in part, of plant material is not permitted.

.2 Be responsible to monitor all sub-trades for plant material abuse. Restitution for all damages found will be solely upon the Contractor.

.3 A fine for not less than plant material repair or replacement costs plus for loss of aesthetic or intrinsic value per individual plant, will be levied. The decision of the Consultant in determination of damage will be final.

1.3 FIRES

.1 Fires and burning of rubbish on site is not permitted.

1.4 DISPOSAL OF WASTES

.1 Burying of rubbish and waste materials on site is not permitted.

.2 Disposal of waste, or volatile materials such as mineral, spirits, oil or paint thinner, into waterways, storm or sanitary sewers prohibited.

.3 Remove rubbish, waste products and debris in accordance with regulations of authorities having jurisdiction.

1.5 CARE OF EXISTING PLANT MATERIAL

.1 Use all means necessary to protect plant materials before start up and during construction.

.2 Do not disturb the existing grade or store heavy equipment within the drip line of existing trees. If access is required within the drip line of existing trees, then protect the access route with a moveable timber bridge to cushion/spread weight of vehicles over a greater surface area. Consultant to approve access route and timber bridge construction before work begins.

.3 Protection of branches that are interfering with construction: All branches that pose temporary interference to the process of construction, are to be tied up or back under the supervision of the Consultant. Bindings thus provided will be removed as soon as feasible by the completion of construction (or phase of construction) to reduce possible water sprouting or structural damage.

.4 Pruning trees that are interfering with construction: Remove interfering branches, without injury to trunks only when directed by the Consultant. The Consultant will determine all trees which require pruning, the extent of pruning allowed, and will identify the amount of compensatory pruning required for loss of roots or tops. The Contractor will adhere to limitations of on-site construction movement around identified trees.

.5 Monitor condition of trees, in particular, possible wind damage or snow load damage to branches that are tied up.

.6 Wash foliage should excessive construction dust build up on plant material.

1.6 TRAFFIC PROVISIONS AND STORAGE

.1 Determine interference of trees and their root zones before moving equipment or supplies on site to avoid any damage to trees.

.2 Traffic provisions:

.1 Use only approved access routes for vehicular and heavy pedestrian movement.

.3 Parking areas shall be pre-designated at each construction site.

.1 Contractor responsible to provide soil aeration of compacted tree root areas through holes bored into the soil at the direction of the Consultant.

.4 Storage:

.1 Store construction materials, fuels, chemicals, etc., in approved areas only.

.2 Store equipment, soil, building materials and debris beyond the drip-line of trees.

1.7 EXCAVATING ADJACENT TO EXISTING TREES

.1 Locate and stake locations of electric service utility lines, and other underground construction.

.2 Excavations within 2.0 metres of trees will be permitted only with prior approval of the Consultant. Prior to excavating, all tree roots along the side to be exposed must be severed with a trencher to a depth of 500mm along the line of excavation. Prune all exposed roots with a sharp pruning tool, in order to provide a clean severance of roots.

.3 Excavations beyond two (2) metres from trees do not require trenching. Immediately after excavation, prune all exposed roots with a sharp pruning tool, in order to provide a clean severance of roots. Place a tarp over excavation wall to prevent exposed roots from drying out. Backfill around tree roots as soon as possible.

1.8 HERBICIDES / PESTICIDES

.1 Use only with approval of Consultant and Owner and in strict accordance with applicable regulations and manufacturer’s instructions.

1.9 DRAINAGE

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 Province of Saskatchewan

.1 Occupational Health and Safety Act, 1993, S.S. 2005.

1.2 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Submit 1 copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.

.4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.5 Submit copies of incident and accident reports.

.6 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Requirements.

.7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 days after receipt of comments from Departmental Representative.

.8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.

.10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.3 FILING OF NOTICE

.1 File Notice of Project with Provincial authorities prior to beginning of Work.

1.4 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

1.5 MEETINGS

.1 Schedule and administer Health and Safety Meeting with Departmental Representative prior to commencement of Work.

1.6 REGULATORY REQUIREMENTS

.1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.

1.7 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.8 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.9 COMPLIANCE REQUIREMENTS

.1 Comply with Occupational Health and Safety Regulations, 1996.

.2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 UNFORSEEN HAZARDS

.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.11 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

.1 Have site-related working experience specific to activities associated with overhead work.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.5 Be on site during execution of Work .

1.12 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Departmental Representative.

1.13 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.14 BLASTING

.1 Blasting or other use of explosives is not permitted without prior receipt of written instruction by Departmental Representative.

.2 Do blasting operations in accordance with Section 31 23 16 Utility Trench Excavation and Backfill.

1.15 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

END OF SECTION

Part 1 General

1.1 REFERENCES AND CODES

.1 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.2 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions and municipal by-laws.

.2 Smoking on site is restricted to within personal vehicles or designated smoking locations.

END OF SECTION

Part 1 General

1.1 INSPECTION

.1 Allow Departmental Representative and Consultant access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative or Consultant, instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.2 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.3 PROCEDURES

.1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.4 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

1.5 REPORTS

.1 Submit two (2) copies of inspection and test reports to Departmental Representative.

.2 Provide copies to subcontractor of work being inspected or tested.

1.6 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

1.7 MOCK-UPS

.1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.

.2 Construct in locations acceptable to Departmental Representative and as specified in specific Section.

.3 Prepare mock-ups for Departmental Representative and Consultant's review with reasonable promptness and in orderly sequence, to not cause delays in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 If requested, Departmental Representative will assist in preparing schedule fixing dates for preparation.

.6 Mock-ups may remain as part of Work.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.3 TEMPORARY HEATING AND VENTILATION

.1 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.

.2 Ventilating:

- .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
- .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.3 Permanent heating system of building may be used when available. Obtain written approval from Departmental Representative prior to using equipment. Be responsible for damage to heating system if use is permitted.

.4 Refer to Mechanical and Electrical sections for specific requirements regarding temporary use of utilities.

.5 On completion of Work for which permanent heating system is used, provide service maintenance to system at discretion of the Departmental Representative.

.6 Pay costs for maintaining temporary heat, when not using permanent heating system.

.7 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

- .1 Conform with applicable codes and standards.
- .2 Enforce safe practices.
- .3 Prevent abuse of services.
- .4 Prevent damage to finishes.
- .5 Vent direct-fired combustion units to outside.

.8 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.4 TEMPORARY POWER AND LIGHT

.1 Provide and maintain temporary lighting throughout project. Existing lighting and power systems may be utilized.

1.5 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary telephone, fax, data hook up, lines and equipment necessary for own use and use of Departmental Representative.

1.6 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by Authorities Having Jurisdiction and governing codes, regulations and bylaws.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-S269.2-M1987(R2003), Access Scaffolding for Construction Purposes.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.3 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.

.2 Identify areas which have to be gravelled to prevent tracking of mud.

.3 Indicate use of supplemental or other staging area.

.4 Provide construction facilities in order to execute work expeditiously.

.5 Remove from site all such work after use.

1.4 SCAFFOLDING

.1 Scaffolding in accordance with CAN/CSA-S269.2.

.2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, and temporary stairs.

1.5 HOISTING

.1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.

.2 Hoists and cranes to be operated by qualified operator.

.3 Provide protective coverings for finish surfaces of cars and entrances.

1.6 SITE STORAGE/LOADING

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.7 CONSTRUCTION PARKING

.1 Parking will be permitted on site.

.2 Provide and maintain adequate access to project site.

1.8 OFFICES

.1 Provide and maintain, during the entire progress of the Work, a suitable office on the site, for own use, with suitable tables or benches for the examination of drawings, specifications, etc., and where all notices and instructions from the Consultant may be received and acknowledged. Provide suitable meeting space for site meetings. Provide adequate heating, ventilating and lighting. Location of these offices to be coordinated with the Departmental Representative.

.2 Provide marked and fully stocked first-aid case in a readily available location.

1.9 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.10 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

.3 Contractor shall be responsible for cleaning and maintenance of designated facilities.

1.11 CONSTRUCTION SIGNAGE

.1 No signs or advertisements, other than warning signs, are permitted on site.

1.12 PROTECTION AND MAINTENANCE OF TRAFFIC AND PEDESTRIANS

.1 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.

.2 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs

.3 Protect travelling public from damage to person and property.

.4 Do not block roads without obtaining approval to do so from the Departmental Representative.

.5 Contractor's traffic on roads selected for hauling material shall not interfere with on-going training on site.

.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.

.7 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

.8 Dust control: adequate to ensure safe operation at all times.

.9 Provide snow removal during period of Work.

1.13 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways on an on-going basis.

.3 Store materials resulting from demolition activities that are salvageable.

.4 Stack stored new or salvaged material not in construction facilities.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.2 GUARD RAILS, BARRICADES, AND SIGNAGE

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.

.2 Provide Construction Zone warning and access control signage.

1.3 HOARDING

.1 Erect temporary site enclosure using 1.8 m high chainlink fence with steel posts spaced at maximum 2.4 m on centre. Maintain fence in good repair.

.2 Provide lockable truck entrance gates and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.

.3 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.4 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

.3 Design enclosures to withstand wind pressure and snow loading.

1.5 DUST TIGHT SCREENS

.1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers and finished areas of Work.

.2 Maintain and relocate protection until such work is complete.

.3 Maintain negative pressure in area of dust generating work. Exhaust directly to the exterior.

1.6 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.7 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

1.8 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.10 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Be responsible for damage incurred due to lack of or improper protection.

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Within text of each specifications section, reference may be made to reference standards.

.2 Conform to these reference standards, in whole or in part as specifically requested in specifications.

.3 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.

.4 Cost for such testing will be born by Owner in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.

.4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Consultant reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.4 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials, lumber, steel members, doors and frames on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

.9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 TRANSPORTATION

.1 Pay costs of transportation of products required in performance of Work.

1.6 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

.2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.7 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.8 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.9 CONCEALMENT

.1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

1.10 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.11 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Departmental Representative of conflicting installation. Install as directed.

1.12 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.13 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.14 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.15 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location and depth of capped service.

END OF SECTION

Part 1 General

1.1 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practice in Place of Work, acceptable to Departmental Representative.

1.2 SURVEY REFERENCE POINTS

.1 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.

.2 Make no changes or relocations without prior written notice to Departmental Representative.

.3 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.4 Require surveyor to replace control points in accordance with original survey control.

1.3 SURVEY REQUIREMENTS

.1 Existing base horizontal and vertical control points are designated on drawings.

.2 Establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.

.3 Establish lines and levels, locate and lay out, by instrumentation.

.4 Stake for grading, fill and top soil placement and landscaping features.

.5 Stake slopes and berms.

.6 Establish pipe invert elevations.

.7 Stake batter boards for foundations.

.8 Establish foundation column locations and floor elevations.

.9 Establish lines and levels for mechanical and electrical work.

1.4 EXISTING SERVICES

.1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.

.2 Remove abandoned service lines within 2m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative

1.5 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Departmental Representative of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.6 RECORDS

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

.3 Record locations of maintained, re-routed and abandoned service lines.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit name and address of Surveyor to Departmental Representative.

.2 On request of Departmental Representative submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit written request in advance of cutting or alteration which affects:

- .1 Structural integrity of elements of project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of operational elements.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or separate contractor.

.3 Include in request:

- .1 Identification of project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on Work of Owner or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

1.2 FORMS

.1 Special forms may be required during the course of this Work. Forms will be supplied by the Departmental Representative.

1.3 MATERIALS

.1 Required for original installation.

.2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

1.4 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.5 EXECUTION

.1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective and non-conforming Work.

.5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.

.9 Restore work with new products in accordance with requirements of Contract Documents.

.10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping or firestopping sealant material using UL or ULC rated assembly in accordance with manufacturer's instructions.

.12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

.13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise. Coordinate Work with mechanical and electrical divisions.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.

.2 Remove waste materials from site at daily regularly scheduled times. Do not burn waste materials on site.

.3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.4 Provide on-site containers for collection of waste materials and debris.

.5 Dispose of waste materials and debris off site.

.6 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.

.7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 FINAL CLEANING

.1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy. Remove debris and surplus materials from accessible concealed spaces.

.3 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.4 Vacuum carpet in renovated areas and where construction traffic occurs. If heavily soiled, carpeting shall be commercially steam cleaned. This will be at the discretion of the Departmental Representative.

.5 Clean and wax areas of resilient sheet and tile flooring in renovated areas, where required by specification section.

.6 Dust all horizontal surfaces, clean all glass and wipe down walls in renovated areas.

END OF SECTION

Part 1 General

1.1 WASTE MATERIAL STORAGE, HANDLING AND PROTECTION

.1 Store, materials to be salvaged in locations as directed by Departmental Representative.

.2 Unless specified otherwise, materials for removal do not become Contractor's property.

.3 Protect, stockpile, store and catalogue salvaged items.

.4 Separate non-salvageable materials from required list of salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.5 Protect salvaged materials from movement or damage.

.6 Provide on-site facilities for collection, handling, and storage of anticipated quantities of waste materials.

.7 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.

1.2 DIVERSION OF MATERIALS

.1 Separate materials and equipment required to be salvaged from general waste stream and stockpile in appropriate storage area, as reviewed by Departmental Representative and consistent with applicable fire regulations.

.2 On-site sale of salvaged materials is not permitted.

1.3 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of waste, volatile materials, mineral spirits, oil, and paint thinner into waterways, storm, or sanitary sewers.

1.4 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises.

.2 Maintain security measures established by existing facility and where required provide temporary security measures approved by Departmental Representative.

.3 Burning of waste on site is not permitted.

1.5 SCHEDULING

.1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.Execution

1.6 APPLICATION

.1 Handle waste materials in accordance with appropriate regulations and codes.

1.7 CLEANING

.1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.2 Clean-up work area as work progresses.

END OF SECTION

Part 1 General

1.1 INSPECTION AND DECLARATION

.1 Contractor's Inspection: Contractor and Subcontractors: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.2 Request Departmental Representative Inspection.

.2 Departmental Representative Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.

.3 Completion: submit written certificate that following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.

.4 Certificates required by Fire Commissioner and Utility companies have been submitted.

.5 Operation of systems have been demonstrated to Owner's personnel.

.6 Commissioning of systems is complete and commissioning forms have been completed.

.7 Work is complete and ready for final inspection.

.4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative, Consultants and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

.5 Where re-inspection is required due to uncompleted deficiencies, the time required by the Departmental Representative and Consultants will be recorded and reimbursement of this time may be charges back to the Contractor by deducting from amounts retained.

1.2 CLEANING

.1 In accordance with Section 01 74 11 - Cleaning.

.2 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Refer to Mechanical and Electrical Divisions for information specific to the mechanical and electrical close-out submittals.

.3 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.4 Copy will be returned after final inspection, with Departmental Representative's comments.

.5 Revise content of documents as required prior to final submittal.

.6 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of operating and maintenance manuals in English.

.7 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

.8 Furnish evidence, if requested, for type, source and quality of products provided.

.9 Defective products will be rejected, regardless of previous inspections. Replace products at Contractor’s own expense.

.10 Pay costs of transportation.

1.2 FORMAT

.1 Organize data as instructional manual.

.2 Provide two (2) bound copies including 1 PDF copy on DVD or CD in each of the manuals.

.3 Provide two (2) additional PDF copies on DVD or CD.

.4 Binders: cloth, hard covered, expandable, loose leaf paper size 219 x 279 mm. Colour “black.” Provide two (2) copies.

.5 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.

.6 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents. Lettering to be “gold” colour.

.7 Provide printed title on DVD/CD version to coincide with title on bound version.

.8 Arrange content by systems, under Section numbers and sequence of Table of Contents.

.9 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.10 Text: manufacturer's printed data, or typewritten data.

.11 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.3 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;

.1 Date of submission; names.

.2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Shop Drawings: illustrating details of a portion of work.

.4 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.5 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.6 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

1.4 AS-BUILTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Departmental Representative.

1.5 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of opaque drawings, provided by Departmental Representative.

.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: mark each item to record actual construction, including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections.

.7 Refer to Mechanical and Electrical Divisions for information specific to the mechanical and electrical close-out submittals.

1.6 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control.

.15 Additional requirements: as specified in individual specification sections.

1.7 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-Protection and Weather-Exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional Requirements: as specified in individual specifications sections.

1.8 SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to location as directed; place and store.

.4 Receive and catalogue items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

.6 Additional Requirements: as specified in individual specifications sections.

1.9 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to location as directed; place and store.

.4 Receive and catalogue items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.10 SPECIAL TOOLS

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to location as directed; place and store.

.4 Receive and catalogue items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.11 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

1.12 WARRANTIES AND BONDS

.1 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.

.2 Assemble approved information in binder and submit upon acceptance of work. Organize binder as follows:

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

.4 Verify that documents are in proper form, contain full information, and are notarized.

.5 Co-execute submittals when required.

.6 Retain warranties and bonds until time specified for submittal.

.3 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

.4 Respond in a timely manner to oral or written notification of required construction warranty repair work.

.5 Written verification will follow oral instructions. Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.13 PRE-WARRANTY CONFERENCE

.1 Meet with Departmental Representative, to develop understanding of requirements of this section. Schedule meeting prior to contract completion, and at time designated by Departmental Representative.

.2 Departmental Representative will establish communication procedures for:

.1 Notification of construction warranty defects.

.2 Determine priorities for type of defect.

.3 Determine reasonable time for response.

.3 Provide name, telephone number and address of licensed and bonded company that is authorized to initiate and pursue construction warranty work action.

.4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.

.2 Refer to all project Specification Sections for detailed description of commissioning requirements.

.3 Acronyms:

.1 Cx - Commissioning.
.2 Cx Authority – Commissioning Authority.
.3 EMCS - Energy Monitoring and Control Systems.
.4 O&M - Operation and Maintenance.
.5 PI - Product Information.
.6 PV - Performance Verification.
.7 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
.2 Ensure appropriate documentation is compiled into the O&M manual.
.3 Effectively train O&M staff.

.2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

.3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

.1 Commissioning (Cx) Plan. The Contractor will be responsible for developing the Commissioning (Cx) Plan.

.2 The parties responsible for Cx activities shall be identified in the Commissioning (Cx) Plan.

.3 Cx to be a line item of Contractor's cost breakdown.

.4 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.5 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the installed systems are proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities include transfer of critical knowledge to facility operational personnel.

.6 Departmental Representative will issue Interim Acceptance Certificate when:

.1 Completed Cx documentation has been received, reviewed for suitability and approved by Cx Authority.

.2 Equipment, components and systems have been commissioned.

.3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Consultant and Cx Authority, to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

.1 Before Construction:

.1 Review contract documents, confirm by writing to Departmental Representative:

.1 Adequacy of provisions for Cx.

.2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction:

.1 Co-ordinate provision, location and installation of provisions for Cx.

.3 Before start of Cx:

.1 Have Cx Plan up-to-date.

.2 Ensure installation of related components, equipment, sub-systems, systems is complete.

.3 Fully understand Cx requirements and procedures.

.4 Have Cx documentation shelf-ready.

.5 Understand completely design criteria and intent and special features.

.6 Submit complete start-up documentation to Departmental Representative.

.7 Have Cx schedules up-to-date.

.8 Ensure systems have been cleaned thoroughly.

.9 Complete TAB procedures on systems; submit TAB reports to Departmental Representative for review and approval.

.10 Ensure "As-Built" system schematics are available.

.4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit:

.1 Name of Contractor's Cx agent.

.2 Draft Cx documentation.

.3 Preliminary Cx schedule.

.2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.

.3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 8 weeks prior to start of Cx.

.4 Provide additional documentation relating to Cx process required by Departmental Representative.

1.8 COMMISSIONING DOCUMENTATION

.1 Refer to individual equipment Specification Sections for (Cx) forms: Installation Check Lists, Product Information (PI) and Performance Verification (PV) forms for requirements.

.2 Consultant and Cx Authority to review and approve Cx documentation.

.3 Provide completed and approved Cx documentation to Departmental Representative.

1.9 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16 - Construction Progress Schedules.

.2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

.1 Approval of Cx reports.

.2 Verification of reported results.

.3 Repairs, retesting, re-commissioning, re-verification.

.4 Training.

1.10 COMMISSIONING MEETINGS

.1 Cx meetings will be held following project meetings and as specifically requested.

.2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.

.3 Cx meetings will be held on a regular basis until commissioning deliverables have been addressed.

.4 At approximately 50% completion stage a separate Cx scope meeting will be held to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:

.1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.

.2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.

.5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.

.6 Meeting will be chaired by Contractor, who will record and distribute minutes.

.7 Ensure subcontractors and relevant manufacturer representatives are present at 50% and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.12 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days notice prior to commencement.

.2 Departmental Representative may witness start-up.

.3 Consultant and Cx Authority will witness testing for PV.

.4 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

.1 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative.

.1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.

.2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

.2 Integrity of warranties:

.1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.

.2 Verify with manufacturer that testing as specified will not void warranties.

.3 Qualifications of manufacturer's personnel:

.1 Experienced in design, installation, and operation of equipment and systems.

.2 Ability to interpret test results accurately.

.3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Conduct start-up and testing in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.

.2 Visual inspection of quality of installation.

.2 Start-up: follow accepted start-up procedures.

.3 Operational testing: document equipment performance.

.4 System PV: include repetition of tests after correcting deficiencies.

.5 Post-substantial performance verification: to include fine-tuning.

.3 Correct deficiencies and obtain approval from Consultant and Cx Authority after distinct phases have been completed and before commencing next phase.

.4 Documents require tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:

.1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.

.2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.

.3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.

.1 Rejected equipment to be remove from site and replace with new.

.2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.

.2 Start-up documentation to include:

.1 Factory and on-site test certificates for specified equipment.

.2 Pre-start-up inspection reports.

.3 Signed installation/start-up check lists.

.4 Start-up reports,

.5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 With assistance of manufacturer develop written maintenance program and submit Departmental Representative for approval before implementation.

.3 Operate and maintain systems for length of time required for commissioning to be completed.

.4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 TEST RESULTS

.1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF COMMISSIONING

.1 Notify Departmental Representative at least 14 days prior to start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.19 INSTRUMENTS / EQUIPMENT

.1 Submit to Departmental Representative for review and approval:

.1 Complete list of instruments proposed to be used.

.2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date, and calibration accuracy.

.2 Provide the following equipment as required:

.1 2-way radios.

.2 Ladders.

.3 Equipment as required to complete work.

1.20 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under actual operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

.4 EMCS trending to be available as supporting documentation for performance verification.

1.21 WITNESSING COMMISSIONING

.1 Consultant and Cx Authority to witness activities and verify results.

1.22 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.3 Provide copies to Departmental Representative within 10 days of test and with Cx report.

1.23 COMMISSIONING CONSTRAINTS

.1 Commissioning will be undertaken on new equipment and modified equipment provided under this contract. Where these are tied into existing building systems the Cx will need to be coordinated with the building operator.

1.24 EXTRAPOLATION OF RESULTS

.1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.25 EXTENT OF VERIFICATION

.1 Provide manpower and instrumentation to verify up to 100% of reported results.

.2 Number and location to be at discretion of Departmental Representative.

.3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.

.4 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.

.5 Perform additional commissioning until results are acceptable to Consultant and Cx Authority.

1.26 REPEAT VERIFICATIONS

.1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:

.1 Verification of reported results fail to receive Consultant's or Cx Authority approval.

.2 Repetition of second verification again fails to receive approval.

.3 Departmental Representative deems Contractor's request for second verification was premature.

1.27 SUNDRY CHECKS AND ADJUSTMENTS

.1 Make adjustments and changes which become apparent as Cx proceeds.

.2 Perform static and operational checks as applicable and as required.

1.28 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.

.2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.29 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Cx Authority.

1.30 ACTIVITIES UPON COMPLETION OF COMMISSIONING

.1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.31 TRAINING

.1 Provide training in accordance with Section 01 91 41 - Commissioning (Cx) - Training and requirements of Contract Specification Sections.

1.32 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.33 OCCUPANCY

.1 Cooperate fully with Departmental Representative during stages of acceptance; facility will remain fully occupied.

1.34 INSTALLED INSTRUMENTATION

.1 Use instruments installed under Contract for TAB and PV if:

.1 Accuracy complies with these specifications.

.2 Calibration certificates have been deposited with Departmental Representative.

.2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.35 PERFORMANCE VERIFICATION TOLERANCES

.1 Application tolerances:

.1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Unless noted otherwise in this contract Specifications, to be within +/- 10% of specified values.

.2 Instrument accuracy tolerances:

.1 To be of higher order of magnitude than equipment or system being tested.

.3 Measurement tolerances during verification:

.1 Unless noted otherwise in this contract Specifications actual values to be within +/- 2 % of recorded values.

1.36 OWNER'S PERFORMANCE TESTING

.1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.

Part 2 Schedules

2.1 SCHEDULE OF ARCHITECTURAL SYSTEMS

.1 All door hardware and controls: door hardware and electronic controls function.

2.2 CX SCHEDULE FOR MECHANICAL SYSTEMS

.1 Produce schedule of Cx activities in bar chart format to a scale that will ensure legibility. Bar chart to indicate:

.2 Sequences of testing equipment and systems, interrelationship between tests, duration of tests and training periods.

.3 Cx resources which will be committed to this project to ensure completion by prescribed dates.

.1 Training Plan.

.2 Cx Documentation Plan.

.3 Water/fire mains and related site fire hydrants:

.4 Commission as soon as installation is complete, using procedures described in NFPA reference standards to provide protection for exterior envelope of new building during construction.

.5 Wet pipe sprinkler systems:

.1 Test completed systems in accordance with NFPA 13.

.6 Plumbing systems:

.1 To be filled, then proceed with flushing, cleaning and disinfection processes.

.2 Test plumbing and piping systems installed under this project.

.7 HVAC systems:

.1 Ductwork, piping and conduit systems that will be concealed to be tested and certified to specified standards before being concealed. This work is specified in relevant technical sections of Division 23.

.2 HVAC systems to be initially started up, "bumped" in a stand-alone mode and pre-start-up inspections completed.

.3 Start after dust-producing construction procedures have been completed and areas are dust-free.

.4 Start HVAC to replace temporary heating systems after Consultant's written approval.

.5 Operate HVAC to permit TAB and ensure full compliance with contract documents when weatherstripping, caulking and sealing of exterior envelope has been completed, and interior partitions and doors are installed and ceiling return plenums are in place.

.8 HVAC and related hydronic systems:

.1 Test in conjunction with controls, and fire and smoke detection systems.

.9 Items which have a detrimental effect on operation and maintenance. To receive preliminary attention at this point. To be fully commissioned at same time as relevant equipment and systems.

.10 Vibration isolation and seismic control measures:

.1 Test these measures at same time as connected system.

.11 Equipment and systems subject to specified codes and standards or subject to approval of an authority having jurisdiction:

.1 Commission equipment and systems in accordance with those requirements.

.2 Where testing is required as part of a regulatory process, and where Cx procedures are fully developed, are appropriate to project, ensure tests as

required by such codes are performed. Departmental Representative to witness tests as part of Quality Assurance role.

.12 Controls:

.1 Testing and Cx to be specified in relevant sections under Division 23, which defines conditions for acceptance.

.2 Point-by-point and end-to-end testing to be carried out by installation Contractor, monitored by Departmental Representative and verified as part of system verification.

.3 Demonstration of operation of systems under operating conditions and over full operating range to take place prior to 30-day test period and to be witnessed by Departmental Representative. Includes simulated opposite-season tests. Controls programming and operation to be verified after HVAC systems have been TAB'd.

.13 To reduce VOC concentrations to acceptable levels:

.1 Flow rates of outside air into HVAC systems to be adjusted as required during Cx, after occupancy and as necessary after occupancy.

.14 Commission mechanical systems and associated equipment as follows:

.1 Plumbing systems:

.1 Installation and Operation of all plumbing fixtures installed under this project.

.2 Installation and Operation of hot water generating equipment (all point of use heaters and common heaters).

.3 Installation and Operation of Domestic Recic pump

.4 Installation and Operation of Domestic Booster Package

.5 All piping installed to serve fixtures.

.2 Hydronic systems:

.1 To be filled, pumps "bumped" in stand-alone mode and pre-start-up inspections completed. Then undertake cleaning and flushing processes.

.2 Commission after exterior envelope has been completed and exterior has been caulked, but only after relevant water treatment systems have been commissioned.

.3 Commission at same time as HVAC systems are being TAB'd.

.3 HVAC and exhaust systems:

.1 HVAC systems (RTU-1 to RTU-6, P-1 to P-4, Boiler B-1 to B-2, System Fill SF-1)

.2 Exhaust systems (All exhaust fan systems and controls)

.3 Terminal Heating Units (All unit heaters, cabinet unit heaters, duct heating coils and perimeter radiation with associated controls for each device)

.4 Dedicated DX Systems (AC-1/2 with CU-1)

.4 Fire and life safety systems:

.1 Wet pipe sprinkler systems.

.2 Fire Hydrant.

.3 Fire extinguishers.

.15 Product Information forms shall be completed and submitted with Shop Drawings. A sample of each type of form is provided with the specifications.

.16 Performance Verification forms (samples provided as noted) shall be finalized with contractor and completed by the contractor prior to performance review with Departmental Representative for the following mechanical systems:

.1 Roof Top Units (RTU-1 – RTU-6, PV sample provided for RTU-1)

.2 Exhaust fans EF-1 to EF-15 (PV sample provided) – 100% to be reviewed with Cx Agent after commissioning is complete.

.3 Boilers B-1 and B-2 – 100% to be reviewed with Cx Agent after commissioning is complete.

.4 Pumps P-1, P-2, P-3 and P-4 (PV sample provided) – 100% to be reviewed with Cx Agent after commissioning is complete.

.5 Air Conditioning Units AC-1/ 2 and associated condensing unit. – 100% to be reviewed with Cx Agent after commissioning is complete.

.6 All Perimeter Heating Terminal Units: 30% to be reviewed with Cx Agent after commissioning is complete.

.7 All Unit Heater and Cabinet Unit Heaters: 100% to be reviewed with Cx Agent after commissioning is complete.

.8 All Duct Heating Coils: 100% to be reviewed with Cx Agent after commissioning is complete.

.9 Testing and Air Balancing Report: 30% to be reviewed with Cx Agent after commissioning is complete.

.10 Domestic water Heaters: 100% to be reviewed with Cx Agent after commissioning is complete.

2.3 SCHEDULE OF ELECTRICAL SYSTEMS

.1 The following is a listing of the building electrical systems to be commissioned:

.1 Low Voltage Lighting Control Devices (includes potential relocation for optimizing effectiveness of sensing zones)

.2 Low Voltage Switchboards (includes adjustments and confirmation of all trip settings from project's Over-Current Coordination study).

.3 Panelboards Breaker Type (includes proper operation of emergency transfer panel, verification of panel directories)

.4 Motor Starters including Variable Frequency Drives

.5 Grounding (includes ground resistance test results)

.6 Lighting Operation

.7 Emergency Lighting (includes aiming of lamps to optimize illumination onto egress paths).

.8 Fire Alarm System (includes integrated life safety testing and monitoring of alarm call outs)

.9 Communication Cable Inside Building (includes review of all testing printouts)

.10 Security System and Door Access (by Owner's own forces)

2.4 INTEGRATED LIFE SAFETY SYSTEMS

.1 Upon completion of individual system tests, test for integration of life safety systems upon

.1 Loss of Utility power / Return of Utility power

.2 Fire alarm signal upon loss / return of power feed

.2 Electronic Hardware and Detention Hardware Systems: Test integration with fire alarm event.

.3 Fire Protection Systems: test integrated systems to verify that components work together as designed.

.4 Performance of HVAC, fire protection, EMCS and systems forming part of integrated systems to be verified after systems has been TAB'd to ensure compliance with prescribed requirements.

.5 Fire alarm call out, horn strobes.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Commissioning forms to be completed for equipment, system and integrated system.

.2 Product Information (PI) forms are appended to this Section.

.3 Example Performance Verification (PV) forms are appended to this Section.

1.2 INSTALLATION/START-UP CHECK LISTS

.1 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists may be required for specific project conditions.

.3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in O&M Manual at completion of project.

.5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the Cx Manual at completion of work.

.2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Consultant and Cx Authority approvals.

1.4 PERFORMANCE VERIFICATION (PV) FORMS

.1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.

.2 PV report forms include those developed by Contractor, and records the measured data and readings taken during functional testing and Performance Verification procedures.

.3 Prior to PV of integrated system, complete the PV forms of related systems and obtain Consultant's and Cx Authority approval.

1.5 COMMISSIONING FORMS

.1 The Consultant will develop and provide the Contractor with final project-specific Commissioning forms in hard-copy format complete with specification data.

.2 Revise items on Commissioning forms to suit project requirements.

1.6 COMMISSIONING VERIFICATION PROCESS

.1 Use Commissioning forms to verify installation and record performance of equipment and systems.

.2 Strategy for Use:

.1 Consultant provides Contractor project-specific Commissioning forms with Specification data included.

.2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.

.3 Confirm operation as per design criteria and intent.

.4 Identify variances between design and operation and reasons for variances.

.5 Verify operation in specified normal and emergency modes and under specified load conditions.

.6 Record analytical and substantiating data.

.7 Reported results will be verified by the Consultant and Cx Authority.

.8 Form to bear signatures of recording technician and reviewed and signed off by Consultant and Cx Authority.

.9 Submit immediately after tests are performed.

.10 Reported results in true measured SI unit values.

.11 Originals of completed forms are to be retained on site during start-up, testing and commissioning period. Maintain in Commissioning Manual binder.

.12 Forms to be hard copy with type written results in Commissioning Manual Binder.

END OF SECTION

Mechanical Component Form Index		
Section 1: Air Moving Equipment		
Form	Equipment	Reference
CFM1.1	Roof Top Unit RTU-1	Provided in Specifications
CFM1.2	Roof Top Unit RTU-2	Similar to CFM1.1
CFM1.3	Roof Top Unit RTU-3	Provided in Specifications
CFM1.4	Roof Top Unit RTU-4	Similar to CFM1.3
CFM1.5	Roof Top Unit RTU-5	Similar to CFM1.3
CFM1.6	Exhaust Fan EF-1 to EF-4	Provided in Specifications
CFM1.7	Exhaust Fan EF-5 to EF-6	Similar to CFM 1.6
CFM1.8	Exhaust Fan EF-7	Similar to CFM 1.6
CFM1.9	Exhaust Fan EF-8 to EF-10	Provided in Specifications
CFM1.10	Exhaust Fan EF-11	Similar to CFM1.6
CFM1.11	Exhaust Fan EF-12 to EF-14	Similar to CFM1.9
Section 2: Hydronic Equipment		
Form	Equipment	Reference
CFM2.1	Fan Forced Heater FF-1 to FF-5	Provided in Specifications
CFM2.2	Unit Heater UH-1 to UH-8	Similar to CFM2.1
CFM2.3	Wall Fin Radiation	Provided in Specifications
CFM2.4	Boiler	Not included
CFM2.5	Pump P-1 and P-2	Provided in Specifications
CFM2.6	Pump P-3 and Pump P-4	Provided in Specifications
Section 3: Air Conditioning Equipment		
Form	Equipment	Reference
CFM3.1	Air Conditioning Unit AC-1& AC-2/CU-1	Provided in Specifications

Mechanical Component Form Index		
Section 4: Miscellaneous		
Form	Equipment	Reference
CFM4.1	Silencers	Provided in Specifications
CFM4.2	System Fill	Not Provided
CFM4.3	Expansion Tank ET-1	Not Provided
CFM4.4	Expansion Tank ET-2	Not Provided
Section 5: Plumbing		
Form	Equipment	Reference
CFM5.1	Water Heater WH-1& WH-2	Provided in Specifications
CFM5.2	Pump P-5	Provided in Specifications
CFM5.3	Pump P-6	Similar to CFM5.2
CFM5.4	Pump FP-1	Similar to CFM5.2
CFM5.5	Plumbing Fixtures	Provided in Specifications

Project Name:	**Project #:**	**S-35-2014**
New Modular Police Building Ahtahkakoop	**Component Form #:**	**CFM3.1**

Component Verification Form

System:	*Equipment:*	*Tag:*
HVAC	**Packaged Cooling Equipment**	**AC-1**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	Modular Police Building
Area Served	Room 143/149
Floor Located	Main Floor / Roof
Room	Room 143/149

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed	
Indoor Unit					
Air Flow Low Speed	151 L/s (320 CFM)	(0 CFM)	-	Eng: ☐	Con: ☐
Air Flow High Speed	200 L/s (424 CFM)	(0 CFM)	-	Eng: ☐	Con: ☐
# of speeds	3.00	-	-	Eng: ☐	Con: ☐
# of AC units	2.00	-	-	Eng: ☐	Con: ☐
Total Cooling	3.52 kW (12 MBH)	(0 MBH)	-	Eng: ☐	Con: ☐
Voltage / Phase	208/1	-	-	Eng: ☐	Con: ☐
SEER	15.2	-	-	Eng: ☐	Con: ☐
EER	10.1	-	-	Eng: ☐	Con: ☐
Breaker	15A	-	-	Eng: ☐	Con: ☐
Condensate Pump	Yes	-	-	Eng: ☐	Con: ☐
Pump factory wired	Yes	-	-	Eng: ☐	Con: ☐
Refrigerant	HFC (R410A)	-	-	Eng: ☐	Con: ☐
Outdoor Unit CU-1					
Voltage / Phase	208/1	-	-	Eng: ☐	Con: ☐
Min. Circuit Ampacity	18 amps	-	-	Eng: ☐	Con: ☐
Max Overcurrent	30 amps	-	-	Eng: ☐	Con: ☐
Refrigerant	HFC (R410A)	-	-	Eng: ☐	Con: ☐
Warranty	6 years	-	-	Eng: ☐	Con: ☐
Wind gaurds	Yes	-			
Load Modulation	Variable Compressor	-	-	Eng: ☐	Con: ☐
Ambient Operation to	-40.00 C -(40.00 F)	(32.00 F)	-	Eng: ☐	Con: ☐
Accessories					
Filter Width	100mm	-	-	Eng: ☐	Con: ☐
Filter Efficiency	Merv 8	-	-	Eng: ☐	Con: ☐
				☐	☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Project Name:	**Project #:**	**S-35-2014**
New Modular Police Building Ahtahkakoop	**Component Form #:**	**CFM2.3**

Component Verification Form		*Section:*
System: **HVAC**	*Equipment:* **Electric Baseboard**	*Tag:* **Type A**

INSTALLED EQUIPMENT DATA:

Manufacturer	TWA
Type	Hot Water Wall-Fin Radiation
Model Number	
Serial Number	

LOCATION DATA:

Building	Modular Police Building
Area Served	Building
Floor Located	Main Floor
Room	Various

PERFORMANCE DATA:

	Specified	**Shop Drawings**	**Required Modification**	**Installed**	
Type B Panel					
Length	617 mm (24.3 in.)	(0.0 in.)	-	Eng: ☐	Con: ☐
Control	Remote Thermostat			Eng: ☐	Con: ☐
Control Transformer`	Yes		-	Eng: ☐	Con: ☐
Transf. Factory Wired and Mounted	Yes		-	Eng: ☐	Con: ☐
Energy Exchanged	1.50 kW (5 MBH)	(0 MBH)	-	Eng: ☐	Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Project Name:	**Project #:**	**S-35-2014**
New Modular Police Building Ahtahkakoop	**Component Form #:**	**CFM1.6**

Component Verification Form

Section:

System:	*Equipment:*	*Tag:*
HVAC	**EXHAUST FAN**	**EF-1 to EF-4**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	Modular Police Building
Area Served	EF-1: Room 141/142, EF-2: Room 138/139
	EF-3: Room 136/137, EF-4: Room 159/160
Equip Location	Crawlspace

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed	
Fan:					
Fan Type	Inline Cabinet		-	Eng: ☐	Con: ☐
Air Flow	47 L/s (100 CFM)	(0 CFM)	-	Eng: ☐	Con: ☐
E.S.P.	125 Pa (0.50 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐	Con: ☐
Sound	3 Sones		-	Eng: ☐	Con: ☐
Motor Size	0.10 kW (0.13 hp)	(0.00 hp)	-	Eng: ☐	Con: ☐
Voltage / Phase	120/1		-	Eng: ☐	Con: ☐
Motor Type	Direct Drive		-	Eng: ☐	Con: ☐
Control	Local Switch with timer				
Options:					
Insulation Lining	13mm		-	Eng: ☐	Con: ☐
Backdraft Damper	Yes		-	Eng: ☐	Con: ☐
Isolators	Spring		-	Eng: ☐	Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Project Name:	**Project #:**	**S-35-2014**
New Modular Police Building Ahtahkakoop	**Component Form #:**	**CFM1.6**

Component Verification Form

System:	*Equipment:*	*Section:* / *Tag:*
HVAC	**EXHAUST FAN**	**EF-8**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	Modular Police Building
Area Served	Room 147
Equip Location	Roof

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed
Fan:				
Fan Type	Roof Exhaust		-	Eng: ☐ Con: ☐
Air Flow	71 L/s (151 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
E.S.P.	31 Pa (0.12 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
Sound	1.5 Sones		-	Eng: ☐ Con: ☐
Motor Size	0.01 kW (0.01 hp)	(0.00 hp)	-	Eng: ☐ Con: ☐
Voltage / Phase	120/1		-	Eng: ☐ Con: ☐
Motor Type	Direct Drive		-	Eng: ☐ Con: ☐
Control	Line Voltage Switch			
Options:				
Insulation Lining	13mm		-	Eng: ☐ Con: ☐
Backdraft Damper	Yes		-	Eng: ☐ Con: ☐
Isolators	Yes		-	Eng: ☐ Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Project Name:	**Project #:**	**S-35-2014**
New Modular Police Building Ahtahkakoop	**Component Form #:**	**CFM2.1**

Component Verification Form

System:	*Equipment:*	*Section:* / *Tag:*
HVAC	**Fan Forced Heater**	**FF-1 to FF-5**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	Modular Police Building
Area Served	
Floor Located	Main Floor
Room	

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed	
Supply Fan:					
Cabinet	20 gauge steel		-	Eng: ☐	Con: ☐
Air Flow	75 L/s (159 CFM)	(0 CFM)	-	Eng: ☐	Con: ☐
Voltage / Phase	240/1 phase	115/1	-	Eng: ☐	Con: ☐
Control	Remote Thermostat			Eng: ☐	Con: ☐
Control Transformer`	Yes		-	Eng: ☐	Con: ☐
Transf. Factory Wired and Mounted	Yes		-	Eng: ☐	Con: ☐
Energy Exchanged	4.00 kW (14 MBH)	(0 MBH)	-	Eng: ☐	Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Project Name:	**Project #:**	**S-35-2014**
New Modular Police Building Ahtahkakoop	**Component Form #:**	**CFM2.5**

Component Verification Form		*Section:*
System: **HVAC**	*Equipment:* **PUMP**	*Tag:* **P-1 and P-2**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	Modular Police Building
Area Served	Boiler Circ pump
Floor Located	Main Floor
Room	Room 139

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed	
Pump:					
Pump Style	Cartridge Circulator		-	Eng: ☐	Con: ☐
Flow	0.09 L/s (1.5 US gpm)	(0 US gpm)	-	Eng: ☐	Con: ☐
Fluid	Propylene / Water		-	Eng: ☐	Con: ☐
Head	14.90 kPa (4.99 ft.w.c.)	(0.00 ft.w.c.)	-	Eng: ☐	Con: ☐
Motor Size	0.21 kW (0.28 hp)	(0.00 hp)	-	Eng: ☐	Con: ☐
Motor Efficiency	Premium		-	Eng: ☐	Con: ☐
Voltage / Phase	120/60		-	Eng: ☐	Con: ☐
Construction	Stainless Steel				
Options:					
				☐	☐
				☐	☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Project Name:	**Project #:**	**S-35-2014**
New Modular Police Building Ahtahkakoop	**Component Form #:**	**CFM5.2**

Component Verification Form

System:	*Equipment:*	*Section:* / *Tag:*
HVAC	**PUMP**	**P-5**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	Modular Police Building
Area Served	Domestic Recirc
Floor Located	Main Floor
Room	Room 139

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed	
Pump:					
Pump Style	Cartridge Circulator		-	Eng: ☐	Con: ☐
Flow	0.09 L/s (1.5 US gpm)	(0 US gpm)	-	Eng: ☐	Con: ☐
Fluid	Potable Water		-	Eng: ☐	Con: ☐
Head	14.90 kPa (4.99 ft.w.c.)	(0.00 ft.w.c.)	-	Eng: ☐	Con: ☐
Motor Size	0.21 kW (0.28 hp)	(0.00 hp)	-	Eng: ☐	Con: ☐
Motor Efficiency	Premium		-	Eng: ☐	Con: ☐
Voltage / Phase	120/60		-	Eng: ☐	Con: ☐
Construction	Stainless Steel				
Options:					
				☐	☐
				☐	☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Project Name: New Modular Police Building Ahtahkakoop	**Project #:** S-35-2014
	Component Form #: CFM1.1

Component Verification Form

System:	*Equipment:*	*Section:* / *Tag:*
HVAC	**Roof Top Unit**	**RTU-1**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	Roof Top Unit
Model Number	
Serial Number	

LOCATION DATA:

Building	Modular Police Building
Area Served	
Floor Located	Roof
Room	

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed
Supply Fan:				
Air Flow	1,038 L/s (2,201 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
T.S.P.	685 Pa (2.75 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
E.S.P.	249 Pa (1.00 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
Fan RPM	1760		-	Eng: ☐ Con: ☐
Fan Static Efficiency	47%		-	Eng: ☐ Con: ☐
Motor Size	2.24 kW (3.00 hp)	(0.00 hp)	-	Eng: ☐ Con: ☐
Motor RPM	1760 RPM		-	Eng: ☐ Con: ☐
Motor Efficiency	Premium		-	Eng: ☐ Con: ☐
Return Fan:				
Air Flow	1,038 L/s (2,201 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
T.S.P.	414 Pa (1.66 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
E.S.P.	125 Pa (0.50 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
Fan RPM	1358		-	Eng: ☐ Con: ☐
Fan Static Efficiency	51%		-	Eng: ☐ Con: ☐
Motor Size	1.49 kW (2.00 hp)	(0.00 hp)	-	Eng: ☐ Con: ☐
Motor RPM	1760 RPM		-	Eng: ☐ Con: ☐
Motor Efficiency	Premium		-	Eng: ☐ Con: ☐
Heat Wheel:				
Air Flow	1,038 L/s (2,201 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
Sensible Effectiveness	76.3%		-	Eng: ☐ Con: ☐
Latent Effectiveness	72.0%		-	Eng: ☐ Con: ☐
Motor Size	0.06 kW (0.08 hp)	(0.00 hp)	-	Eng: ☐ Con: ☐
Motor RPM	1750 RPM		-	Eng: ☐ Con: ☐
Defrost Control	VFD Motor		-	Eng: ☐ Con: ☐
Pre-Heating Coil:				
Air Flow	1,038 L/s (2,201 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
E.A.T.	-41.70 C -(43.06 F)	(32.00 F)	-	Eng: ☐ Con: ☐
L.A.T	7.20 C (44.96 F)	(32.00 F)	-	Eng: ☐ Con: ☐
A.P.D.	15 Pa (0.06 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
Energy Source	Electric		-	Eng: ☐ Con: ☐
Control	Modulating		-	Eng: ☐ Con: ☐
Size	60.00 kW (205 MBH)	(0 MBH)	-	Eng: ☐ Con: ☐
Heating Coil:				
Air Flow	1,038 L/s (2,201 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
E.A.T.	5.00 C (41.00 F)	(32.00 F)	-	Eng: ☐ Con: ☐
L.A.T	38.00 C (100.40 F)	(32.00 F)	-	Eng: ☐ Con: ☐
A.P.D.	5 Pa (0.02 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
Energy Source	Electric		-	Eng: ☐ Con: ☐
Control	Modulating/SCR		-	Eng: ☐ Con: ☐
Size	40.00 kW (136 MBH)	(0 MBH)	-	Eng: ☐ Con: ☐

Project Name:	**Project #:**	**S-35-2014**
New Modular Police Building Ahtahkakoop	**Component Form #:**	**CFM1.1**

Component Verification Form		*Section:*
System: **HVAC**	*Equipment:* **Roof Top Unit**	*Tag:* **RTU-1**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	Roof Top Unit
Model Number	
Serial Number	

LOCATION DATA:

Building	Modular Police Building
Area Served	
Floor Located	Roof
Room	

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed	
Cooling Coil:					
Air Flow	1,038 L/s (2,201 CFM)	(0 CFM)	-	Eng: ☐	Con: ☐
E.A.T. DB	27.80 C (82.04 F)	(32.00 F)	-	Eng: ☐	Con: ☐
E.A.T. WB	16.90 C (62.42 F)	(32.00 F)	-	Eng: ☐	Con: ☐
Coil L.A.T. DB	8.40 C (47.12 F)	(32.00 F)	-	Eng: ☐	Con: ☐
Unit L.A.T. DB	9.60 C (49.28 F)	(32.00 F)	-	Eng: ☐	Con: ☐
A.P.D.	10 Pa (0.04 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐	Con: ☐
Suction Temperature	6.70 C (44.06 F)	(32.00 F)	-	Eng: ☐	Con: ☐
Total Energy Exch.	25.78 kW (88 MBH)	(0.0 MBH)	-	Eng: ☐	Con: ☐
Sensible Energy Exch.	23.08 kW (79 MBH)	(0.0 MBH)	-	Eng: ☐	Con: ☐
Refrigerant	R-410A (HFC)		-	Eng: ☐	Con: ☐
Compressors	2		-	Eng: ☐	Con: ☐
Lead Capacity Control	Variable Speed		-	Eng: ☐	Con: ☐
Lag Capacity Control	on/off		-	Eng: ☐	Con: ☐
Cooling Efficiency	9.4		-		
IEER	14.9		-		
Electrical:					
Wiring	Single Point		-	Eng: ☐	Con: ☐
Voltage	575 / 3 phase		-	Eng: ☐	Con: ☐
Unit FLA	105 amps		-	Eng: ☐	Con: ☐
Min. Circuit Ampacity	107 amps		-	Eng: ☐	Con: ☐
Max Overcurrent	110 amps		-	Eng: ☐	Con: ☐

Sound:	Discharge		Return		Comments		
	Spec	Shop	Spec	Shop			
63	85 dB		84 dB		-	Eng: ☐	Con: ☐
125	84 dB		82 dB		-	Eng: ☐	Con: ☐
250	86 dB		79 dB		-	Eng: ☐	Con: ☐
500	82 dB		72 dB		-	Eng: ☐	Con: ☐
1000	74 dB		72 dB		-	Eng: ☐	Con: ☐
2000	72 dB		70 dB		-	Eng: ☐	Con: ☐
4000	69 dB		67 dB		-	Eng: ☐	Con: ☐
8000	63 dB		61 dB		-	Eng: ☐	Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Prepared By: HDA Engineering Ltd. Regina, Sk, (306) 525-9815

Project Name:	**Project #:**	**S-35-2014**
New Modular Police Building Ahtahkakoop	**Component Form #:**	**CFM1.3**

Component Verification Form — *Section:*

System:	*Equipment:*	*Tag:*
HVAC	**Roof Top Unit**	**RTU-3**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	Roof Top Unit
Model Number	
Serial Number	

LOCATION DATA:

Building	Modular Police Building
Area Served	
Floor Located	Roof
Room	

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed	
Fan:					
Air Flow	906 L/s (1,921 CFM)	(0 CFM)	-	Eng: ☐	Con: ☐
T.S.P.	685 Pa (2.75 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐	Con: ☐
E.S.P.	249 Pa (1.00 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐	Con: ☐
S.P.	349 Pa (1.40 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐	Con: ☐
Fan RPM	1268		-	Eng: ☐	Con: ☐
Motor Size	1.49 kW (2.00 hp)	(0.00 hp)	-	Eng: ☐	Con: ☐
Motor RPM	1760 RPM		-	Eng: ☐	Con: ☐
Motor Efficiency	Premium		-	Eng: ☐	Con: ☐
Sound	75 dBa		-		
Heating Coil:					
Air Flow	906 L/s (1,921 CFM)	(0 CFM)	-	Eng: ☐	Con: ☐
E.A.T.	9.40 C (48.92 F)	(32.00 F)	-	Eng: ☐	Con: ☐
L.A.T	23.30 C (73.94 F)	(32.00 F)	-	Eng: ☐	Con: ☐
Energy Source	Electric		-	Eng: ☐	Con: ☐
Control	Modulating/SCR		-	Eng: ☐	Con: ☐
Size	15.00 kW (51 MBH)	(0 MBH)	-	Eng: ☐	Con: ☐
Cooling Coil:					
Air Flow	755 L/s (1,601 CFM)	(0 CFM)	-	Eng: ☐	Con: ☐
E.A.T. DB	24.70 C (76.46 F)	(32.00 F)	-	Eng: ☐	Con: ☐
E.A.T. WB	17.00 C (62.60 F)	(32.00 F)	-	Eng: ☐	Con: ☐
Unit L.A.T. DB	12.80 C (55.04 F)	(32.00 F)	-	Eng: ☐	Con: ☐
Nominal Energy	14.70 kW (50 MBH)	(0.0 MBH)	-	Eng: ☐	Con: ☐
Net Energy	14.40 kW (49 MBH)	(0.0 MBH)	-	Eng: ☐	Con: ☐
Refrigerant	R-410A (HFC)		-	Eng: ☐	Con: ☐
Compressors	1		-	Eng: ☐	Con: ☐
Lag Capacity Control	two stage		-	Eng: ☐	Con: ☐
Cooling Efficiency	12.8		-		
SEER	17.6		-		
Electrical:					
Wiring	Single Point		-	Eng: ☐	Con: ☐
Voltage	600 / 3 phase		-	Eng: ☐	Con: ☐
Min. Circuit Ampacity	22 amps		-	Eng: ☐	Con: ☐
Max Overcurrent	25 amps		-	Eng: ☐	Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Prepared By: HDA Engineering Ltd. Regina, Sk, (306) 525-9815

Project Name: New Modular Police Building Ahtahkakoop	**Project #:** S-35-2014
	Component Form #: CFM4.1

Component Verification Form		*Section:*
System: **HVAC**	*Equipment:* **Silencer**	*Tag:* **SIL-1**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	Modular Police Building
Area Served	Room 107.1
Floor Located	Main Floor
Room	

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed
Supply Fan:				
Length	2000 mm 80 in.	0 in.	-	Eng: ☐ Con: ☐
Inlet Size	300x150 (12"x10")		-	Eng: ☐ Con: ☐
Airflow	64 L/s (136 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
Configuration	Z - configuration		-	Eng: ☐ Con: ☐
Attenuation - 63 Hz	12		-	Eng: ☐ Con: ☐
Attenuation - 125 Hz	24		-	Eng: ☐ Con: ☐
Attenuation - 250 Hz	43		-	Eng: ☐ Con: ☐
Attenuation - 500 Hz	52		-	Eng: ☐ Con: ☐
Attenuation - 1 kHz	54		-	Eng: ☐ Con: ☐
Attenuation - 2kHz	55		-	Eng: ☐ Con: ☐
Attenuation - 4kHz	48		-	Eng: ☐ Con: ☐
Attenuation - 8kHz	32		-	Eng: ☐ Con: ☐
Outer Casing	22 ga. Galvanized		-	Eng: ☐ Con: ☐
Inner Casing	22 ga. Perforated Galv.		-	Eng: ☐ Con: ☐
Media	fiberglass		-	Eng: ☐ Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Project Name:	**Project #:**	**S-35-2014**
New Modular Police Building Ahtahkakoop	**Component Form #:**	**CFM5.1**

Component Verification Form

System:	*Equipment:*	*Section:* / *Tag:*
HVAC	**Water Heater**	**WH-1**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	Modular Police Building
Area Served	
Floor Located	Main Floor
Room	

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed	
Supply Fan:					
Style	Electric Tankless		-	Eng: ☐	Con: ☐
T&P Relief Valve	Yes		-	Eng: ☐	Con: ☐
Voltage / Phase	120/1phase		-	Eng: ☐	Con: ☐
Temp Rise at 0.5 GPM	22.80 C (41.00 F)		-	Eng: ☐	Con: ☐
Height	273 mm (10.7 in.)	(0.0 in.)	-	Eng: ☐	Con: ☐
Width	133 mm (5.2 in.)	(0.0 in.)	-	Eng: ☐	Con: ☐
Depth	73 mm (2.9 in.)	(0.0 in.)	-	Eng: ☐	Con: ☐
# of Elements	1		-	Eng: ☐	Con: ☐
Gas Heat Exchanger	3.00 kW (10 MBH)	(0 MBH)	-	Eng: ☐	Con: ☐
Electrical:					
Min. Circuit Ampacity	25 amps		-	Eng: ☐	Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

1. TEST PURPOSE

.1 To test all plumbing fixture installations to ensure that the system and all associated sub-systems operate as intended during normal and abnormal operating conditions.

.2 To document that the fixture performs as intended.

.3 To highlight required modifications and corrections to the fixture and allow those corrections to take place prior to substantial completion and turn over to owner.

2. Test Prerequisites Mechanical:

		C	E
.1	As-built drawings are complete and have been submitted ----------	☐	☐
.2	All component verifications are complete and reviewed ----------	☐	☐
.3	Fixtures are installed and operational ----------	☐	☐
.4	Testing, adjusting and balancing (TAB) is complete for all associated systems (Hot Water Recirc). ----------	☐	☐
.5	TAB report is complete and reviewed. ----------	☐	☐

3. Operational Testing Procedures

.1 Water Closets – WC-1

Location	Isolation Installed	Isolation Functions	Escutcheons Installed	6L Flush Works	4L Flush Works	No Leaks Evident	No Water Hammer Evident	Mounting Height	Lid Lock Functions
Room 102									
Room 110									
Room 120(up)									
Room 120(down)									
Room 121 (up)									
Room 121 (down)									
Room 136									

.2 Water Closets – WC-2

Location	Isolation Installed	Isolation Functions	Escutcheons Installed	6L Flush Works	4L Flush Works	No Leaks Evident	No Water Hammer Evident	Mounting Height	Lid Lock Functions
Room 133									
Room 134									
Room 138									

Location	Isolation Installed	Isolation Functions	Escutcheons Installed	6L Flush Works	4L Flush Works	No Leaks Evident	No Water Hammer Evident	Mounting Height	Lid Lock Functions
Room 144									
Room 146									
Room 150									
Room 151									
Room 156									

.3 Urinal

Location	Cleanout Accessible	Trap Installed	Trap Primed	Mounting Height					
Room 121									

.4 Lavatories – L-1

Location	Isolation Installed	Isolation Functions	Escutcheons Installed	Discharge Temp. Set	Washing Time	Sensor Beam OK	Back-up Battery	No Leaks Evident	No Water Hammer Evident	Flow Control
Room 102										

.5 Lavatories – L-2

Location	Isolation Installed	Isolation Functions	Escutcheons Installed	Discharge Temp. Set	Washing Time	Sensor Beam OK	Back-up Battery	No Leaks Evident	No Water Hammer Evident	Flow Control
Room 110										
Room 115										
Room 136										

.6 Lavatories – L-3

Location	Isolation Installed	Isolation Functions	Escutcheons Installed	Discharge Temp. Set	Washing Time	Sensor Beam OK	Back-up Battery	No Leaks Evident	No Water Hammer Evident	Flow Control
Room 120										
Room 121										
Room 136										

.7 Showers

Location	Diverter Functions	Wall Head Functions	Handheld Functions	Hot Water Functional	Cold Water Functional	No Leaks Evident	No Water Hammer Evident	Flow Control
Room 120 (SH-1)								
Room 121 (SH-1)								
Room 139 (SH-2)								

.8 Sinks

Location	Isolation Installed	Isolation Functions	Escutcheons Installed	Hot Water Functional	Cold Water Functional	No Leaks Evident	No Water Hammer Evident	Flow Control
Room 129 (SK-3)								
Room 141 (SK-4)								
Room 142 (SK-2)								
Room 154 (SK-2)								
Room 163 (SK-1)								

.9 Mop Sinks

Location	Isolation Installed	Isolation Functions	Escutcheons Installed	Hot Water Functional	Cold Water Functional	No Leaks Evident	No Water Hammer Evident	Flow Control

Location	Isolation Installed	Isolation Functions	Escutcheons Installed	Hot Water Functional	Cold Water Functional	No Leaks Evident	No Water Hammer Evident	Flow Control
Room 131								
Room 147								

.10 Laundry Box – LB-1

Location	Isolation Installed	Isolation Functions	Bubbler Functions	Both Pads Function	Cold Water Functional	No Leaks Evident	No Water Hammer Evident	Flow is Reasonable
Room 147								

.11 Eyewash stations – EW-1

Location	Isolation Installed	Isolation Functions	Bubbler Functions	Both Pads Function	Cold Water Functional	No Leaks Evident	No Water Hammer Evident	Flow is Reasonable
Room 135								

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer:_____ Date:_____

CxA:_____ Date:_____

Project Name: New Modular Police Building Ahtahkakoop, Saskatchewan	Project #: S-35-2014 Performance Verification #: PVM4.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Air Conditioning ACU-1 & ACU-2 / CU-1**	*Room:* **140/155**

1. TEST PURPOSE

.1 To test installation of the air conditioning equipment, ventilation equipment and controls to ensure that the systems and all associated sub-systems operate as intended during normal and abnormal operating conditions.

.2 To document that the system operation performs as intended.

.3 To highlight required modifications and corrections to the system operation and allow those corrections to take place prior to substantial completion and turn over to owner.

2. Test Prerequisites

		C	E
.1	Mechanical:		
.1	As-built drawings are complete and have been submitted	☐	☐
.2	All component verifications are complete and reviewed	☐	☐
.3	Testing, adjusting and balancing (TAB) is complete for all associated systems.	☐	☐
.4	TAB report is complete and reviewed.	☐	☐
.5	Manufacturer start-up is completed and report submitted, approved.	☐	☐
.2	Controls:		
.1	As-built points lists have been submitted and reviewed.	☐	☐
.2	All associated controls have been verified point to point including: inputs, outputs, valves, actuators, interlocks, time delays, failure modes, restart modes, schedules, reset schedules, graphics and trending.	☐	☐
.3	All sensors/devices have been calibrated.	☐	☐
.4	All sequences of operation at both extremes and at midpoints have been verified.	☐	☐
.5	All manual overrides and jumpers have been removed to allow for automatic operation.	☐	☐
.6	Trending within the BMS is operational.	☐	☐
.3	Equipment		
.1	Verify ACU-1 is complete and clean	☐	☐
.2	Verify CU-1 is complete and clean	☐	☐
.3	Verify ACU-2 is complete and clean	☐	☐
.4	Verify CU-2 is complete and clean	☐	☐
.5	Verify filters are reasonably clean (testing filters, not final)	☐	☐
.6	Verify ACU-1 has an electric reheat coil	☐	☐
.7	Verify ACU-1 electric reheat coil is disabled as per manufacturers requirements	☐	☐
.8	Verify ACU-2 has an electric reheat coil	☐	☐
.9	Verify ACU-2 electric reheat coil is disabled as per manufacturers requirements	☐	☐
.10	Exhaust system is functioning in condenser room	☐	☐

3. Functional Performance Tests

.1 Establish trend logs where required to verify operation and provide supporting documentation.

.2 Verification of field temperature devices.

.1 Space Temperature: ---------- C E

.1 Temperature indicated through BMS ---------- _____ °C ------ ☐ ☐

.2 Temperature indicated at ACU-1 control---------- _____ °C ------ ☐ ☐

.3 Temperature indicated at ACU-2 control---------- _____ °C ------ ☐ ☐

.4 Actual measured temperature---------- °C ------ ☐ ☐

.2 Space Humidity: ---------- C E

.1 Humidity indicated at BMS---------- _____ % ------- ☐ ☐

.2 Humidity indicated at ACU-1 control---------- _____ % ------- ☐ ☐

.3 Humidity indicated at ACU-2 control---------- _____ % ------- ☐ ☐

.4 Actual measured humidity ---------- % ------- ☐ ☐

.3 Occupied/Unoccupied Schedule (Space Sensor)

.1 Verify space is unoccupied. -----

.2 Confirm BMS registers room as unoccupied ----------

.3 Verify air flow is at unoccupied minimum. (record under air flows) -

.4 Occupy space and confirm BMS registers room as occupied ----------

.5 Air flow increases to occupied minimum ----------

.4 Normal Space Tempering Operation C E

.1 Set space setpoint to current space temperature---------- ☐ ☐

.2 ACU-1 and ACU-2 to be off---------- ☐ ☐

.3 Increase setpoint to 4 deg.C. above current space temperature ---------- ☐ ☐

.4 ACU-1 and ACU-2 to be off---------- ☐ ☐

.5 Decrease setpoint to below current space temperature (point at which ACU-1 and ACU-2 energize) ---------- ☐ ☐

.6 ACU-1 and ACU-2 energize---------- ☐ ☐

.7 CU-1 operate to reject heat---------- ☐ ☐

.8 Decrease setpoint to 4 deg.C. below current space temperature ---------- ☐ ☐

.9 ACU-1 and ACU-2 energize---------- ☐ ☐

.10 CU-1 operate to reject heat---------- ☐ ☐

.11 Reset space temperature setpoints ---------- ☐ ☐

4. Failure Modes

.1 High Temperature

.1 Decrease High Temperature limit to below current room temperature---------- ☐ ☐

.2 Verify alarm registers at BMS---------- ☐ ☐

.3 Reset high temperature limit---------- ☐ ☐

.2 Low Temperature

.1 Increase Low Temperature limit to above current room temperature---------- ☐ ☐

.2 Verify alarm registers at BMS ☐ ☐

.3 Reset low temperature limit ☐ ☐

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer: _____ Date:_____

CxA: _____ Date:_____

Project Name:	Project #: S-35-2014
New Modular Police Building Ahtahkakoop, Saskatchewan	Performance Verification #: PVM3.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Exhaust Fan EF-01**	*Room #:* **133/134**

1. TEST PURPOSE

.1 To test installation of the exhaust fan to ensure that the system and all associated sub-systems operate as intended during normal and abnormal operating conditions.

.2 To document that the system operation performs as intended.

.3 To highlight required modifications and corrections to the system operation and allow those corrections to take place prior to substantial completion and turn over to owner.

2. Test Prerequisites

		C	E
.1	Mechanical:		
.1	As-built drawings are complete and have been submitted	☐	☐
.2	All component verifications are complete and reviewed	☐	☐
.3	Testing, adjusting and balancing (TAB) is complete for all associated systems.	☐	☐
.4	TAB report is complete and reviewed.	☐	☐
.2	Controls:		
.1	All associated controls have been verified point to point including: inputs, outputs, valves, actuators, interlocks, time delays, failure modes, restart modes, schedules, reset schedules, graphics and trending.	☐	☐
.2	All sensors/devices have been calibrated.	☐	☐
.3	All manual overrides and jumpers have been removed to allow for automatic operation.	☐	☐
.3	Equipment		
.1	Turn fan off manually at disconnect	☐	☐
.2	Verify system is complete and clean	☐	☐
.3	Verify fan rotation	☐	☐
.4	Verify back draft damper installation	☐	☐
.5	Verify installation of access doors	☐	☐
.6	Reset disconnect	☐	☐
.4	Timer Setpoint		
.1	Record timer setpoint Minutes	☐	☐

3. Functional Testing

.1	Enable		
.1	Verify RTU-1 is operational and exhausts is functioning	☐	☐
.2	Verify EF-01 is off	☐	☐
.3	Enable exhaust fan at wall button	☐	☐
.4	Verify EF-01 enables	☐	☐
.5	Confirm that airflow increases from exhaust	☐	☐
.6	Monitor operation for length of time on timer	☐	☐

Project Name:	Project #: S-35-2014
New Modular Police Building Ahtahkakoop, Saskatchewan	Performance Verification #: PVM3.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Exhaust Fan EF-01**	*Room #:* **133/134**

.1 Record time enabled---------- ---------- ☐ ☐
.2 Record time fan shuts down ---------- ---------- ☐ ☐

4. Operational Testing (when fan is running)

	C	E
.1 Operation of EF-1		
.1 Ensure fan is on----------	☐	☐
.2 Verify vibration isolators appear to be functioning----------	☐	☐
.3 Noise generated is within reason in space----------	☐	☐

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer:_____ Date:_____

CxA:_____ Date:_____

Project Name:	Project #: S-35-2014
New Modular Police Building Ahtahkakoop, Saskatchewan	Performance Verification #: PVM2.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Exhaust Fan EF-11**	*Room #:* **143**

1. TEST PURPOSE

.1 To test installation of the exhaust fan to ensure that the system and all associated sub-systems operate as intended during normal and abnormal operating conditions.

.2 To document that the system operation performs as intended.

.3 To highlight required modifications and corrections to the system operation and allow those corrections to take place prior to substantial completion and turn over to owner.

2. Test Prerequisites

		C	E
.1	Mechanical:		
.1	As-built drawings are complete and have been submitted	☐	☐
.2	All component verifications are complete and reviewed	☐	☐
.3	Testing, adjusting and balancing (TAB) is complete for all associated systems.	☐	☐
.4	TAB report is complete and reviewed.	☐	☐
.2	Controls:		
.1	All associated controls have been verified point to point including: inputs, outputs, valves, actuators, interlocks, time delays, failure modes, restart modes, schedules, reset schedules, graphics and trending.	☐	☐
.2	All sensors/devices have been calibrated.	☐	☐
.3	All manual overrides and jumpers have been removed to allow for automatic operation.	☐	☐
.3	Equipment		
.1	Turn fan off manually at disconnect	☐	☐
.2	Verify system is complete and clean	☐	☐
.3	Verify fan rotation	☐	☐
.4	Verify back draft damper installation	☐	☐
.5	Verify installation of access doors	☐	☐
.6	Reset disconnect	☐	☐
.4	Timer Setpoint		
.1	Record timer setpoint Minutes	☐	☐

3. Functional Testing

.1	Enable		
.1	Verify RTU-3 is operational and exhausts is functioning	☐	☐
.2	Verify EF-011 is off	☐	☐
.3	Enable exhaust fan at wall button	☐	☐
.4	Verify EF-011 enables	☐	☐
.5	Confirm that airflow increases from exhaust	☐	☐

Project Name: New Modular Police Building Ahtahkakoop, Saskatchewan	Project #: S-35-2014
	Performance Verification #: PVM2.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Exhaust Fan EF-11**	*Room #:* **143**

.6 Record time fan shuts down---------- ☐ ☐

4. Operational Testing (when fan is running)

	C	E
.1 Operation of EF-11		
.1 Ensure fan is on----------	☐	☐
.2 Verify vibration isolators appear to be functioning----------	☐	☐
.3 Noise generated is within reason in space----------	☐	☐

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer:_____ Date:_____

CxA:_____ Date:_____

Project Name: New Modular Police Building Ahtahkakoop, Saskatchewan	Project #: S-35-2014
	Performance Verification #: PVM2.5

Performance Verification Test Form		*Section:*
System: HVAC	*Equipment:* Exhaust Fan EF-05 & EF-06	*Room #:* 132

1. TEST PURPOSE

.1 To test installation of the exhaust fan to ensure that the system and all associated sub-systems operate as intended during normal and abnormal operating conditions.

.2 To document that the system operation performs as intended.

.3 To highlight required modifications and corrections to the system operation and allow those corrections to take place prior to substantial completion and turn over to owner.

2. Test Prerequisites

		C	E
.1	Mechanical:		
.1	As-built drawings are complete and have been submitted	☐	☐
.2	All component verifications are complete and reviewed	☐	☐
.3	Testing, adjusting and balancing (TAB) is complete for all associated systems.	☐	☐
.4	TAB report is complete and reviewed.	☐	☐
.2	Controls:		
.1	All associated controls have been verified point to point including: inputs, outputs, valves, actuators, interlocks, time delays, failure modes, restart modes, schedules, reset schedules, graphics and trending.	☐	☐
.2	All sensors/devices have been calibrated.	☐	☐
.3	All manual overrides and jumpers have been removed to allow for automatic operation.	☐	☐
.3	Equipment		
.1	Turn fan off manually at disconnect	☐	☐
.2	Verify system is complete and clean	☐	☐
.3	Verify fan rotation	☐	☐
.4	Verify back draft damper installation	☐	☐
.5	Verify installation of access doors	☐	☐
.6	Reset disconnect	☐	☐
.4	System Setpoints		
.1	System is set to activate until condition is cleared, minimum run timer is expired and alarm is acknowledged	☐	☐
.2	Record minimum run timer minutes	☐	☐
.3	Alarm activates on fault detection	☐	☐
.4	Audio alarm is disabled for warning	☐	☐
.5	Alarm activates on fault detection	☐	☐
.6	No activation delay on warning	☐	☐
.7	Record activation delay on alarm minutes	☐	☐
.8	Audio alarm is enabled	☐	☐
.9	Record CO warning setpoint PPM	☐	☐

Project Name: New Modular Police Building Ahtahkakoop, Saskatchewan	Project #: S-35-2014
	Performance Verification #: PVM2.5

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Exhaust Fan EF-05 & EF-06**	*Room #:* **132**

.10 Record CO alarm setpoint PPM ---------- ☐ ☐
.11 Record NOx warning setpoint PPM ---------- ☐ ☐
.12 Record NOx alarm setpoint PPM ---------- ☐ ☐

3. Operational Testing (test when fans are running during functional test)

		C	E
.1	Operation of EF-5		
.1	Ensure fan is on	☐	☐
.2	Verify vibration isolators appear to be functioning	☐	☐
.3	Noise generated is within reason in space	☐	☐
.2	Operation of EF-6	C	E
.1	Ensure fan is on	☐	☐
.2	Verify vibration isolators appear to be functioning	☐	☐
.3	Noise generated is within reason in space	☐	☐

4. Functional Testing

.1 Normal Operation (ensure no gas detected in space)
.1 EF-5 is on ---------- ☐ ☐
.2 Verify outside air damper is open ---------- ☐ ☐
.3 EF-6 is off ---------- ☐ ☐
.4 Measure Discharge Air Temperature:
.1 Actual measured temperature -------^{O}C ---------- ☐ ☐
.5 Increase discharge air setpoint for heating coil to above ambient ---------- ☐ ☐
.6 Heating coil enables and modulates to suit setpoint ---------- ☐ ☐
.7 Measure Discharge Air Temperature:
.1 Actual measured temperature -------^{O}C ---------- ☐ ☐
.8 Disable EF-05 ---------- ☐ ☐
.9 Verify outside air damper closes ---------- ☐ ☐
.10 Verify heating coil deenergizes ---------- ☐ ☐
.11 Reset Fan ---------- ☐ ☐
.12 Verify fan EF-5 re-energizes ---------- ☐ ☐
.13 Verify outside air damper opens to minimum ---------- ☐ ☐
.14 Heating coil enables and modulates to suit setpoint ---------- ☐ ☐
.15 Reset heating coil discharge air setpoint ---------- ☐ ☐

.2 Primary Gas Detection
.1 EF-5 is on ---------- ☐ ☐
.2 Start vehicle in space (or apply test gas to sensors) ---------- ☐ ☐
.3 Sensor detects gas ---------- ☐ ☐
.4 EF-6 energizes ---------- ☐ ☐
.5 Record time fan enables ---------- ☐ ☐

Project Name: New Modular Police Building Ahtahkakoop, Saskatchewan	Project #: S-35-2014
	Performance Verification #: PVM2.5

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Exhaust Fan EF-05 & EF-06**	*Room #:* **132**

.6 Verify outside air damper remains open ☐ ☐
.7 When gas rises above warning limit, record gas level/type PPM ☐ ☐
.8 Warning enables but not in alarm ☐ ☐
.9 When gas rises above alarm limit, record gas level/type PPM ☐ ☐
.10 Record time alarm limit is breached ☐ ☐
.11 Record time alarm occurs ☐ ☐
.12 Remove source ☐ ☐
.13 Record time gas level drops below alarm limit ☐ ☐
.14 Acknowledge alarm ☐ ☐
.15 Verify EF-06 shuts down after minimum run time ☐ ☐
.16 EF-5 remains on ☐ ☐
.17 Verify outside air damper remains open ☐ ☐

5. Failure Modes

.1 Motor Failure EF-6

.1 Cut power to motor (EF-6) ☐ ☐
.2 Apply gas to trip high limit ☐ ☐
.3 Verify alarm registers (audible and visual) ☐ ☐
.4 Restore power to EF-6 ☐ ☐
.5 EF-6 resumes control ☐ ☐
.6 Acknowledge Alarm ☐ ☐

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer: _____ Date:_____

CxA: _____ Date:_____

Project Name: New Modular Police Building Ahtahkakoop, Saskatchewan	Project #: S-35-2014
	Performance Verification #: PVM2.6

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Exhaust Fan EF-07**	*Room #:* **165**

1. TEST PURPOSE

.1 To test installation of the exhaust fan to ensure that the system and all associated sub-systems operate as intended during normal and abnormal operating conditions.

.2 To document that the system operation performs as intended.

.3 To highlight required modifications and corrections to the system operation and allow those corrections to take place prior to substantial completion and turn over to owner.

2. Test Prerequisites

		C	E
.1	Mechanical:		
.1	As-built drawings are complete and have been submitted	☐	☐
.2	All component verifications are complete and reviewed	☐	☐
.3	Testing, adjusting and balancing (TAB) is complete for all associated systems.	☐	☐
.4	TAB report is complete and reviewed.	☐	☐
.2	Controls:		
.1	All associated controls have been verified point to point including: inputs, outputs, valves, actuators, interlocks, time delays, failure modes, restart modes, schedules, reset schedules, graphics and trending.	☐	☐
.2	All sensors/devices have been calibrated.	☐	☐
.3	All manual overrides and jumpers have been removed to allow for automatic operation.	☐	☐
.3	Equipment		
.1	Turn fan off manually at disconnect	☐	☐
.2	Verify system is complete and clean	☐	☐
.3	Verify fan rotation	☐	☐
.4	Verify back draft damper installation	☐	☐
.5	Verify installation of access doors	☐	☐
.6	Reset disconnect	☐	☐
.4	System Setpoints		
.1	System is set to activate until condition is cleared, minimum run timer is expired and alarm is acknowledged	☐	☐
.2	Record minimum run timer minutes	☐	☐
.3	Alarm activates on fault detection	☐	☐
.4	Audio alarm is disabled for warning	☐	☐
.5	Alarm activates on fault detection	☐	☐
.6	No activation delay on warning	☐	☐
.7	Record activation delay on alarm minutes	☐	☐
.8	Audio alarm is enabled	☐	☐
.9	Record CO warning setpoint PPM	☐	☐

Project Name: New Modular Police Building Ahtahkakoop, Saskatchewan	Project #: S-35-2014
	Performance Verification #: PVM2.6

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Exhaust Fan EF-07**	*Room #:* **165**

.10 Record CO alarm setpoint PPM ☐ ☐
.11 Record NOx warning setpoint PPM ☐ ☐
.12 Record NOx alarm setpoint PPM ☐ ☐

3. Functional Testing

.1 Schedule (ensure no gas detected in space)
- .1 EF-7 is off ☐ ☐
- .2 Verify outside air damper is closed ☐ ☐

.2 Primary Gas Detection
- .1 Start vehicle in space (or apply test gas to sensors) ☐ ☐
- .2 Sensor detects gas ☐ ☐
- .3 EF-7 energizes ☐ ☐
- .4 Record time fan enables ☐ ☐
- .5 When gas rises above warning limit, record gas level/type PPM ☐ ☐
- .6 Warning enables but not in alarm ☐ ☐
- .7 When gas rises above alarm limit, record gas level/type PPM ☐ ☐
- .8 Record time alarm limit is breached ☐ ☐
- .9 Record time alarm occurs ☐ ☐
- .10 Remove source ☐ ☐
- .11 Record time gas level drops below alarm limit ☐ ☐
- .12 Acknowledge alarm ☐ ☐
- .13 Verify fan shuts down after minimum run time ☐ ☐
- .14 Verify outside air damper closes to minimum position ☐ ☐

.3 Secondary Gas Detection
- .1 Apply test gas to sensors for second gas source ☐ ☐
- .2 Sensor detects gas ☐ ☐
- .3 EF-7 energizes ☐ ☐
- .4 Record time fan enables ☐ ☐
- .5 When gas rises above warning limit, record gas level/type PPM ☐ ☐
- .6 Warning enables but not in alarm ☐ ☐
- .7 When gas rises above alarm limit, record gas level/type PPM ☐ ☐
- .8 Record time alarm limit is breached ☐ ☐
- .9 Record time alarm occurs ☐ ☐
- .10 Remove source ☐ ☐
- .11 Record time gas level drops below alarm limit ☐ ☐
- .12 Acknowledge alarm ☐ ☐
- .13 Verify fan shuts down after minimum run time ☐ ☐
- .14 Verify outside air damper closes to minimum position ☐ ☐

Project Name: New Modular Police Building Ahtahkakoop, Saskatchewan	Project #: S-35-2014
	Performance Verification #: PVM2.6

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Exhaust Fan EF-07**	*Room #:* **165**

4. Operational Testing

		C	E
.1	Operation of EF-7		
.1	Ensure fan is on	☐	☐
.2	Verify vibration isolators appear to be functioning	☐	☐
.3	Noise generated is within reason in space	☐	☐

5. Failure Modes

.1	Motor Failure EF-7		
.1	Cut power to motor (EF-7)	☐	☐
.2	Apply gas to trip high limit	☐	☐
.3	Verify alarm registers (audible and visual)	☐	☐
.4	Restore power to EF-7	☐	☐
.5	EF-7 resumes control	☐	☐
.6	Acknowledge Alarm	☐	☐

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer:_____ Date:_____

CxA:_____ Date:_____

Project Name: New Modular Police Building Ahtahkakoop, Saskatchewan	Project #: S-35-2014 Performance Verification #: PVM5.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Force Flow**	*Tag:* **FF-1**

1. TEST PURPOSE

.1 To test all force flow installations to ensure that the system and all associated sub-systems operate as intended during normal and abnormal operating conditions.

.2 To document that the system operation performs as intended.

.3 To highlight required modifications and corrections to the system operation and allow those corrections to take place prior to substantial completion and turn over to owner.

.4 To ensure that the system and all sub-systems operates as required and intended and document that operation before turning over to the owner.

2. Test Prerequisites

		C	E
.1	Mechanical:		
.1	As-built drawings are complete and have been submitted ----------	☐	☐
.2	All component verifications are complete and reviewed ----------	☐	☐
.3	Testing, adjusting and balancing (TAB) is complete for all associated systems. ----------	☐	☐
.4	TAB report is complete and reviewed. ----------	☐	☐
.5	Heating is operational. ----------	☐	☐
.2	Controls:		
.1	As-built points lists have been submitted and reviewed. ----------	☐	☐
.2	All associated controls have been verified point to point including: inputs, outputs, valves, actuators, interlocks, time delays, failure modes, restart modes, schedules, reset schedules, graphics and trending. ----------	☐	☐
.3	All sensors have been calibrated. ----------	☐	☐
.4	All sequences of operation at both extremes and at midpoints have been verified. ----------	☐	☐
.5	All manual overrides and jumpers have been removed to allow for automatic operation. ----------	☐	☐
.6	All hardware interlocks and safeties (if any) are operational. ----------	☐	☐
.7	Trending within the BMS is operational. ----------	☐	☐

3. Operational Testing Procedures

.1 Establish trend logs where required to verify operation and provide supporting documentation.

.2 Occupied/Unoccupied Schedule

.1	Force flow follows air handling unit occupancy schedule ----------	☐	☐

Project Name: New Modular Police Building Ahtahkakoop, Saskatchewan	Project #: S-35-2014 Performance Verification #: PVM5.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Force Flow**	*Tag:* **FF-1**

.3 Calibration of field temperature devices.

.1 Space Temperature:

.1 Temperature indicated through BMS ---------- _____ ---------- ^{O}C ☐ ☐

.2 Actual measured temperature ---------- _____ ---------- ^{O}C ☐ ☐

.4 Normal operation:

.1 Adjust thermostat to 35 deg.C.

.1 Control valve opens ---------- ---------- ☐ ☐

.2 Fan energizes ---------- ---------- ☐ ☐

.2 Return thermostat to normal 20 deg.C.

.1 Control valve closes ---------- ---------- ☐ ☐

.2 Fan turns off ---------- ---------- ☐ ☐

.5 Unoccupied Operation

.1 Manipulate BMS to simulate unoccupied schedule

.1 Space heating setpoint reverts to nightsetback condition ---------- ☐ ☐

.2 Record night setback setpoint ---------- _____ ---------- ^{O}C ☐ ☐

.2 Return BMS to occupied condition

.1 Space heating setpoint reverts to normal operation ---------- ☐ ☐

.6 Loss of Power

.1 Cut power to AHU controller

.1 Heating Valve goes to full heat ---------- ---------- ☐ ☐

.2 Restore Power

.1 Heating Valve reverts to control ---------- ---------- ☐ ☐

Project Name: New Modular Police Building Ahtahkakoop, Saskatchewan	Project #: S-035-2014
	Performance Verification #: PVM6.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Pumps P-1 and P-2**	*Room:*

1. TEST PURPOSE

.1 To test installation of the pump to ensure that the system and all associated sub-systems operate as intended during normal and abnormal operating conditions.

.2 To document that the system operation performs as intended.

.3 To highlight required modifications and corrections to the system operation and allow those corrections to take place prior to substantial completion and turn over to owner.

2. Test Prerequisites

		C	E
.1	Mechanical:		
.1	As-built drawings are complete and have been submitted	☐	☐
.2	All component verifications are complete and reviewed	☐	☐
.3	Testing, adjusting and balancing (TAB) is complete for all associated systems.	☐	☐
.4	TAB report is complete and reviewed.	☐	☐
.2	Controls:		
.1	As-built points lists have been submitted and reviewed.	☐	☐
.2	All associated controls have been verified point to point including: inputs, outputs, valves, actuators, interlocks, time delays, failure modes, restart modes, schedules, reset schedules, graphics and trending.	☐	☐
.3	All sensors/devices have been calibrated.	☐	☐
.4	All sequences of operation at both extremes and at midpoints have been verified.	☐	☐
.5	All manual overrides and jumpers have been removed to allow for automatic operation.	☐	☐
.6	Trending within the BMS is operational.	☐	☐

3. Operational Testing

		C	E
.1	Start/Stop		
.1	Ensure all Mechanical room heating equipment is not calling for heating	☐	☐
.2	Set building to unoccupied	☐	☐
.3	Set outdoor temperature below -20 Deg.C.	☐	☐
.4	Verify pump starts	☐	☐
.5	Reset outdoor air temperature	☐	☐
.6	Verify pump de-energizes	☐	☐
.2	Operation		
.1	Ensure pump is on	☐	☐
.2	Verify vibration isolators appear to be functioning	☐	☐
.3	Noise generated is within reason in Mechanical Room	☐	☐
.4	Noise generated is within reason at floor below	☐	☐
.5	Vibration does not carry through piping	☐	☐

4. Failure Modes

	C	E
.1 Motor Failure		
.1 Cut power to motor	☐	☐
.2 Verify alarm registers at BMS	☐	☐
.3 Restore power to motor	☐	☐
.4 Verify BMS shows correct status	☐	☐

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer:_____ Date:_____

CxA:_____ Date:_____

Project Name: New Modular Police Building Ahtahkakoop, Saskatchewan	Project #: S-035-2014
	Performance Verification #: PVM6.2

Performance Verification Test Form		*Section:*
System: HVAC	*Equipment:* Pumps	*Tag:* P-3 & P-4

1. TEST PURPOSE

.1 To test installation of the pump to ensure that the system and all associated sub-systems operate as intended during normal and abnormal operating conditions.

.2 To document that the system operation performs as intended.

.3 To highlight required modifications and corrections to the system operation and allow those corrections to take place prior to substantial completion and turn over to owner.

2. Test Prerequisites

		C	E
.1	Mechanical:		
.1	As-built drawings are complete and have been submitted	☐	☐
.2	All component verifications are complete and reviewed	☐	☐
.3	Testing, adjusting and balancing (TAB) is complete for all associated systems.	☐	☐
.4	TAB report is complete and reviewed.	☐	☐
.2	Controls:		
.1	As-built points lists have been submitted and reviewed.	☐	☐
.2	All associated controls have been verified point to point including: inputs, outputs, valves, actuators, interlocks, time delays, failure modes, restart modes, schedules, reset schedules, graphics and trending.	☐	☐
.3	All sensors/devices have been calibrated.	☐	☐
.4	All sequences of operation at both extremes and at midpoints have been verified.	☐	☐
.5	All manual overrides and jumpers have been removed to allow for automatic operation.	☐	
.6	Trending within the BMS is operational.	☐	☐

3. Operational Testing

		C	E
.1	Start/Stop		
.1	Set building to unoccupied	☐	☐
.2	Set outdoor air temperature below -20 Deg.C.	☐	☐
.3	Set mixed air temperature below 5 Deg.C.	☐	☐
.4	Verify pump starts	☐	☐
.5	Reset outdoor air and mixed air temperatures and occupancy	☐	☐
.6	Verify pump deenergizes	☐	☐
.7	Verify that BMS indicates status correctly on screen at each condition	☐	☐
.2	Operation	C	E
.1	Ensure pump is on	☐	☐
.2	Verify vibration isolators appear to be functioning	☐	☐
.3	Noise generated is within reason in Mechanical room	☐	☐
.4	Vibration does not carry through piping	☐	☐

4. Failure Modes

		C	E
.1	Motor Failure		
.1	Cut power to motor	☐	☐
.2	Verify alarm registers at BMS	☐	☐
.3	Restore power to motor	☐	☐
.4	Verify BMS shows correct status	☐	☐

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer:_____ Date:_____

CxA:_____ Date:_____

Project Name:	Project #: S-35-2014
New Modular Police Building Ahtahkakooop, Saskatchewan	Performance Verification #: PVM1.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Roof Top Unit RTU-1**	*Room #:* **N/A**

1. TEST PURPOSE

.1 To test all components of the air handling unit to ensure that the system and all associated sub-systems operate as intended during normal and abnormal operating conditions.

.2 To document that the system operation performs as intended.

.3 To highlight required modifications and corrections to the system operation and allow those corrections to take place prior to substantial completion and turn over to owner.

.4 To ensure that the system and all sub-systems operates as required and intended and document that operation before turning over to the owner.

2. Test PrerequisitesMechanical:

	C	E
.1 System:		
.1 All component verifications are complete and reviewed ----------	☐	☐
.2 Testing, adjusting and balancing (TAB) is complete for all associated systems. ----------	☐	☐
.3 TAB report is complete and reviewed. ----------	☐	☐
.4 Heating is operational. ----------	☐	☐
.5 Cooling is operational. ----------	☐	☐
.6 Energy recovery unit is operational. ----------	☐	☐
.7 Verify supply fan operation:		
.1 Rotation ---------- ----------	☐	☐
.2 Lubrication ---------- ----------	☐	☐
.3 Belt Alignment ---------- ----------	☐	☐
.8 Verify exhaust fan operation:		
.1 Rotation ---------- ----------	☐	☐
.2 Lubrication ---------- ----------	☐	☐
.3 Belt Alignment ---------- ----------	☐	☐

.2 Controls:

.1 All associated controls have been verified point to point including: inputs, outputs, valves, actuators, interlocks, time delays, failure modes, restart modes, schedules, reset schedules, graphics and trending. ----------

.2 All sensors have been calibrated. ----------

.3 All sequences of operation at both extremes and at midpoints have been verified.

.4 All manual overrides and jumpers have been removed to allow for automatic operation. ----------

.5 All hardware interlocks and safeties (if any) are operational. ----------

Project Name: New Modular Police Building Ahtahkakooop, Saskatchewan	Project #: S-35-2014
	Performance Verification #: PVM1.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Roof Top Unit RTU-1**	*Room #:* **N/A**

3. Operational Testing Procedures

				C	E
.1	Occupied/Unoccupied Schedule				
.1	Weekday Schedule	ON _____	OFF _____	☐	☐
.2	Weekend Schedule	ON	OFF	☐	☐
.3	Holiday Schedule	ON	OFF	☐	☐
.2	Coil and drain pan				
.1	Fill drain pan with water (during fan operation, with door closed)				
.1	Water drains freely----------			☐	☐
.2	No leaks evident----------			☐	☐
.3	All water flows to drain----------			☐	☐
.3	System shut down (or unoccupied mode):				
.1	Set system to unoccupied mode ----------			☐	☐
.2	Supply Fan ramps down and "OFF"----------			☐	☐
.3	Exhaust Fan ramps down and "OFF" ----------			☐	☐
.4	ERV shuts down----------			☐	☐
.5	Once fans are off RTU Relief Damper moves to "CLOSED" ----------			☐	☐
.6	Once fans are off RTU Intake Damper moves to "CLOSED" ----------			☐	☐
.7	Heating is "Off" ----------			☐	☐
.8	Cooling is "OFF" ----------			☐	☐
.4	System Start Up				
.1	Start-up system (Set to occupied) ----------			☐	☐
.1	Verify RTU O/A damper opens ---------- ----------☐			☐	
.2	Verify RTU Exhaust damper opens ---------- ----------			☐	☐
.3	Verify RTU Supply fan starts and ramps to setpoint----------			☐	☐
.4	Verify RTU Return fan start and ramps to setpoint ----------			☐	☐
.5	RTU controls heat/cool to meet space temperature or discharge air temperature---------- ----------			☐	☐
.5	Discharge Air Control (OAT below free cooling – assumed to be 0 deg.C):				
.1	Turn off heat recovery wheel (RTU to stay operating) ----------			☐	☐
.2	Cooling is off----------			☐	☐
.3	Measure Discharge Air Temperature:				
.1	Actual measured temperature----------		--- ^{O}C	☐	☐
.4	Increase space temperature setpoint ----------			☐	☐
.5	Confirm heat output increases ----------			☐	☐
.6	Measure Discharge Air Temperature:				
.1	Actual measured temperature----------		--- ^{O}C	☐	☐

Project Name: New Modular Police Building Ahtahkakooop, Saskatchewan	Project #: S-35-2014
	Performance Verification #: PVM1.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Roof Top Unit RTU-1**	*Room #:* **N/A**

.7 Turn on heat recovery wheel (RTU to stay operating)---------- ☐ ☐
.8 Wheel operates to transfer energy ---------- ☐ ☐
.9 Heating output decreases ---------- ☐ ☐
.10 Measure Discharge Air Temperature:
.1 Actual measured temperature---------- --- ^{O}C ☐ ☐
.11 Reset temperature setpoint ---------- ☐ ☐

.6 Discharge Air Control (OAT above 21 deg.C.):

.1 Turn off heat recovery wheel (RTU to stay operating) ---------- ☐ ☐
.2 Heating is off---------- ☐ ☐
.3 Measure Discharge Air Temperature:
.1 Actual measured temperature---------- --- ^{O}C ☐ ☐
.4 Decrease space temperature setpoint ---------- ☐ ☐
.5 Cooling coil modulates to suit new space temperature setpoint -------- ☐ ☐
.6 Measure Discharge Air Temperature:
.1 Actual measured temperature---------- --- ^{O}C ☐ ☐
.7 Turn on heat recovery wheel (RTU to stay operating)---------- ☐ ☐
.8 Wheel operates to transfer energy ---------- ☐ ☐
.9 Cooling output decreases ---------- ☐ ☐
.10 Measure Discharge Air Temperature:
.1 Actual measured temperature---------- --- ^{O}C ☐ ☐
.11 Reset temperature setpoint ---------- ☐ ☐

.7 Pre-heat coil:

.1 Record Preheat coil setpoints:
.1 Outside air temperature setpoint ---------- --- ^{O}C ☐ ☐
.2 Preheat Leaving air temperature ---------- --- ^{O}C ☐ ☐
.2 Adjust setpoints to enable coil operation ---------- ☐ ☐
.3 Confirm coil enables---------- ☐ ☐
.4 Measure Preheat Air Temperature:
.1 Actual measured temperature---------- --- ^{O}C ☐ ☐
.5 Increase preheat temperature setpoint---------- ☐ ☐
.6 Coil modulates to suit new setpoint ---------- ☐ ☐
.7 Measure Discharge Air Temperature:
.1 Actual measured temperature---------- --- ^{O}C ☐ ☐
.8 Reset preheat coil setpoints ---------- ☐ ☐

Project Name: New Modular Police Building Ahtahkakooop, Saskatchewan	Project #: S-35-2014
	Performance Verification #: PVM1.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Roof Top Unit RTU-1**	*Room #:* **N/A**

4. Failure Mode Testing Procedures

.1 Supply Fan Failure:

.1 Switch Power Off at Disconnect

.1	Critical Alarm---------- ----------	☐	☐
.2	Alarms at thermostat ---------- ----------	☐	☐
.3	Heating off ---------- ----------	☐	☐
.4	Outdoor Air Damper at 0% ---------- ----------	☐	☐
.5	Exhaust Damper at 0%---------- ----------	☐	☐
.6	Cooling off ---------- ----------	☐	☐
.7	Return fan stops ---------- ----------	☐	☐
.8	ERV stops ---------- ----------	☐	☐

.2 Turn Power On

.1	Fan system starts ---------- ----------	☐	☐

.2 Exhaust Fan Failure:

.1 Switch Power Off at Disconnect

.1	Critical Alarm---------- ----------	☐	☐
.2	Alarms at thermostat ---------- ----------	☐	☐
.3	Heating off ---------- ----------	☐	☐
.4	Outdoor Air Damper at 0% ---------- ----------	☐	☐
.5	Exhaust Damper at 0%---------- ----------	☐	☐
.6	Cooling off ---------- ----------	☐	☐
.7	Supply fan stops---------- ----------	☐	☐
.8	ERV stops ---------- ----------	☐	☐

.2 Turn Power On

.1	Fan system starts ---------- ----------	☐	☐

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer:_____ Date:_____

CxA:_____ Date:_____

Project Name:	Project #: S-35-2014
New Modular Police Building Ahtahkakoop, Saskatchewan	Performance Verification #: PVM1.3

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Roof Top Unit RTU-3**	*Room #:* **N/A**

1. TEST PURPOSE

.1 To test all components of the air handling unit to ensure that the system and all associated sub-systems operate as intended during normal and abnormal operating conditions.

.2 To document that the system operation performs as intended.

.3 To highlight required modifications and corrections to the system operation and allow those corrections to take place prior to substantial completion and turn over to owner.

.4 To ensure that the system and all sub-systems operates as required and intended and document that operation before turning over to the owner.

2. Test Prerequisites Mechanical:

	C	E
.1 System:		
.1 All component verifications are complete and reviewed ----------	☐	☐
.2 Testing, adjusting and balancing (TAB) is complete for all associated systems. ----------	☐	☐
.3 TAB report is complete and reviewed. ----------	☐	☐
.4 Heating is operational. ----------	☐	☐
.5 Cooling is operational. ----------	☐	☐
.6 Economizer is operational. ----------	☐	☐
.7 Verify supply fan operation:		
.1 Rotation ---------- ----------	☐	☐
.2 Lubrication ---------- ----------	☐	☐
.3 Belt Alignment ---------- ----------	☐	☐
.8 Verify exhaust fan operation:		
.1 Rotation ---------- ----------	☐	☐
.2 Lubrication ---------- ----------	☐	☐
.3 Belt Alignment ---------- ----------	☐	☐

.2 Controls:

.1 All associated controls have been verified point to point including: inputs, outputs, valves, actuators, interlocks, time delays, failure modes, restart modes, schedules, reset schedules, graphics and trending. ----------

.2 All sensors have been calibrated. ----------

.3 All sequences of operation at both extremes and at midpoints have been verified.

.4 All manual overrides and jumpers have been removed to allow for automatic operation. ----------

.5 All hardware interlocks and safeties (if any) are operational. ----------

Project Name: New Modular Police Building Ahtahkakoop, Saskatchewan	Project #: S-35-2014
	Performance Verification #: PVM1.3

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Roof Top Unit RTU-3**	*Room #:* **N/A**

3. Operational Testing Procedures

				C	E
.1	Occupied/Unoccupied Schedule				
.1	Weekday Schedule	ON _____	OFF _____	☐	☐
.2	Weekend Schedule	ON	OFF	☐	☐
.3	Holiday Schedule	ON	OFF	☐	☐
.2	Verification of field temperature devices.				
.1	Return Air Temperature (prior to air handling unit):				
.1	Actual measured temperature----------		--- ^{O}C	☐	☐
.3	Coil and drain pan				
.1	Fill drain pan with water (during fan operation, with door closed)				
.1	Water drains freely----------		----------	☐	☐
.2	No leaks evident----------		----------	☐	☐
.3	All water flows to drain----------		----------	☐	☐
.4	System shut down (or unoccupied mode):				
.1	Set system to unoccupied mode ----------			☐	☐
.2	Supply Fan ramps down and "OFF"----------			☐	☐
.3	Once fans are off RTU Relief Damper moves to "CLOSED" ----------			☐	☐
.4	Once fans are off RTU Intake Damper moves to "CLOSED" ----------			☐	☐
.5	Heating is "Off" ----------			☐	☐
.6	Cooling is "OFF" ----------			☐	☐
.5	System Start Up				
.1	Start-up system (Set to occupied)----------			☐	☐
.1	Verify RTU O/A damper opens---------- ----------☐			☐	
.2	Verify RTU Supply fan starts and ramps to setpoint----------			☐	☐
.3	Verify RTU Relief damper opens---------- ----------			☐	☐
.4	RTU controls heat/cool to meet space temperature or discharge air temperature---------- ----------			☐	☐
.6	Discharge Air Control (OAT below free cooling – assumed to be 0 deg.C):				
.1	Cooling is off----------			☐	☐
.2	Measure Discharge Air Temperature:				
.1	Actual measured temperature----------		--- ^{O}C	☐	☐
.3	Increase space temperature setpoint ----------			☐	☐
.4	Confirm heat output increases ----------			☐	☐
.5	Measure Discharge Air Temperature:				
.1	Actual measured temperature----------		--- ^{O}C	☐	☐

Project Name: New Modular Police Building Ahtahkakoop, Saskatchewan	Project #: S-35-2014 Performance Verification #: PVM1.3

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Roof Top Unit RTU-3**	*Room #:* **N/A**

.7 Discharge Air Control (OAT above 21 deg.C.):

.1	Heating is off----------	☐	☐
.2	Measure Discharge Air Temperature:		
.1	Actual measured temperature---------- --- ^{O}C	☐	☐
.3	Decrease space temperature to 1.5 Deg.C below current temp.---------	☐	☐
.4	Cooling coil modulates to suit new space temperature setpoint --------	☐	☐
.5	Confirm stage 1 operates and modulates ----------	☐	☐
.6	Measure Discharge Air Temperature:		
.1	Actual measured temperature---------- --- ^{O}C	☐	☐
.7	Decrease space temperature setpoint down to maximum cooling ------	☐	☐
.8	Cooling coil modulates to suit new space temperature setpoint --------	☐	☐
.9	Confirm stage 1 and 2 enable and modulate ----------	☐	☐
.10	Measure Discharge Air Temperature:		
.1	Actual measured temperature---------- --- ^{O}C	☐	☐
.11	Reset temperature setpoint ----------	☐	☐

.8 Economizer:

.1	Verify economizer functions in accordance with manufacturers tests-	☐	☐

4. Failure Mode Testing Procedures

.1 Supply Fan Failure:

.1	Switch Power Off at Disconnect		
.1	Critical Alarm---------- ----------	☐	☐
.2	Alarms at thermostat ---------- ----------	☐	☐
.3	Heating off ---------- ----------	☐	☐
.4	Outdoor Air Damper at 0% ---------- ----------	☐	☐
.5	Relief Damper at 0% ---------- ----------	☐	☐
.6	Cooling off ---------- ----------	☐	☐
.2	Turn Power On		
.1	Fan system starts ---------- ----------	☐	☐

Project Name:	Project #: S-35-2014
New Modular Police Building Ahtahkakoop, Saskatchewan	Performance Verification #: PVM1.3

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Roof Top Unit RTU-3**	*Room #:* **N/A**

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer:_____ Date:_____

CxA:_____ Date:_____

Project Name: New Modular Police Building Ahtahkakoop, Saskatchewan	Project #: S-035-2014
	Performance Verification #: PVM5.6

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Wall-Fin Radiation**	*Tag:* **Type A**

1. TEST PURPOSE

.1 To test installation of the exhaust fan to ensure that the system and all associated sub-systems operate as intended during normal and abnormal operating conditions.

.2 To document that the system operation performs as intended.

.3 To highlight required modifications and corrections to the system operation and allow those corrections to take place prior to substantial completion and turn over to owner.

2. Test Prerequisites

		C	E
.1	Mechanical:		
.1	As-built drawings are complete and have been submitted	☐	☐
.2	All component verifications are complete and reviewed	☐	☐
.3	Testing, adjusting and balancing (TAB) is complete for all associated systems.	☐	☐
.4	TAB report is complete and reviewed.	☐	☐
.2	Controls:		
.1	As-built points lists have been submitted and reviewed.	☐	☐
.2	All associated controls have been verified point to point including: inputs, outputs, valves, actuators, interlocks, time delays, failure modes, restart modes, schedules, reset schedules, graphics and trending.	☐	☐
.3	All sensors/devices have been calibrated.	☐	☐
.4	All sequences of operation at both extremes and at midpoints have been verified.	☐	☐
.5	All manual overrides and jumpers have been removed to allow for automatic operation.	☐	
.6	Trending within the BMS is operational.	☐	☐

3. Operational Testing Procedures

.1 Establish trend logs where required to verify operation and provide supporting documentation.

		C	E
.2	Occupied/Unoccupied Schedule		
.1	Space follows roof top unit occupancy schedule	☐	☐

.3 Operational Test

Location	Measured Space Temp	BMS Space Temp	Increase Setpoint – Valve opens	Decrease Setpoint – Valve Closes	Return Setpoint to Normal	Set to unoccupied – confirm night setback	Cut power – valve opens	Restore power – normal control
Room 102								
Room 103								
Room 104								
Room 110								
Room 111								
Room 120								
Room 121								
Room 126								
Room 159								
Room 160								
Room 162								
Room 163								
Room 164								

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer:_____ Date:_____

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Wall-Fin Radiation**	*Tag:* **Type A**

CxA:_____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
RAL File No:
Owner File No:

Section: 019133.02

Item: **BREAKER PANELBOARD**

LOCATION DATA:

Floor _____ Room _____ Panel ID _____

EQUIPMENT DATA:

Manufacturer	_____	Bus Amperage/Bracing	_____
Model Number	_____	c/w TVSS Unit	___ Yes ___ No
Volt/Phase/Wire	_____		
No. of Circuits	_____	Match Installed	___ Yes ___ No

STATIC CHECKS: **DATE / CHECKED BY:** _____

Enclosure Details

Mounting	_____		
EEMAC Enclosure Type	_____		
Door Type	_____		
Drip Hood	___ Yes ___ No	Door Lock	___ Yes ___ No

Feeder Details

Wire Size	_____	Wire Insulation	_____
Ground Wire Type & Size	_____	Conduit Size	_____

Branch Breaker

Mounting	___ Bolt In ___ Plug In	Branch Lugs Torqued	___ Yes ___ No
Branch Wires Labelled	___ Yes ___ No	Neutral Wires Labelled	___ Yes ___ No
GFCI Breakers Labelled	___ Yes ___ No	GFCI Breakers Tested	___ Yes ___ No

Auxiliary Components

Main Breaker	_____ A	Interrupting Capacity	_____ KA
Main Lugs Torqued	___ Yes ___ No	Isolated Ground Bar	___ Yes ___ No
Bus Type	___ Copper ___ Aluminum		

Miscellaneous

Conduit Skirting	___ Yes ___ No	Lamecoid Accurate	___ Yes ___ No
Spare Conduits	___ Yes ___ No	Breaker Filler Pieces Installed	___ Yes ___ No
Exterior Clean	___ Yes ___ No	Circuit Directory Installed	___ Yes ___ No
Interior Clean	___ Yes ___ No	Top Connectors Sealed	___ Yes ___ No

OPERATION CHECKS: **DATE / MEASURED BY:** _____

Measured Values	**Amperage**	**Voltage**
	Line A _____ Amps	AB _____ Volts
	Line B _____ Amps	BC _____ Volts
	Line C _____ Amps	CA _____ Volts

SIGN-OFFS:

Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
RAL File No:
Owner File No:

Section: 019133.02

Item: **CDP PANELBOARD**

LOCATION DATA:

Floor _____ Room _____ Panel ID _____

EQUIPMENT DATA:

Manufacturer	_____	Bus Amperage/Bracing	
Model Number	_____	c/w TVSS Unit	___ Yes ___ No
Volt/Phase/Wire	_____		
No. of Breakers	_____	Match Installed	___ Yes ___ No

STATIC CHECKS: **DATE / CHECKED BY:** _____

Enclosure Details

Mounting	___ Flush ___ Surface ___ Padmount		
3mm Sheet Steel	___ Yes ___ No	Phosphated	___ Yes ___ No
Door Type	_____	Painted & Touched-up	___ Yes ___ No
Drip Hood	___ Yes ___ No	Door Lock	___ Yes ___ No

Feeder Details

Wire Size	_____	Wire Insulation	_____
Ground Wire Type & Size	_____	Conduit Size	_____

Branch Breaker

Mounting	___ Bolt In ___ Plug In	Branch Lugs Torqued	___ Yes ___ No
Branch Wires Labelled	___ Yes ___ No	Neutral Wires Labelled	___ Yes ___ No

Auxiliary Components

Bus Type ___ Copper ___ Aluminum

Miscellaneous

Conduit Skirting	___ Yes ___ No	Lamecoid Accurate	___ Yes ___ No
Spare Conduits	___ Yes ___ No	Breaker Filler Pieces Installed	___ Yes ___ No
Exterior Clean	___ Yes ___ No	Top Connectors Sealed	___ Yes ___ No
Interior Clean	___ Yes ___ No		

OPERATION CHECKS: **DATE / MEASURED BY:** _____

Measured Values

Amperage		**Voltage**	
Line A	_____ Amps	AB	_____ Volts
Line B	_____ Amps	BC	_____ Volts
Line C	_____ Amps	CA	_____ Volts

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
RAL File No:
Owner File No:

019133.02

Item: **EQUIPMENT RACK**

LOCATION DATA:

Floor _____ Room _____ Panel ID _____

EQUIPMENT RACK:

Manufacturer _____ Match Installed ___ Yes ___ No
Series _____
Model Number _____

STATIC CHECKS: **DATE / CHECKED BY:** _____

Components Installed

19-inch mounting rails	___ Yes	___ No	Fibre Patch Panel - Qty:	_____	
42U Rack Units	___ Yes	___ No	Data Patch Panel - Qty:	_____	
152mm Side Channels	___ Yes	___ No			
2-Ring horizontal managers	___ Yes	___ No			
2 - Shelves	___ Yes	___ No	Min Clearance - Front: 914mm	___ Yes	___ No
6-Outlet Power Bar	___ Yes	___ No	Min Clearance - Back: 1067mm	___ Yes	___ No
12-foot Shielded Cord Set	___ Yes	___ No	Min Clearance - Side: 762mm	___ Yes	___ No
Integral on/off Switch	___ Yes	___ No			
15A Breaker Reset	___ Yes	___ No			
EMI/RFI Filtering	___ Yes	___ No			
Ground Lug Terminated	___ Yes	___ No			

Cabling

Fibre Cable:	Type:	_____	Size: _____	Colour:	_____
Data Cables:	Category:	_____	Size: _____	Colour:	_____

Connectors:

Fibre Connectors	Type:	_____	Size: _____	Colour:	_____
Data Connectors	Category:	_____	Size: _____	Colour:	_____

OPERATION CHECKS:

Cable installation and testing:

Installed and Certified by:
Company: _____ Name: _____ Date: _____

Labeling info provided by Owner	___ Yes	___ No	Rack layout info provided	___ Yes	___ No
Patch Cords Supplied	___ Yes	___ No	by Owner:		
Cable Test Report Submitted	___ Yes	___ No	All Cables Passed Tests:	___ Yes	___ No

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
RAL File No: 019133.02
Owner File No:

Item: **DISCONNECT SWITCHES**

LOCATION DATA:

Floor _____ Room _____ Equipment: _____

EQUIPMENT DATA:

Manufacturer _____
Model Number _____
Volt/Phase/Amperage _____
Horsepower _____ Match Installed ___ Yes ___ No

STATIC CHECKS: **DATE / CHECKED BY:** _____

Elevator Main Disconnect Switch

Fusible Switch	___ Yes	___ No
Volt/Phase	_____	
Pole/Wire	_____	
Switch Amperage - 60A	___ Yes	___ No
Fuse Amperage - 35A	___ Yes	___ No

Enclosure Details

Mounting	___ Flush	___ Surface
EEMAC Enclosure Type	_____	
Padlockable	___ Yes	___ No
Label	___ Yes	___ No

Elevator Cab Light Main Disconnect Switch

Breaker Switch	___ Yes	___ No
Volt/Phase	_____	
Pole/Wire	_____	
Switch Amperage - 15A	___ Yes	___ No

Enclosure Details

Mounting	___ Flush	___ Surface
EEMAC Enclosure Type	_____	
Padlockable	___ Yes	___ No
Label	___ Yes	___ No

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
RAL File No: 019133.02
Owner File No:

Item: **EXIT LIGHT**

FIXTURE TYPE: _____ Number Installed: _____

EQUIPMENT DATA: **DATE / CHECKED BY:** _____

Manufacturer _____

Catalogue Number _____

Fixture Type _____

Housing _____

Voltage _____

Lamp Wattage _____

Lamp Type _____

Lettering Type _____

Number of Faces _____

Circuit _____

Mounting

Nexus Compatible _____

Options _____

_____

Match Installed ___ Yes ___ No

_____

_____

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
RAL File No:
Owner File No:

Section: 019133.02

Item: **F/A COMPONENTS**

EQUIPMENT DATA:

Manufacturer _____ Match Installed ___ Yes ___ No
System _____

STATIC CHECKS: **DATE / CHECKED BY:** _____

System Devices	**Model Number**	**Match installed**
Manual Pull Stations		___ Yes ___ No
Smoke Detectors		___ Yes ___ No
Monitor Modules		___ Yes ___ No
Control Modules		___ Yes ___ No
Relay Modules		___ Yes ___ No
Fault Isolator Modules		___ Yes ___ No
Power Supply		___ Yes ___ No
Annunciator Panel		___ Yes ___ No
Signal Devices		___ Yes ___ No

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
RAL File No:
Owner File No:

Section: 019133.02

Item: **GROUNDING**

STATIC CHECKS: **DATE / CHECKED BY:** _____

Grounded Systems

Communications	___ Yes	___ No
Switchboard	___ Yes	___ No
Transformers	___ Yes	___ No
Lay-in Trays	___ Yes	___ No
Feeder Conduits	___ Yes	___ No
Green Insul. on Branch Conduits	___ Yes	___ No
Continuity checked	___ Yes	___ No

Miscellaneous

Riser _____

Ground Bus _____

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
RAL File No: 019133.02
Owner File No:
Item: **LIGHTING**

FIXTURE TYPE: _____ Number Installed: _____

EQUIPMENT DATA: **DATE / CHECKED BY:** _____

Manufacturer _____

Catalogue Number _____

Voltage _____

Lamp Type _____

Lamp Wattage _____

Number of Lamps _____

Ballast/Driver Type _____

Size _____

Mounting _____

Diffuser _____

Options _____

_____

Match Installed ___ Yes ___ No

SIGN-OFFS:

Contractor: _____ Signature: _____ Date:_____

Cx Rep: _____ Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
Location:
RAL File No:
Owner File No:

Section: 019133.02

Item: **LV PANELS**

LOCATION DATA:

Floor: _____ Room: _____ ID: _____

EQUIPMENT DATA:

Manufacturer _____ Match Installed ___ Yes ___ No
System _____
Model Number _____ Relay Capacity: _____ Relays: _____

STATIC CHECKS: **DATE / CHECKED BY:** _____

Components Installed

Intelligent Card	___ Yes	___ No	Data-Line	___ Yes	___ No
Photo Control Package	___ Yes	___ No	BMS Interface Module	___ Yes	___ No
Networking Modules	___ Yes	___ No	Photo-control Module	___ Yes	___ No
Power Supply Units	___ Yes	___ No	OCC Sensors	___ Yes	___ No
Digital Switches w/ Pilot Light	___ Yes	___ No	Photo Sensors (Indoor)	___ Yes	___ No
Relays w/ Pilot Light Switch	___ Yes	___ No	Photo Sensors (Outdoor)	___ Yes	___ No
Channel Bushbuttons	___ Yes	___ No			

Panel Installation

Power supply terminated	___ Yes	___ No	Operating manuals provided	___ Yes	___ No
Panel relays terminated	___ Yes	___ No			
Remote relays terminated	___ Yes	___ No			
Class 2 wiring terminated	___ Yes	___ No			
Lamecoid Identification	___ Yes	___ No			

OPERATION CHECKS:

Programming and Start-up

Start-up and programming verified by:
Company: _____ Name: _____ Date: _____

Control Devices:

LV Switching conforms to drawings	___ Yes	___ No
Indoor Photo Sensors Operational	___ Yes	___ No
Outdoor Photo Sensors Operational	___ Yes	___ No
Occupancy Sensors Operational	___ Yes	___ No

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
RAL File No: 019133.02
Owner File No:
Item: **MOTOR STARTER**

LOCATION DATA:

Floor _____ Room _____ ID _____

EQUIPMENT DATA:

Manufacturer	_____	Thermal Protection	___ Yes ___ No
Model Number	_____	Panel/Cct Fed From	_____
Starter Volt/Phase/Wire	_____	Starter Size	_____
Starter Type	_____	Match Installed	___ Yes ___ No

STATIC CHECKS: **DATE / CHECKED BY:** _____

Motor Protection Switch

Type	___ Fuse ___ Breaker	Pilot Lights Checked	___ Yes ___ No
Size	_____		

Overload Elements

Overload Correctly Sized	___ Yes ___ No	Amperage Range	_____ Amps

Motor Data

Service Factor	_____	Full Load Current	_____ Amps
Motor Volt/Phase/Wire	_____	Motor Horsepower	_____ HP
Motor Design Type	_____	Motor Code	_____
Motor Insulation	_____	Motor Locked Rotor Current	_____ Amps
Cable Distance to Drive	_____	Motor RPM	_____ RPM

Enclosure Details

Mounting	___ Flush ___ Surface		
EEMAC Enclosure Type	_____		
Door Type	_____		
Drip Hood	___ Yes ___ No	Door Lock	___ Yes ___ No

Miscellaneous

Exterior Clean	___ Yes ___ No	Top Connectors Water Tight	___ Yes ___ No
Interior Clean	___ Yes ___ No	Conduit Connectors Sealed	___ Yes ___ No
Indicating Lights Operate	___ Yes ___ No	Ground Wire Type & Size	___ Type ___ AWG
Hand/Off/Auto Switch	___ Yes ___ No	Phase Rotation Confirmed	___ Yes ___ No
Air Filters Present	___ Yes ___ No	Operation Manual Included	___ Yes ___ No
Air Filters Changed Pre-Startup	___ Yes ___ No	Record of VFD Settings	___ Yes ___ No

OPERATION CHECKS: **DATE / MEASURED BY:** _____

Starter Operation

Manual Operation Checked	___ Yes ___ No	Auto Operation Checked	___ Yes ___ No
Disconnect Function Checked	___ Yes ___ No	Fire Alarm Shutdown Checked	___ Yes ___ No
VFD Display Calibrated	___ Yes ___ No	Auto Restart Checked	___ Yes ___ No
Motor RPM Verified	___ Yes ___ No	Owner Training Completed	___ Yes ___ No

Measured Values	**Amperage**		**Voltage**		**Voltage**	
	Line A	_____ Amps	AB	_____ Volts	AN	_____ Volts
	Line B	_____ Amps	BC	_____ Volts	BN	_____ Volts
	Line C	_____ Amps	CA	_____ Volts	CN	_____ Volts

Motor Terminal Waveforms Taken	___ Yes ___ No	Skip Frequencies	_____
Acceleration Time	_____	Carries Frequency	_____
Deceleration Time	_____	Maximum Speed	_____
Output Pulse Risetime	_____	Minimum Speed	_____
Speed Control	☐-10VDC ☐4-20mA ☐ +/-10VDC	Speed Display	☐ % ☐ Hz

SIGN-OFFS:

Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
Location:
Owner File No:

019133.02

Item: **Wiring Devices**

STATIC CHECKS: **DATE / CHECKED BY:** _____

Receptacles location and operation confirmation

Duplex Receptacles (5-15R)	_____ Yes	_____ No
Single Receptacles (5-15R)	_____ Yes	_____ No
T-Slot Receptacles (5-20R)	_____ Yes	_____ No
Tamper resistant safety Receptacles (5-15R)	_____ Yes	_____ No
GFCI (Safe-Lock - 5mA Ground Fault)	_____ Yes	_____ No

Switches location and operation confirmation

120V Switches (SPST, 15A)	_____ Yes	_____ No
120V Pilot Light Switches (SPST - 15A)	_____ Yes	_____ No
Fractional HP/KW Manual Starters	_____ Yes	_____ No
120V Illuminated Switches	_____ Yes	_____ No
Dimmer Switches	_____ Yes	_____ No

Comments:

SIGN-OFFS:

Contractor: Signature:_____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature:_____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
CDP PANELBOARDS

Sect. 019133.02

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, manufacturer's recommendations and Specifications.
- ☐ Confirm that the panelboard has been securely fastened and mounted on unistrut and / or plywood backboards (where required by the specifications).
- ☐ Confirm that all feeder and branch circuit conductors are properly sized, terminated with the proper torque, identified as required by the Specifications. Ensure that the panelboard, panelboard feeders & branch wiring have been Megger tested. Panel phase and branch wiring colour & circuit number must correspond.
- ☐ Ensure that trip rating of each breaker is present and visible.
- ☐ Mark all lugs and terminals that have been torqued with red lacquer or marker.
- ☐ Ensure that the branch circuits and their breakers are correctly matched.
- ☐ Ensure that the panelboards lamecoid tag conforms to the drawings & Specification.
- ☐ Ensure that all sections of the Contractor Start-up and Testing Sheet(s) are signed or initialed and dated.
- ☐ Complete record drawings.
- ☐ Conduct Owner training on the operation and maintenance of the panelboards.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

Notes: _____

_____

_____

_____

Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
Data/Voice System

Form. 019133.02

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the specifications and comply with the shop drawings.
- ☐ Perform the installation in accordance with the manufacturer's recommendations and in accordance with the specifications and drawings.
- ☐ Conduct testing of the cabling system in accordance the standards outlined in the specifications.
- ☐ Confirm termination of all vertical and horizontal copper cable.
- ☐ Confirm termination of all fibre cable.
- ☐ All fibre and copper cables are provided with service loops at the equipment racks and BIX blocks.
- ☐ In all wall or pac pole drops, a 300mm cable slack is provided before entering wall or pac pole suspended in the ceiling.
- ☐ Confirm identification of equipment and all tagging is completed in accordance with the specifications and Owner's requirements.
- ☐ Confirm management of all vertical and horizontal cables, including installation of waterfalls at equipment racks.
- ☐ Confirm velcor straps are used. Cable ties are unacceptable.
- ☐ Confirm grounding within the Data/Com Rooms in accordance with the requirements of the Canadian Electrical Code, specifications and drawings, including bonding of the equipment racks, conduit stubs and cable trays.
- ☐ Confirm clearances at the equipment racks.
- ☐ Each equipment racks is supplied with a floor mounting base, fibre and copper patch panels, cable managers, power bar, and shelves.
- ☐ Confirm equipment racks are secured to floor.
- ☐ Confirm power to server equipment is energized and polarity of all wiring devices is checked.
- ☐ Supply and turn-over to Owner the fibre and copper patch cords in the quantities, types and lengths noted in the specifications.
- ☐ Submit cable test reports, include copies or CD disk in the Operating and Maintenance Manual.
- ☐ Conduct Owner training on the layout and installation of this system.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

Notes: _____

_____

Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
DISCONNECT SWITCHES F/NF

Sect. 019133.02

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, manufacturer's recommendations and Specifications.
- ☐ Confirm that the disconnect switches has been securely fastened.
- ☐ Confirm that all feeder and branch circuit conductors are properly sized, terminated with the proper torque, identified as required by the Specifications.
- ☐ Mark all lugs and terminals that have been torqued with red lacquer or marker.
- ☐ Ensure that the branch circuits and their fuses are correctly matched.
- ☐ Ensure that the disconnect switches lamecoid tags conforms to the drawings & Specification.
- ☐ Ensure that all sections of the Contractor Start-up and Testing Sheet(s) are signed or initialed and dated.
- ☐ Complete record drawings.
- ☐ Conduct Owner training on the operation and maintenance of the panelboards.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
EXIT AND EMERGENCY LIGHTING

Sect. 019133.02

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings (if provided).
- ☐ The installation is completed in accordance with the Canadian Electrical Code, specifications and manufacturer's recommendations.
- ☐ Confirm that all conductors for supply and control are properly sized, terminated with proper torque.
- ☐ Confirm exit lighting clearly indicate the means of egress and are visible in all public areas.
- ☐ Confirm exit light fixtures are connected to a dedicated emergency circuit as indicated on the floor plans.
- ☐ Ensure that exit light circuit breaker is locked in on position.
- ☐ Confirm complete illumination of the EXIT signs.
- ☐ Perform functional & other tests (as applicable) required by the Specifications, the Manufacturer or the Design Consultant.
- ☐ Conduct Owner training in regards to the operation and maintenance of the emergency exit lighting.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
FIRE ALARM

Sect. 019133.02

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings.
- ☐ Complete installation and wiring of all components of the fire alarm system in accordance with the manufacturer's recommendations, specifications, and in accordance with the National Standard of Canada/Underwriters' Laboratory of Canada Standards CAN/ULC-S524-M06 "Standard for the Installation of Fire Alarm Systems".
- ☐ Complete the inspection and testing of the fire alarm system in accordance with the National Standard of Canada/Underwriters' Laboratory of Canada Standards CAN/ULC-S536-04 "Standard for the Inspection and Testing of Fire Alarm Systems".
- ☐ Complete the verification of the fire alarm system in accordance with the National Standard of Canada/Underwriters' Laboratory of Canada Standards CAN/ULC-S537-04 "Standard for the Verification of Fire Alarm System Installations".
- ☐ Confirm fire alarm system connected to a dedicated circuit with breaker lock-on device on branch breaker.
- ☐ Fire alarm control panel is fed with mineral insulated cable, or is provided with 1-hour rating on feeder to the fire alarm panel.
- ☐ Initiate alarm from each breakglass station.
- ☐ Initiate an alarm from each smoke detector and heat detector by initiating an alarm using a magnet, artificial smoke, or by jumping out device in case of fixed temperature heat detectors. The method to activate a detector shall be confirmed by the manufacturer's verification agent.
- ☐ Initiate an alarm from the sprinkler system by testing flow within a floor control zone valve.
- ☐ Conduct an open circuit tests at various points on the Class B tolerant loops. Initiate an alarm from various points on the open circuit.
- ☐ Initiate an alarm to check supervisory and control functions at the fire alarm control and annunciator panel.
- ☐ Check correctness of identification of annunciator zones and device mapping at the annunciator.
- ☐ Initiate one test alarm to central supervisory station after notice of test is given.
- ☐ Check operation of all auxiliary contacts and devices, and verify that auxiliary control door holders, fan shut-down, elevator homing, etc, is fully operational.
- ☐ Perform functional and other tests (as applicable) as required by the Specifications, the Manufacturer or the Consultant.
- ☐ Check operation of fire alarm audible and visual signal appliances in public areas.
- ☐ Record sound levels for fire alarm signal devices within public areas.
- ☐ Confirm signal to the municipal fire department in accordance with the requirements of the 2010 National Building Code.
- ☐ Submit manufacturer's fire alarm certificate of verification and fire alarm test report.
- ☐ Confirm spared devices are provided to the owner as required by the Specifications.
- ☐ Complete record drawings.

- ☐ Conduct Owner training on the operation and maintenance of the fire alarm system.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into notes areas of any unfinished areas or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
GROUNDING

Sect. 019133.02

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings (if provided).
- ☐ Perform tests that are required by the Canadian Electrical Code, ANSI/NETA standard's, manufacturer's recommendations and Specifications.
- ☐ All electrical equipment and wiring grounded in accordance with the Canadian Electrical Code, and local inspection authority's rules and regulations.
- ☐ The ground bus in each switchboard, transformer, motor control centre, etc., connected to the grounding network by two AWG #3/0 bare copper conductors.
- ☐ All motors with flexible connections have separate insulated ground wire run bridging the flexible connections with the ground wire run back to the nearest junction box or motor control centre.
- ☐ Exposed copper cleaned to a bright surface, and finished with two coats of clean, insulating varnish.
- ☐ Where bonds are covered with soil, the conductors are to be coated with anti-corrosion compound "Kopr-Shield" (Thomas & Betts Co.) before compression connector is applied. All bonding done with 'C' tap and lug compression connectors.
- ☐ All grounding connectors, conductor and terminations checked and approved by the Consultant prior to concealment by fill or architectural finishes.
- ☐ The main grounding electrode or system shall have a fall-of-potential test. Refer to IEEE Standard 81. Five ohms is the maximum allowable resistance between the main grounding electrode and ground.
- ☐ Determine resistance between main grounding system and all major electrical equipment frames, system neutral and any floating neutrals. Any resistance values greater than 0.5 ohm shall be examined.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
LIGHTING

Sect. 019133.02

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, specifications, and manufacturer's recommendations.
- ☐ Confirm that all circuit conductors for supply and control are properly sized, terminated with proper torque, identified as required by the Specifications.
- ☐ Confirm proper ballast and voltage ratings are installed within the fixtures.
- ☐ Confirm correct lamps are provided for the fixture in accordance with the specifications and manufacturer's requirements. Ensure lamp colour temperatures and colour rendering index (CRI) are in accordance with the requirements of the specifications.
- ☐ Confirm fixtures are clean, proper fit of lenses and fixture trims.
- ☐ Confirm installation of switches, occupancy sensors and photocells.
- ☐ Adjust coverage and time delay-off to all wall and ceiling occupancy sensors.
- ☐ Complete record drawings for layout of lighting, circuit identification and control.
- ☐ Conduct Owner training in regards to the operating and maintenance of lighting fixtures, including the type of lamps installed, lamp and ballast or LED/driver replacement, driver or ballast warranties, and general maintenance of the fixtures.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
LOW VOLTAGE LIGHTING

Sect. 019133.02

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical Specification and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, ANSI/NETA standards, manufacturer's recommendations and Specification.
- ☐ Confirm that all line voltage and class II wiring for supply and control are properly sized, terminated, identified as required by the specifications.
- ☐ Day-light sensors installed for interior perimeter lighting.
- ☐ Exterior photo-sensors installed for exterior lighting.
- ☐ Low voltage power packs are installed and locations marked on as-built drawings.
- ☐ Verify and adjust photo control sensitivity for interior and exterior lighting.
- ☐ Occupancy sensors interconnected to switches as shown on drawings.
- ☐ Provide record of occupancy sensor and photocell programming.
- ☐ Aim and adjust photo controls to optimize function.
- ☐ Conduct Owner training in regards to the operation, programming and maintenance of the lighting control system.
- ☐ Complete record drawings.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
OVERCURRENT PROTECTIVE DEVICES

Sect. 019133.02

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical Specification and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, ANSI/NETA standards, manufacturer's recommendations and Specification.
- ☐ Confirm that the overcurrent protection device is correctly sized and has been securely fastened.
- ☐ Confirm that all supply and load feeders are properly sized, terminated with the proper torque, identified as required by the Specification. Ensure that the supply and load feeders have been Megger tested.
- ☐ Mark all lugs and terminals that have been torqued with red lacquer or marker.
- ☐ Ensure that all sections of the Contractor Start-up and Testing Sheet(s) are signed or initialed and dated.
- ☐ Complete record drawings
- ☐ Conduct Owner training on the operation and maintenance of the overcurrent protective equipment.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
BREAKER PANELBOARDS

Sect. 019133.02

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, manufacturer's recommendations and Specifications.
- ☐ Confirm that the panelboard has been securely fastened and mounted on unistrut and / or plywood backboards (where required by the specifications).
- ☐ Ensure panel interior is at the correct depth from the tub or wall face. Confirm that the nuts securing the interior to the tub bolts / tub are properly tightened.
- ☐ Confirm that all feeder and branch circuit conductors are properly sized, terminated with the proper torque, identified as required by the Specifications. Ensure that the panelboard, panelboard feeders & branch wiring have been Megger tested. Panel phase and branch wiring colour & circuit number must correspond.
- ☐ Mark all lugs and terminals that have been torqued with red lacquer or marker.
- ☐ Ensure that the branch circuits and their breakers are correctly matched.
- ☐ Ensure that the panelboards lamecoid tag conforms to the drawings & Specification.
- ☐ Insert final typewritten panel directory and provide breaker lock-on devices as per Specification.
- ☐ Operate the PTT test feature if GFCI breakers are in the panelboard.
- ☐ Ensure that all sections of the Contractor Start-up and Testing Sheet(s) are signed or initialed and dated.
- ☐ Complete record drawings.
- ☐ Conduct Owner training on the operation and maintenance of the panelboards.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
WIRING DEVICES

Spec. 019133.02

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, manufacturer's recommendations and Specifications.
- ☐ Test receptacles for polarity.
- ☐ Test GFCI Receptacles with an appropriate ground fault tester.
- ☐ Verify panel directories and circuit identification indicated on the record drawings are consistent and correct.
- ☐ Record drawings are completed, indicating actual location of devices and circuit identification.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

Notes:

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 This Section specifies roles and responsibilities of Training.

1.2 TRAINEES

.1 Trainees: personnel selected for operating and maintaining this facility. Includes Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.

.2 Trainees will be available for training for purposes of familiarization with systems.

1.3 INSTRUCTORS

.1 Consultant will provide:

.1 Descriptions of systems.

.2 Instruction on design philosophy, design criteria, and design intent.

.2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:

.1 Start-Up, operation, shut-down of equipment, components and systems.

.2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.

.3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.3 Contractor and equipment manufacturer to provide instruction on:

.1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:

.1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.

.2 Effective on-going inspection, measurements of system performance.

.3 Proper preventive maintenance, diagnosis and trouble-shooting.

.4 Ability to update documentation.

.5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

.1 Instructors to be responsible for content and quality.

.2 Training materials to include:

.1 "As-Built" Contract Documents.

.2 Operating & Maintenance Manual.

.3 TAB and PV Reports.

.3 Departmental Representative will review training manuals.

.4 Training materials to be in a format that permits future training procedures to same degree of detail.

.5 Supplement training materials:

.1 Transparencies for overhead projectors.

.2 Multimedia presentations.

.3 Manufacturer's training videos.

.4 Equipment models.

1.6 SCHEDULING

.1 Include in Commissioning Schedule time for training.

.2 Deliver training during regular working hours, training sessions to be for duration specified in relevant Specification Sections.

.3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

.1 Be responsible for:

.1 Implementation of training activities,

.2 Coordination among instructors,

.3 Quality of training, training materials,

.2 Departmental Representative will evaluate training and materials.

.3 Upon completion of training, provide written report, signed by Instructors, with complete list of attendees, and witnessed by Consultant and Cx Authority.

.4 Coordination with Departmental Representative.

1.8 TRAINING CONTENT

.1 Training to include demonstrations by Instructors using the installed equipment and systems.

.2 Content includes:

.1 Review of facility and occupancy profile.

.2 Functional requirements.

.3 System philosophy, limitations of systems and emergency procedures.

.4 Review of system layout, equipment, components and controls.

.5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.

.7 Maintenance and servicing.

.8 Trouble-shooting diagnosis.

.9 Interaction among systems during integrated operation.

.10 Review of O&M documentation.

.3 Provide specialized training as specified in relevant Sections of the Specifications.

END OF SECTION

Part 1 General

1.1 SOILS REPORT

.1 A copy of a detailed soils report with respect to the building site is available for viewing at the offices of:

.1 SEPW Architecture Inc.
Unit #102 - 3718 Kinnear Place
Saskatoon, SK S7P 0A6

is titled as: Geotechnical Report
Proposed RCMP Detachment
Ahtahkakoop, Saskatchewan

dated: 30 December 2015

prepared by: Clifton Associates Ltd. (File S2068)

.2 The soils report gives properties of the soils and recommendations for the design of foundations, prepared primarily for the use of the Consultant. The recommendations given are not to be construed as requirements of the Contract unless they are also contained in the Specifications or indicated on drawings.

.3 The report, by its nature, cannot reveal all conditions that exist or can occur on site. Should sub-surface conditions be found to vary substantially from those indicated in the Soils Report, changes in the design and construction of foundations will be made accordingly, with resulting credits or expenditures accruing to the Owner.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Removal of existing sitework in preparation for new construction.

1.2 RELATED WORK

.1	Topsoil Stripping and Stockpiling	Section 31 14 13
.2	Site Grading	Section 31 22 00

1.3 MATERIAL OWNERSHIP

.1 All useable lumber, bricks, and miscellaneous materials shall become the property of the Owner.

1.4 SAFETY

.1 Take all precautions for the safety and the protection of the employees, public vehicle and pedestrian traffic by adequate fencing, hoarding, flagmen and barricades as may be required in the interest of safety and in accordance with provincial and municipal requirements.

1.5 DAMAGE TO MUNICIPAL STRUCTURES

.1 Care shall be taken to avoid damage to sidewalks, pavement and any and all municipal works. Be responsible for repair or replacement of any damaged public property or utility to the satisfaction of the property owner.

1.6 DAMAGE TO ADJACENT PROPERTIES

.1 Take all precautions necessary for the protection of fences, trees, structures, pavement and excavations on adjoining properties. Be responsible for any damages resulting from whatever causes; make good any such damages to the satisfaction of adjacent property owners, and settle any claims which may arise.

1.7 DISCONNECTION OF SERVICES

.1 Arrange, and pay the cost of, disconnection of any services by the appropriate utility company. No claims shall be made for delays which may result in such disconnections. Should municipal authority elect to shut off the water supply by closing the service valve only, mark and protect the valve during the course of construction. If a water leak develops, immediately bring the matter to the municipal authority's attention and pay for the cost of repair if due to Contractor negligence.

1.8 BACKFILL

.1 Where necessary to provide backfill, provide in accordance with Section 31 22 00 - Site Grading.

1.9 DEMOLITION

.1 Be responsible for the demolition of existing structures, as shown on drawings. Pay costs required by the Municipality, SaskPower, SaskTel, SaskEnergy, and any other party or agency involved. Remove all abandoned and terminated water, gas, sewer, telephone and electrical lines. Co-ordinate the termination and removal of all services involved. Be responsible for the removal or relocation of any services adjacent to the property necessary for the completion of the work.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this section.

1.2 WORK INCLUDED

.1 Form for all cast-in-place concrete indicated on drawings and subsequently remove all such forms.

1.3 DESIGN AND CODE REQUIREMENTS

.1 Formwork and supporting falsework shall be designed and constructed in accordance with the requirements of CAN/CSA S269.3-M92 (R2008) and CAN/CSA -A23.1-09 as applicable to the work.

.2 Assume full responsibility for the design and for the adequacy and safety of all formwork and falsework.

.3 Retain a professional engineer to design falsework which consists of shoring more than one tier in height or which is a framed structure.

.4 The design and erection of formwork and related supporting works shall comply with construction safety legislation and regulations.

1.4 HANDLING AND STORAGE

.1 Deliver, handle and store formwork materials to prevent weathering, warping or damage detrimental to the strength of the materials or to the surface to be formed.

.2 Ensure that formwork surfaces which will be in contact with concrete are not contaminated by foreign matter. Handle and erect the fabricated formwork so as to prevent damage.

Part 2 Products

2.1 QUALITY AND STRENGTH

.1 The quality and strength of formwork material shall comply with the requirements set forth in this Specification and CAN/CSA A23.1-09.

2.2 FINISHES

.1 Form materials for concrete surfaces which will be exposed to view, or which require smooth and uniform surfaces for applied finishes or other purposes, shall consist of square edges, smooth panels of plywood, metal or plastic to approval of the Consultant. The

panels shall be square and made in a true plane, clean, free of holes, surface markings and defects.

.2 Square edged, tongue and groove or shiplap lumber may be used to form concrete which will not be exposed to view or which does not require smooth uniform surface for other purposes.

2.3 MATERIALS

.1 Form plywood: exterior grade, Douglas Fir conforming to CSA Standard O121-08. Plywood shall be resin coated one side (in contact with concrete). Use sound undamaged plywood with clean true edges. Make up or patching strips between panels shall be kept to a minimum.

.2 Lumber for forms, falsework, shoring and bracing: conform to CAN/CSA O141-05 (R2009) for Softwood Lumber, and the applicable authorized grading authority. All lumber shall be a grade to which allowable unit stresses may be assigned in accordance with the National Building Code. All lumber shall be grade marked by the authorized grading authority.

.3 Form Ties: Fabricated units having a minimum working strength when assembled of 21 MPa and shall be adjustable in lengths to permit tightening and alignment of forms. Ties shall be made with breakback ends or other means of removing the tie end to a depth of at least 25 mm from the concrete surface, after the forms are removed. Flat tie for Architectural exposed concrete to include plastic cones leaving no metal within 20 mm of surface.

.4 Form release agent: Proprietary material which will not stain the concrete or impair the natural bonding or colour characteristics of coating intended for use on the concrete.

.5 Waterstops: Purpose made polyvinyl chloride; 12 MPa minimum tensile strength, -46^0 C. to $+70^0$ C working temperature range, conforming to CGSB 41 GP 35M, Type 2.

.6 Tubular column forms: round spirally wound laminated fibre forms, internally treated with release material.

.7 Dovetail anchor slots: minimum 0.6 mm galvanized steel with insulation filled slots.

.8 Pre-moulded joint fillers:

.1 Bituminous impregnated fibreboard: ASTM D1751-73.

.2 Vinyl Foam: to ASTM D1752-67 (1973) Type I, flexible grade.

.3 Standard Cork: to ASTM D1752-67 (1973) Type II.

Part 3 Execution

3.1 CONDITION OF SURFACES

.1 Examine the excavations and foundations for adequate working room and support for the work of this section.

.2 Verify lines, levels and centre lines before proceeding with the work and ensure that dimensions agree with drawings.

.3 Report to the Consultant discrepancies in other work which affect the work of this section.

3.2 PREPARATION

.1 Coat the inside surfaces of forms with a form release agent, used in accordance with the manufacturer's instructions.

.2 Apply the agent prior to placing reinforcing steel, anchoring devices and embedded parts.

3.3 ASSEMBLY AND ERECTION

.1 Construct the formwork and shoring and bracing to meet the design and code requirements, accurately so that the resultant finished concrete shall conform to the shapes, lines and dimensions shown on the drawings, within the specified tolerances.

.2 Formwork shall be so arranged and assembled as to permit easy dismantling and stripping so that the concrete will not be damaged during its removal.

.3 Review locations of ties and form panels for exposed concrete work with the Consultant.

.4 Check and correct formwork as required, both horizontally and vertically, during the placing of the concrete.

.5 Construct formwork to maintain the following maximum tolerances:

.1 Deviation from horizontal and vertical lines:
6 mm in 3000 mm
20 mm in 12000 mm.

.2 Deviation of building dimensions indicated on Drawings and position of columns, walls and partitions:
6 mm.

.3 Deviation in cross sectional dimensions of columns or beams or in thickness of slabs and walls:
± 6 mm.

.4 Camber slabs and beams:
10 mm per 3000 mm of span unless indicated on drawings.

.6 Obtain Departmental Representative's approval for use of earth forms.

3.4 JOINTS IN FORMS

.1 Make form joints tight in order to prevent leakage of mortar.

.2 Clean all edges and contact surfaces before erection.

.3 Where required, install pvc waterstop to manufacturer's instructions and without displacing reinforcement. Do not distort or pierce waterstop.

3.5 SHORING AND BRACING

.1 Provide bracing to ensure the stability of the formwork as a whole.

.2 Prop or strengthen all previously constructed parts liable to be overstressed by construction loads.

.3 Arrange forms to allow stripping without removal of the principal shores, where these are required to remain in place.

3.6 EMBEDDED PARTS AND OPENINGS

.1 Provide formed openings where required for pipes, conduit, sleeves and other work to be embedded in and passing through concrete members. Accurately locate and set in place items which are to be cast directly into the concrete. Co-ordinate the work of other sections and co-operate with the trade involved in the forming and setting of openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts. No such forming or setting of openings, slots, recesses, chases, sleeves, or parts shall be done unless specifically shown on the drawings or approved prior to installation.

.2 Obtain Consultant's approval before framing openings in concrete beams or columns not specifically detailed on structural drawings.

.3 Provide temporary ports or openings where required to facilitate cleaning and inspection. Openings at the bottom of forms shall be located so that flushing water will drain from the forms.

.4 Close the temporary ports or openings with tight fitting panels, flush with the inside face of the forms, neatly fitted so that the joints will not be apparent in exposed concrete surfaces.

.5 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval in writing or all modifications from the Consultant before placing concrete.

.6 Install continuous vertical anchor slots where concrete walls or columns are masonry faced. Co-ordinate extent and locations of anchor slots with spacing of masonry ties as specified in Division 4.

3.7 FIELD QUALITY CONTROL

.1 Inspect and check the completed formwork, shoring and bracing to ensure that the work is in accordance with the formwork design, and that the supports, fastenings, wedges, ties and parts are secure. The Engineer responsible for the design of the formwork shall assist in this inspection.

.2 Inform the Consultant when the formwork is complete and has been cleaned. Obtain the approval of the engineer responsible for the design of the formwork and the general approval of the Consultant before placing concrete.

3.8 CLEANING

.1 Clean the forms as erection proceeds to remove foreign matter.

.2 Remove cuttings, shavings and debris from within the forms.

.3 Flush the completed forms with water or air jet to remove remaining foreign matter. Ensure that water and debris drain to the exterior through the clean-out ports.

3.9 WINTER CONSTRUCTION

.1 Remove ice and snow from within the forms.

.2 The use of de-icing salts will not be permitted.

.3 Unless formwork and concrete construction proceed within a heated enclosure, do not use water to clean out completed forms. Use compressed air or other means to remove foreign matter.

3.10 REMOVAL OF FORMWORK

.1 Notify the Consultant before removing formwork.

.2 Remove formwork progressively and in accordance with the reference code requirements, and so that no shock loads or imbalanced loads are imposed on the structure.

.3 Do not remove forms and shoring before concrete has attained sufficient strength to ensure safety of structure. If evidence to verify concrete strength is not available, the forms and shores shall not be removed before the following minimum intervals after concrete is placed.

.1	Footings, walls and grade beams	- 4 days.
.2	Columns	- 7 days.
.3	Beams, soffits and slabs	- 21 days.

.4 Loosen forms carefully. Do not wedge pry bars, hammers or tools against concrete surfaces.

.5 Leave forms loosely in place, against vertical surfaces, for protection until complete removal is approved by Consultant.

.6 Store removed forms, for exposed architectural concrete, in a manner that surfaces to be in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.

.7 Re-shore structural members where required due to design requirements or construction conditions and as required to permit progressive construction.

.8 Remove forms not directly supporting weight of concrete as soon as stripping operations will not damage concrete.

.9 Re-use of formwork and falsework is subject to the requirements of CAN/CSA A23.1-09.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made a part of this section.

1.2 WORK INCLUDED

.1 Furnish and install all bonded reinforcement and associated items required and/or indicated on the Drawings for all cast-in-place concrete and reinforced masonry work.

1.3 INSPECTION AND TESTING

.1 Upon request, provide certified copy of mill test report of steel supplied, showing physical and chemical analysis.

1.4 REFERENCE STANDARDS

.1 Do reinforcing work in accordance with CAN/CSA A23.1-09 and welding of reinforcement with CSA W186-M1990 (R2007).

1.5 SUBMITTALS

.1 Prepare, check and submit reinforcing steel and mesh placing drawings and bar bending and cutting schedules for all steel reinforcement shown or specified in accordance with General Conditions.

.2 All drawings and schedules shall be prepared and checked under the direct supervision of a qualified professional engineer who is experienced in this work.

.3 Clearly indicate bar sizes, spacing, location and quantities of reinforcement, mesh, chairs, spacers and hangers with identifying code marks to permit correct placement without reference to structural drawings; to ACI - 315 Manual of Standard Practice and Metric Supplement 1977 by Reinforcing Steel Institute of Ontario.

.4 Design and detail lap lengths and bar development lengths to CAN3 A23.3-04, unless specified on drawings.

.5 Review of shop drawings for size and arrangement of principal and auxiliary members only. Such review will not relieve the Contractor of responsibility for general and detail dimension and fit, or any errors or omissions.

1.6 DELIVERY AND STORAGE

.1 Reinforcing steel, welded wire fabric and accessories shall be delivered, handled and stored in a manner which prevents contamination from bond reducing or foreign matter and damage to its fabricated form.

Part 2 Products

2.1 MATERIALS

.1 *All reinforcing steel:* unless noted otherwise on the drawings or herein shall be deformed bars of new billet steel conforming to the current CAN/CSA G.30.18-09 Grade 400, plain finish for all bars. Minimum splice for 10 M bars to be 450 mm. Minimum lap splice for all other bars to be 36 bar diameters or 675 mm, whichever is greater.

.2 *Weldable reinforcing bars:* high strength ductile, deformed bars to CSA G30.18-09, Grade 400.

.3 *Column ties and beam stirrups:* shall conform to the current CAN/CSA G30.18-09, Grade 300.

.4 *Welded wire fabric:* to CSA G30.5-M1983. Provide in the flat sheets only.

.5 *Tie wires:* shall be 1.29 mm or heavier annealed wire or a patented system approved by the Consultant.

.6 *Reinforcing steel supports:* shall conform to ACI Standard 315 unless otherwise approved by the Consultant.

.7 *Mechanical splices:* subject to the approval of the Consultant.

2.2 FABRICATION

.1 Fabricate bends, splices and ties and supply bar supports and accessories in accordance with the requirements of CAN-A23.3-04. Spacing and arrangements of supports in accordance with ACI 315.

.2 All intermediate grade reinforcing bars shall be bent cold without hickeying. All high strength steel shall be preheated.

.3 Reinforcing bars shall not be straightened or rebent.

.4 Location of reinforcement splices not shown on the drawings subject to approval by the Consultant and shall, for beams and slabs be away from points of maximum stress in the steel.

.5 *Welding of reinforcing bars:* use only weldable bars, preheat and weld to CSA W186-1990 (R2007).

Part 3 Execution

3.1 EXAMINATION

.1 Examine the work upon which this section depends and report any discrepancies to the Consultant.

.2 Commencement of the work shall imply acceptance of conditions.

3.2 PLACING

.1 Reinforcement of the size and shapes shown on the drawings shall be accurately placed in accordance with the approved shop drawings, the structural drawings and the requirements of the current National Building Code.

.2 Clear distances between parallel bars, except for columns, shall be not less than 1.4 times the diameter of the bar, or 30 mm or 1.4 times the maximum size of the coarse aggregate. Bars placed in two or more layers shall be placed directly above and below each other.

.3 Clear distance between bars in columns shall be not less than 1½ the nominal diameter of the bar or 40 mm or 1½ times the maximum size of the coarse aggregate.

.4 Reinforcing steel shall, where not otherwise shown on the structural drawings, be protected by the clear cover of concrete over the reinforcement as follows:

.1 Where concrete is formed against earth, not less than 75 mm.

.2 Where concrete placed against forms is to be exposed to the weather or be in contact with the ground, not less than 50 mm for bars larger than 15 M, and not less than 40 mm for bars 15 M and smaller.

.3 In slabs and walls not exposed to the ground or weather, not less than 20 mm.

.4 In beams, girders and columns not exposed to the ground or weather, not less than 40 mm to principal reinforcement, ties and stirrups.

The foregoing clear covers shall be maintained within 5 mm.

.5 Reinforcement shall be adequately supported by metal chairs, spacers or hangers and secured against displacement within the tolerance permitted and in accordance with the latest ACI Standard 315.

.6 For slabs on grade, footings or similar construction, concrete blocks may be used in place of metal chairs.

.7 Unless specifically detailed otherwise, supply and install additional 10 M bars by 2400 long at 300 mm centres above all steel floor beams supporting open web steel floor joists. Bars to be centred above beam and placed with 25 mm cover to top of slab. Provide 1 - 15 M carrier bar below for chairing.

.8 Unless detailed otherwise, all exterior slabs, walks and pads abutting building foundations to be dowelled with 15 M at 400 on centre, extending minimum 750 into slab.

.9 Review with the Consultant, placement of reinforcement prior to concreting.

.10 Notify the Consultant twenty-four (24) hours prior to placing concrete.

3.3 CLEANING

.1 All materials shall be clean and free of all form oil or deleterious materials.

.2 All deleterious material shall be removed from the surface of the reinforcing steel in a manner acceptable to the Consultant.

3.4 WELDING

.1 Do welding to meet requirements of CSA W186-M1990 (R2007). Have welding performed by workmen qualified under CSA W47.1-09. Welding only by written authority of the Departmental Representative.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this section.

1.2 QUALITY ASSURANCE

.1 Provide at least one person who shall be present at all times during execution of this portion of the Work and who shall be thoroughly trained and experienced in placing the types of concrete specified and who shall direct all work performed under this Section.

.2 For finishing of exposed surfaces of the concrete, use only thoroughly trained and experienced journeyman concrete finishers.

.3 Perform cast-in-place concrete work to requirements of CAN/CSA-A23.1-09 - "Concrete Materials and Methods of Concrete Construction".

1.3 PRODUCT HANDLING

.1 Use all means necessary to protect cast-in-place concrete materials before, during and after installation and to protect the installed work and materials of all other trades.

.2 In the event of damage, immediately make all repairs and replacements necessary to approval of the Consultant and at no additional cost to the Owner.

1.4 INSPECTION AND TESTING

.1 Inspection and testing will be performed by a firm approved by the Departmental Representative and paid for by the Contractor. Unless approved otherwise, the testing agency must perform all aspects of testing including cylinder preparation.

.2 Provide free access to all portions of work and co-operate with appointed firm.

.3 Submit proposed mix design for each class of concrete to Departmental Representative for approval two (2) weeks prior to commencement of work.

.4 Tests of cement and aggregates may be performed to ensure conformance with requirements stated herein.

.5 One concrete test, consisting of three test cylinders, will be taken for every 50 cubic meters or less of each class of concrete placed. One cylinder to be tested at seven (7) days, the remaining two cylinders to be tested at twenty-eight (28) days.

.6 One (1) additional test cylinder will be taken during cold weather concreting, and be cured on job site under same conditions of concrete it represents.

.7 One (1) slump test and one (1) air content test will be taken for each set of test cylinders taken.

.8 Testing of concrete will be performed in accordance with CAN/CSA-A23.2-09 "Method of Test for Concrete".

.9 Test results will be issued to the Contractor, and Departmental Representative. Test reports are to be numbered consecutively beginning with number one.

.10 Required retesting will be paid for by the Contractor.

.11 The Departmental Representative may order additional testing any time even though the required tests indicate the strength requirements have been met. In this instance, the Owner will pay for those tests that meet the specified requirements and the Contractor will pay for those that do not.

.12 Non-destructive methods for testing concrete shall be according to CAN/CSA A23.2-09.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with General Conditions.

.2 Prepare and submit to the Departmental Representative for review, shop drawings showing detailed layout of form dimensions, form joint fitting, form sealing and placement, location of openings and placement of form ties. Submit a detailed description of the exact construction method to be used, for all area designated as sand blasted finish, exposed aggregate finish and architectural exposed concrete

Part 2 Products

2.1 CONCRETE MATERIALS

.1 *Cement:* Normal - N and Sulphate Resistant - HS Portland Type, to CSA A3000-08 - "Portland Cements".

.2 *Fine and Coarse Aggregates:* conforming to CAN/CSA-A23.1-09 - "Concrete Material and Methods of Concrete Construction".

.3 *Fine and Coarse Aggregates:* conforming to CAN/CSA-A23.1-09 - "Concrete Materials and Methods of Concrete Construction". The fine and coarse aggregate for concrete floor slabs and finish toppings shall contain a maximum of 0.4% low density particles as determined by CSA Test A23.2-09 "Low Density Material in Aggregate". Test results shall be submitted to Consultant for review.

.4 *Water:* clean and free from injurious amounts of oil, alkali, organic matter, or other deleterious material.

2.2 ADMIXTURES

.1 *Air Entrainment:* to ASTM C260-06 - "Air-Entraining Admixtures for Concrete".

.2 *Chemical:* to ASTM C494-08a - "Chemical Admixtures for Concrete"; water reducing, strength increasing type WN - normal setting.

.3 *Pozzolanic Mineral:* to CSA A3000-08 "Supplementary Cementing Materials and Their Use in Concrete Construction", fly ash permitted only as approved by Consultant.

2.3 ACCESSORIES

.1 *Vapour Barrier:* 6 mil polyethylene film, to CGSB 70-GP-1a, Type 1 - low permeance heavy duty.

.2 *Curing Compounds:* shall conform to the requirements of the latest issue of ASTM Standard C309.

.3 *Non-shrink Grout:* premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 20 MPa at 3 days and 50 MPa at 28 days. CPD Non Shrink Grout by CPD Construction Products or approved equivalents.

.4 *Void Form:* **to comply with either of the following:**

.1 Biodegradable Void Form: biodegradable, 150 mm deep, structurally sufficient to support weight of wet concrete and other superimposed loads without collapsing until concrete has gained sufficient strength to support these loads after which time the form must promptly degrade. Do not wrap void form. Do not place void form on poly ground sheet. The onus is entirely on the Contractor and Supplier to ensure that the void form is installed to perform as intended.

.2 Compressible Void Form: Compressible void form designed for 150 mm soil heave, installed to supplier’s specifications.

.5 *Joint Filler:* pre moulded bituminous impregnated cane fibre board.

.6 *Vertical Joint Sealant:* non-sag polyurethane sealant designed for use on vertical surfaces. Install strictly in accordance with manufacturer's recommendations.

.7 *Horizontal Joint Sealant:* three component chemically curing, self-levelling, polyurethane joint sealant. Colour selection by Departmental Representative. Install strictly in accordance with manufacturer's recommendations.

.8 *Concrete Expansion Anchors:* Sized as per drawings. Minimum embedment length of all expansion anchors to be 150 mm unless noted otherwise.

.9 *Concrete Inserts with Bolt Extension:* Concrete inserts to be sized as detailed on drawings. Bolt extensions to be mild steel threaded extensions sized as detailed on drawings.

.10 *Concrete Patching Material:* pre-packaged, polymer modified, cementitious product containing graded natural aggregate,

.11 *Bonding Agent:* Approved high polymer polyvinyl acetate emulsion applied in strict accordance with manufacturer's recommendations for proposed application. Mix bonding agent with Portland cement, sand and water to manufacturer's recommendation to achieve a uniform slurry and scrubbed into the surface. Ensure surface is free from all laitance, dirt, dust, debris, grease or other substances. Clean surface with acid etching and hosing down. Neutralize acid if necessary.

.12 *Epoxy Bonding Agent:* Approved mineral filled polymer/epoxy adhesive formulated to bond new concrete to cured concrete. Apply in strict conformance with manufacturer's written recommendations for proposed application.

.13 *Cement Grout Capsules:* reinforcing steel detailed to be installed in pre-placed concrete to be anchored using Cement Grout Capsules.

2.4 CONCRETE MIXES

.1 Mechanical mix concrete in accordance with the requirements of CAN/CSA A23.1-09.

.2 All concrete shall have the following minimum properties.

Based on 2010 National Building Code

Location	Exposure Class	Comp. Strength (MPa) and Age	Aggregate	Air Entrainment	Slump
1. Footings/Pedestals	S-3	30 @ 56 d	20	4 – 7	80 ± 30
2. Interior Slab on Metal Deck **	N	25 @ 28 d	20	0	80 ± 30
3. Exterior Grade Supported Sidewalks/Landing Pads, Slabs	C-2	32 @ 28 d	20	5 – 8	80 ± 30
4. Miscellaneous Concrete	N	25 @ 28 d	20	Specify	80 ± 30

Minimum cement content for Type 50 cement to be 280 kg/m3.
Maximum free water/cement ratio for Type 50 cement to be 0.5.

Semi-lightweight concrete to have unit weight of 2075 ± 75kg/m3.
Lightweight concrete to have unit weight of 1850 ± 75 kg/m3.

**Interior slabs on metal deck to include powder pigment additive to achieve colour selection by Departmental Representative. Basis of design: Interstar Colour Additive, procedures and requirements as per manufacturer's requirements. Provide mock-up samples of concrete colour selection for approval by Departmental Representative.

All slabs finished with dry shake hardener to contain no artificially entrained air.

.3 Submit proposed mix design to Inspection and Testing Firm and to Consultant two (2) weeks prior to commencement of work. Provide certification that mix proportions selected will produce concrete of specified quality and that strength will comply with CAN/CSA A23.1-09.

.4 Each load of ready-mixed or transit-mixed concrete delivered to the project site shall be accompanied by duplicate delivery slips providing the following information:

.1 Name of ready-mix batch plant
.2 Serial number of ticket
.3 Date and truck number
.4 Name of contractor
.5 Specific designation of project
.6 Specific class of concrete
.7 Amount of concrete in cubic metres
.8 Time of loading or first mixing of aggregate, cement and water.

.5 Use accelerating admixtures in cold weather only when approved by Consultant. If approved, the use of admixture will not relax cold weather placement requirements. Use calcium chloride only as approved by the Consultant.

.6 Use set-retarding admixtures during hot weather only when approved by the Consultant.

.7 Use of plasticizers only when approved by Consultant.

.8 Concrete mix for exposed aggregate finish and sandblasted finish shall be designed as a low slump, gap-graded mix with a maximum amount of screened and washed crushed coarse aggregate.

Part 3 Execution

3.1 INSPECTION

.1 Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

.2 Verify that all items to be embedded in concrete are in place.

.3 Verify that concrete may be placed to the lines and elevations indicated on the Drawings, with all required clearance from reinforcement.

3.2 DISCREPANCIES

.1 In the event of discrepancy, immediately notify the Departmental Representative.

.2 Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.3 PREPARATION

.1 Remove all wood scraps and debris from the formed areas in which concrete will be placed.

.2 Thoroughly clean the forms to ensure proper placement and bonding of concrete.

.3 Thoroughly wet the forms, except in freezing weather, or oil them; remove all standing water.

.4 Thoroughly clean all transporting and handling equipment.

3.4 PLACING CONCRETE

.1 Place concrete in accordance with requirements of CAN/CSA A23.1-09 and as indicated on Drawings.

.2 Notify Departmental Representative and Inspection and Testing Firm a minimum of forty-eight (48) hours prior to commencement of concreting operations.

.3 Ensure all anchors, seats, plates and other items to be cast into concrete are placed, held securely and will not cause undue hardship in placing concrete.

.4 Maintain accurate records of poured concrete items. Record date, location of pour, quantity, air temperature and test samples taken.

.5 Ensure reinforcement, inserts, embedded parts, formed joints and fitments are not disturbed during concrete placement.

.6 Prepare previously placed concrete by cleaning with steel brush.

.7 Pour concrete continuously between predetermined construction and control joints. All construction joints subject to approval of the Consultant.

.8 Approval to place concrete shall be contingent on the formwork and reinforcing steel placement and evidence that the Contractor can place the planned casting without stopping.

.9 Pour slabs on grade in checkerboard pattern or saw cut, as indicated on Drawings. Saw cut control joints within twenty-four (24) hours after finishing. Use 6 mm thick blades, cutting 20 mm into depth of slab thickness. Vacuum clean saw cut prior to installation of sealant.

.10 Excessive honeycomb or embedded debris in concrete is not acceptable. Remove and replace defective concrete. Excessive honeycomb is when eraser end of a pencil fits into cavity.

3.5 COLD WEATHER REQUIREMENTS

.1 When the air temperature is at or below 5^0 C. or when there is a probability of it falling to this limit during the placing or curing period, cold weather requirements shall be applicable.

.2 Provide heating equipment or heating plant on the job ready for use when concrete is being placed during cold weather. Such equipment shall be adequate for the purpose of maintaining the required temperature during the placing and curing of the concrete. The methods used for heating shall be approved by the Consultant. Equipment inducing carbon monoxide gas in the building shall not be accepted.

.3 Concrete shall not be placed on or against reinforcement, formwork, ground or any surface that is at a temperature less than 5^0 C.

.4 The temperature of the concrete at all surfaces shall be maintained at not less than 15^0 C for three (3) days, or at not less than 10^0 C for five days after placing. Means shall be provided to humidify the air within enclosures and to keep the concrete and formwork continuously moist if dry heat is used. The concrete shall be kept above freezing temperature for a period of seven (7) days, and shall be kept from alternate freezing and thawing for at least fourteen (14) days after placement.

.5 At the end of the specified protection period the temperature of the concrete shall be reduced gradually at a rate not exceeding that shown in CAN/CSA A23.1-09.

.6 Accelerator or so-called anti-freeze compounds shall ***not*** be permitted unless otherwise approved in writing by the Consultant.

.7 All protective coverings shall be kept clear of the concrete and form surfaces to permit free circulation of air and shall be maintained intact for at least twenty-four (24) hours after artificial heat is discontinued.

3.6 HOT WEATHER REQUIREMENTS

.1 When the air temperature exceeds 27^0, hot weather requirements shall be applicable.

.2 Time of initial mixing to complete discharge shall not exceed 1 hour and 15 minutes and concrete placed shall not exceed 27^0.

.3 Concrete forming surfaces and reinforcing steel shall be sprinkled with cool water just prior to placing concrete. Standing water or puddles shall be removed prior to concrete placement.

.4 Special wind protection will be required as directed by the Consultant.

.5 Columns, walls, beams and slabs shall be kept continuously damp for twenty-four (24) hours by normal curing procedures as outlined by this Specification. Slabs cured by the applications of sealing, shall have curing compound applied immediately after finishing of the slab but before evaporation of surface moisture.

.6 The use of water reducing agents shall be subject to the approval of the Consultant when hot weather conditions prevail.

3.7 CONSTRUCTION JOINTS AND WATERSTOPS

.1 The location and detail of all construction joints not detailed on the structural drawings shall be approved by the Consultant.

.2 Where fresh concrete is to be placed against concrete which has set or has partially set, the surface of the set or partially set concrete shall be roughened, cleaned of all laitance, and thoroughly soaked with water prior to the placement of fresh concrete.

.3 In general the construction joints in floor and roof systems shall be located in the middle of the spans of slabs, beams and girders. Proper key and dowels or extensions of reinforcing shall be provided at all construction joints.

.4 Concrete placed in wall and column forms shall be struck off flush with the underside of the floor and roof systems.

.5 Vertical construction joints in foundation walls shall be properly keyed and dowelled and constructed with an approved water stop, properly anchored against displacement during the placement of the concrete and properly sealed at all of the intersections. Splices and intersections of water stop shall be jointed by heat fusion in accordance with approved manufacturer's instructions.

.6 Where new below grade concrete foundation walls abut existing foundation walls, unless specifically detailed otherwise, install new pvc vertical waterstop at the joint by sawcutting and grouting the waterstop into the existing wall and casting into the new wall. Install full height vertical reglet each side of the joint and seal with approved vertical joint sealant over Ethafoam back up rod. Installation shall be in accordance with manufacturer's recommendations.

3.8 DEFECTIVE CONCRETE

.1 Concrete not meeting the requirements of the Specifications and drawings shall be considered defective concrete.

.2 Concrete not conforming to the lines, details and grade specified herein or as shown on the drawings shall be modified or replaced at the Contractor's expense and to the satisfaction of the Consultant. Finished lines, dimensions and surfaces shall be correct and true within tolerances specified in the Formwork Section of these Specifications.

.3 Concrete not properly placed resulting in excessive honeycombing and all honeycombing and other defects in critical areas of stress, shall be repaired or replaced at the Contractor's expense and to the satisfaction of the Consultant.

.4 Concrete of insufficient strength or improper consistency shall be, as required by the Consultant, subject to one or more of the following:

.1 Changes in mix proportions for the remainder of the work.

.2 Cores drilled and tested from the areas in question as directed by the Consultant and in accordance with CAN/CSA A23.2-09. The test results shall be indicative of the in-place concrete.

.3 Load testing of the structural elements in accordance with CAN3 A23.3-04.

.4 The changes in the mix proportions and the testing shall be at the Contractor's expense.

.5 Concrete failing to meet the strength requirements of this Specification shall be strengthened or replaced at the Contractor's expense and to the satisfaction of the Consultant.

3.9 PATCHING CONCRETE

.1 After the removal of the forms concrete surfaces may be subject to inspection by the Consultant.

.2 All exposed metal form ties, nails, wires, shall be removed, fins broken off and all loose concrete removed.

.3 Form tie pockets shall be thoroughly wetted and patched with patching concrete followed by proper curing.

.4 Honeycombed and other defective surfaces shall be chipped away to a depth of not less than 25 mm with the edges perpendicular to the surface, thoroughly wetted and patched with patching concrete followed by proper curing.

.5 Patching concrete shall be thoroughly compacted into place and finished in such a manner as to match the adjoining concrete. The design mix of the patching concrete shall be approved by the Consultant.

3.10 FINISHING OF FORMED SURFACES

.1 All formed surfaces noted in Architect's Room Finish Schedule as receiving a paint, vinyl or other applied finish shall be final finished to remove all protrusions, ridges and other irregularities. All voids and pinholes are to be filled. Finished surface is to be smooth, straight and true, ready to receive architectural finish as noted.

.2 On all other exposed formed concrete surfaces, except at unfinished areas: remove blemishes, formwork joint marks by rubbing with carborundum block and water. Leave finished surfaces smooth, unmarred. Complete rubbing within twenty-four (24) hours for stripping formwork.

3.11 ANCHOR BOLTS AND WELDMENTS

.1 Set anchor bolts and weldments to the following tolerances:

.1	Alignment:	± 3mm of location, plumb and true.
.2	Projection:	± 6mm of elevations called for.

3.12 BASE PLATES GROUTING

.1 Mix and place as per Manufacturer's specifications. Pack grout tightly under plates and leave no voids. Neatly finish edges.

3.13 EQUIPMENT PADS

.1 Provide concrete pads for equipment where and as indicated on Drawings.

.2 Insert bolts and sleeves and pack solidly with non-shrink grout, in accordance with setting details and templates.

.3 Steel trowel top surfaces smooth. Tool edges.

3.14 CONCRETE TOPPING

.1 All concrete toppings indicated on drawings are to be bonded toppings.

.2 Concrete toppings are to be bonded by either of the following methods unless specifically directed:

.1 Application of cement/bonding agent/sand grout to prepared base course in accordance with CAN/CSA A23.1-09, Clause 7.6.4.2.2 (b).
.2 Application of approved bonding agent to prepared base course.

.3 The following toppings are to be bonded specifically by application of approved bonding agent:

.1 All toppings cast over existing slabs.
.2 All interior toppings.

.4 New concrete slabs which are to receive toppings are to be prepared in accordance with CAN/CSA A23.1-09, Clause 23 and Section 03 35 00.

.5 Existing concrete slabs which are to receive toppings are to be prepared in accordance with Specification Section 03 35 00 and as detailed on the Drawings.

3.15 FOOTINGS

.1 All footings to be placed on undisturbed material. Any disturbed bearing material to be compacted to in situ density.

.2 Adequate precautions shall be taken by the Contractor to prevent the soil at foundation level from drying to becoming wet from surface water prior to placement of concrete.

.3 The Contractor shall ensure that the soil below the foundation is not allowed to freeze, either before or after construction. Under no circumstances should concrete be placed on frozen soil.

3.16 UNDERFLOOR DUCTS

.1 Where underfloor ducts are indicated pour 10 MPa concrete around duct work being careful to avoid damaging or displacing ducts or allowing ducts to float. Concrete to be in two pours with ducts securely anchored into first pour.

3.17 DOVETAIL ANCHOR SLOTS

.1 Cast in continuous dovetail anchor slots to receive dovetail anchors and masonry ties for lateral support of masonry.

.2 Refer to Specifications Division 4 for extent and spacing of masonry ties. Anchor slots to be located to coincide with spacing of masonry ties as specified in Division 4.

3.18 SIDEWALKS

.1 Unless specifically detailed otherwise on drawings or in specifications, sidewalks shall be constructed to the following details.

.2 Use forms for edges of concrete walls to provide straight lines and smooth curves.

.3 Locate asphalt impregnated fibreboard joint filler at 4.5 metre centres and where walks abut walls and other vertical surfaces. Joint filler to be full area of concrete section.

.4 Slabs to be 125 thick cast over 6 mil poly and 200 compacted granular fill. Reinforce with 10 M at 300 mm on centre each way at mid-depth of slab.

.5 Install tooled joints at 1.5 metres on centre.

.6 Round all edges, including edges of control joints and tooled joints, with 12 mm radius edging tool.

.7 Provide exposed surfaces of all sidewalks with medium broomed finish.

.8 Slope walks and slabs as detailed on drawings.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this section.

1.2 WORK INCLUDED

.1 Finish separate floor toppings, slabs on fill and monolithic floor slabs.

.2 Apply concrete hardener, sealer.

.3 Cure finished surfaces.

Part 2 Products

2.1 COMPOUNDS/HARDENERS/SEALERS

.1 *Curing Compound:* chlorinated liquid rubber to CGSB 90-GP-1a, Type 1.

.2 *Non-metallic Surface Sealer:* premixed natural mineral type.

.3 *Penetrating Epoxy Sealer:*

.4 *Coloured Dry Shake Hardener and Sealer:* Hardener to be prepackaged, factory-mixed product containing crushed, washed and graded non-metallic aggregate, Portland cement, colouring pigments and other proprietary components. Sealer to be liquid curing and sealing compound recommended for use on color hardened floors. Sealer to be supplied in colour that is recommended for, and compatible with, colour or dry shake hardener.

.5 *Horizontal Joint Sealer*: three component, chemically curing, self-levelling polyurethane joint sealant. Color selection by Departmental Representative. Install strictly in accordance with manufacturer's recommendations.

.6 *Bonding Agent:* Approved high polymere polyvinyl acetate emulsion applied in strict accordance with manufacturer's recommendations for proposed application.

.7 *Epoxy Bonding Agent:* Approved mineral filled polymer/epoxy adhesive formulated to bond new concrete to cured concrete. Apply in strict conformance with manufacturer's written recommendations for proposed application. Execution

2.2 FLOOR FINISHING

.1 Finish concrete floor surfaces in accordance with CAN/CSA A23.1-09.

.2 Uniformly spread, screed and float concrete. Do not use grate tampers or mesh rollers. Do not spread concrete by vibration. Bring surfaces to levels indicated on Drawings.

.3 Apply Plain or Coloured Dry Shake Hardener and Sealer to concrete floors noted in Architect's Room Finish Schedule as receiving hardener. Colour selecting by Departmental Representative. Apply dry shake in two passes at the rate of 5.0 kg/m2 (100 lb/100 Ft^2) or as recommended by manufacturer for Normal Traffic Conditions. After application of shake hardener is complete, apply minimum one coat of sealer. Application of both the dry shake hardener and sealer is to be strictly in accordance with manufacturer's recommendations.

.4 Unless otherwise noted, all concrete floors which are noted in Architect's Room Finish Schedule as exposed concrete, or as receiving carpeting, resilient flooring or hardener are to be final finished to a hard, smooth dense trowelled surface free from blemishes. Final finish to achieve a "flat" floor in accordance with CAN3 A23.1-09, Table 22 Class A straight edge method to produce floor surface of pleasing characteristics.

.5 All concrete slabs noted in Architect's Room Finish Schedule as receiving thin-set quarry tile finish are to be final finished with a swirl trowel finish plus fine hair brooming to give a surface finish to achieve a "flat" floor in accordance with CAN/CSA A23.1-09, Clause 7.5.6.1 maintaining surface flatness with maximum variation of 5 mm in 3 M and absolute maximum of ± 6 mm.

.6 All concrete slabs noted in Architect's Room Finish Schedule as receiving application of Penetrating Epoxy Sealer are to be final finished with a swirl trowel finish suitable for the application of penetrating type epoxy sealer. Slab is to be finished to a hard, smooth surface free from blemishes. Final finish to achieve a "flat" floor in accordance with CAN/CSA A23.1, Clause 7.5.6.1 to produce floor surface of pleasing appearance, easily cleaned and maintained with high wear-resistance qualities. Maintain surface flatness with maximum variation of 5 mm in 3 M and absolute maximum of ± 6 mm. Co-ordinate suitable curing method for slabs where penetrating type of sealer is used. Supplier's representative must be on site prior to application to advise on finishing procedures and application rate. Apply sealer at rate recommended for medium traffic in a minimum of two passes.

.7 Apply concrete Surface Sealer on floor surfaces noted in Architect's Room Finish Schedule as exposed concrete. Apply strictly in accordance with manufacturer's recommendations.

.8 In areas with floor drains, maintain floor level at walls and pitch surfaces uniformly to drain at 5 mm/M nominal unless indicated otherwise on Drawings.

2.3 TOPPINGS

.1 All new concrete slabs which are to receive topping or thick set tile finish are to be screeded and mechanically floated to achieve surface flatness with maximum variation of 8 mm in 3 M. Depress slabs to accommodate finish where required. Provide a scratch finish in accordance with CAN/CSA A23.1-09, Clause 7.5.6.2 to all concrete slabs receiving topping or thickset tile finish.

.2 All concrete slabs which are to receive a concrete topping shall be cleaned free of oil and loose material.

.3 Place dividers, edge strips, reinforcing, expansion joint assemblies and other cast-in items shown.

.4 Just prior to placing topping, apply cement bonding agent slurry coat in accordance with CAN/CSA A23.1-09, Clause 7.6.4.2.2 (b) or approved bonding agent to base slab.

.5 Apply bonded concrete topping over prepared concrete base slab to CAN/CSA A23.1-09.

.6 All concrete toppings to receive insulation or roofing system shall be final finished by hand or mechanical floating to within a tolerance of 8 mm in 3 M.

.7 All concrete toppings to serve as floor surfaces are to be final finished in accordance with Item 3.1 Floor Finishing.

2.4 CURING AND PROTECTION

.1 All equipment needed for the curing and protection of the concrete shall be on hand and ready for use before actual placing is started.

.2 All exposed non-formed surfaces shall be kept continuously moist for a minimum of seven consecutive days after placement of the concrete. The water for curing shall be clean and free from any materials that will cause staining or discolouration of the concrete. A liquid, membrane forming, curing compound shall be used under circumstances where the application of moisture is impracticable and where such compounds will not jeopardize the appearance of the concrete nor the bonding of future floor finishes.

.3 Special curing techniques shall be employed when the concrete is subject to drying conditions such as high temperatures, low relative humidity and high winds. Concrete wall and column forms shall be kept continuously moist.

.4 Freshly placed concrete shall be protected from the effects of direct sunshine, drying winds, cold, excessive heat and running water by the use of adequate tarpaulins or other suitable material to cover completely or enclose all freshly finished surfaces until the end of the curing period specified.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 04 23 00 – Glass Unit Masonry

.2 Section 05 50 00 - Metal Fabrications.

.3 Section 07 92 00 - Joint Sealing.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

- .1 CSA-A165 Series-94(R2000), Standards on Concrete Masonry Units.
- .2 CSA A179-94(R1999), Mortar and Grout for Unit Masonry.
- .3 CSA-A371-94 (R1999), Masonry Construction for Buildings.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements .

.2 Deliver materials to job site in dry condition.

.3 Storage and Protection.

- .1 Keep materials dry until use except where wetting of bricks is specified .
- .2 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

1.4 SITE CONDITIONS

.1 Site Environmental Requirements.

- .1 Cold weather requirements.
  - .1 Supplement Clause 5.15.2 of CSA-A371 with following requirements.
    - .1 Maintain temperature of mortar between 5 degrees C and 50 degrees C until batch is used or becomes stable.
    - .2 Maintain ambient temperature between 5 degrees C and 50 degrees C and protect site from windchill.
  - .2 Hot weather requirements.
    - .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
    - .2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.

Part 2 Products

2.1 MATERIALS

.1 Masonry materials are specified in Related Sections.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 PREPARATION

.1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

3.3 INSTALLATION

.1 Do masonry work in accordance with CSA-A371 except where specified otherwise.

.2 Build masonry plumb, level, and true to line, with vertical joints in alignment.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.4 CONSTRUCTION

.1 Exposed masonry.

.1 Remove chipped, cracked, and otherwise damaged units, in accordance with CSA A-165, Clause 82.1 in exposed masonry and replace with undamaged units.

.2 Jointing.

.1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, joints true to line, compressed, uniformly concave joints where concave joints are indicated.

.2 Allow joints to set just enough to remove excess water, then rake joints uniformly to 6 mm depth and compress with square tool to provide smooth, compressed, raked joints of uniform depth where raked joints are indicated.

.3 Building-In.

.1 Build in items required to be built into masonry.

.2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

.4 Provision for movement.

.1 Leave 5 mm space below shelf angles.

.2 Built masonry to tie in with stabilizers, with provision for vertical movement.

.5 Lintels.

.1 Install lintels as shown on drawings.

.6 Control joints.

.1 Construct continuous vertical control joints in locations indicated on drawings. Confirm locations with Consultant.

3.5 SITE TOLERANCES

.1 Tolerances in notes to Clause 5.3 of CSA-A371 apply.

3.6 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.7 PROTECTION

.1 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 05 00 – Common Work Results for Masonry

.2 Section 05 50 00 – Metal Fabrications

1.2 REFERENCES

.1 CSA Group

.1 CAN/CSA-A179-04(R2009), Mortar and Grout for Unit Masonry.

.2 CAN/CSA-A371-04(R2009), Masonry Construction for Buildings.

.3 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for glass unit masonry and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect glass unit masonry from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.5 SITE CONDITIONS

.1 Ambient Conditions: assemble and erect components when temperature is above 4 degrees C.

.2 Field Measurements:

.1 Make field measurements necessary to ensure proper fit of all members.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Glass block panels not to be designed to support structural loads.

.2 Provide for expansion and movement at jambs and heads of panels. Do not bridge expansion spaces with mortar.

.3 Do not cut glass blocks.

2.2 MANUFACTURED UNITS

.1 Solid glass block.

.1 Pattern and design: transparent.

.2 Surfaces: smooth.

.3 Colour: clear glass and sandblasted finish as noted in drawings.

.4 Nominal sizes:

.1 200 x 200 x 76 mm thick.

.5 Impact strength: 9-11 Nm, 6.8 kg mass per unit.

.6 Acceptable product: Pittsburgh Corning “Vistabrik”.

2.3 ACCESSORIES

.1 Mortar: white color, type M based on mortar proportion by volume.

.2 Sealant: non-staining, waterproof mastic, silicone, urethane and Section 07 92 00 Joint Sealants. Apply sealant 24 hours after glass unit masonry installation.

.3 Sealant primer: non-staining type recommended by sealant manufacturer.

.4 Fasteners: steel, 6 mm minimum diameter, galvanized to ASTM A153/A153M, and as follows:

.1 To metal: self-drilling, self-tapping screws.

.2 To concrete and masonry: self-drilling, compression type insert, or self-tapping type screws for pre-drilled holes.

.3 To wood: wood screws.

.5 Spacers: plastic, concealed type, allowing pointing mortar and placing reinforcing and panel anchors without obstruction, of size to provide horizontal and vertical joint width indicated, capable of supporting glass units until mortar set, incorporated into structural design of glass unit masonry.

2.4 SOURCE QUALITY CONTROL

.1 Ensure glass block, components and materials are from single manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for glass unit masonry installation in accordance with manufacturer's written instructions.

.2 Beginning of installation means acceptance of conditions.

3.2 PREPARATION

.1 Ensure structure or substrate is adequate to support glass block.

.2 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations and co-ordinate with Section 01 71 00 - Examination and Preparation.

.3 Clean glass units of foreign substances.

.4 Install sandblasted face of glass blocks in orientation noted in drawings.

.5 Establish and protect lines, levels, and coursing.

.6 Protect elements surrounding work of this Section from damage and disfiguration.

3.3 INSTALLATION

.1 Erect glass units and accessories in accordance with manufacturer's instructions.

.2 Set glass units with full bond mortar joints. Furrowing not permitted. Remove excess mortar.

.3 Do not install glass unit when ambient temperature is below 4 degrees C. Maintain ambient temperature above 4 degrees C for 48 hours after installation.

.4 Place units to maintain uniform joint width of 6 mm.

.5 Install unit masonry to avoid contact of glass units with metal accessories or frames.

.6 Shore assembly until mortar will maintain panel in position without movement.

.7 Joint reinforcement:

.1 Install reinforcement in accordance with NBC and as follows.

.2 Place security bars between wythes prior to installation of glass blocks.

3.4 CONSTRUCTION

.1 Mortar Placement:

.1 Place pointing mortar in accordance with manufacturer’s written instructions and CSA A179.

.2 Set glass with full bond mortar joints. Furrowing not permitted. Remove excess mortar.

.3 Place units to maintain uniform joint width of 6 mm.

.2 Jointing:

.1 Tool joints to concave profile, exposing shoulders of glass units.

.2 Rake out mortar joints to depth equal to joint width and not less than 13 mm, to receive pointing mortar.

.3 Rake out mortar joints to half of joint width but not less than 5 mm depth, to receive joint sealant.

.3 Application of pointing mortar.

.1 Neatly tool surface to a concave profile. Expose shoulders of glass units.

.2 Remove excess mortar while it is still plastic using a clean, wet sponge or a scrub brush with stiff bristles.

.3 Vacuum clean mortar joints.

3.5 TOLERANCES

.1 Tolerance for glass block unit construction in accordance with Section 04 05 00 - Common Work Results for Masonry, supplemented as follows.

.1 Variation from specified joint width: plus 2 mm and minimum 0 mm.

.2 Maximum variation from plane of unit to adjacent unit: 1 mm.

.3 Maximum variation from flat plane: 3 mm in 3 m, non-cumulative.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.7 PROTECTION

.1 Brace and protect glass block unit construction in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Make good damage to adjacent materials caused by glass block installation.

3.8 SCHEDULES

.1 Hollow glass block: locate as indicated.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this Section.

1.2 WORK INCLUDED

.1 Structural steel framing members, structural steel support members, struts, complete with required bracing, welds, washers, nuts, shims, anchor plates and bolts.

.2 Baseplates, connectors and bearing plates.

.3 Erection.

1.3 QUALITY ASSURANCE

.1 Structural steel fabricator to be certified as minimum Division 2 Company under CSA W47.1-09 - "Certification of Companies for Fusion Welding of Steel Structures" or CSA Standard W55.3-08 "Resistance Welding Qualification Code for Fabricators of Structural Members" or both, as applicable.

.2 Design to strictly adhere to all codes and standards as enumerated under Section 1.5 Reference Standards.

.3 In the event of conflict between pertinent codes, standards and/or regulations, most stringent shall govern.

1.4 REFERENCE STANDARDS

.1 CSA Standard CAN/CSA-S16-01 - "Limit States Design of Structural Steel Buildings".

.2 CSA G40.21-04 (R2009) - "Structural Quality Steel".

.3 ASTM Standard A325M - "High Strength Bolts for Structural Steel Joints including Suitable Nuts and Plane Hardened Washers".

.4 CSA Standard W59-03 (R2008) - 'Welded Steel Construction".

.5 CSA Standard W47.1-09 - "Certification of Companies for Fusion Welding of Steel Structures".

.6 ASTM Standard A53 - "Welded and Seamless Steel Pipe".

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with General Conditions.

.2 Clearly indicate sizes, spacing and locations of structural members, connections, attachments, anchorages, framed openings and size and type of fasteners and welds.

.3 Indicate all shop and erection details including cuts, copes, connections, holes, threaded fasteners and welds.

.4 Show all welds, both shop and field, by the currently recommended symbols of the Canadian Welding Bureau.

.5 Provide drawings stamped and signed by a Professional Engineer registered in the Province of Saskatchewan.

.6 Review of shop drawings for size and arrangement of principal and auxiliary members only. Such review will not relieve the Contractor of responsibility for general and detail dimension and fit, or any errors or omissions.

1.6 INSPECTION AND TESTING

.1 Materials and workmanship subject to inspection on behalf of Owner.

.2 Report failure of material to fit together properly to Consultant. No corrective measures permitted unless approved by Consultant in writing.

Part 2 Products

2.1 MATERIALS/COMPONENTS

.1 *Standard Rolled Sections:* new material conforming to CSA G40.21-04 (R2009), Grade 350W.

.2 *Hollow Structural Sections:* new material conforming to CSA G40.21-04 (R2009), Grade 350W, Class C.

.3 *Steel Pipe Sections:* new material conforming to ASTM Standard A53, Grade 241.

.4 *Base and Cap Plates:* new material conforming to CSA G40.21-04 (R2009), Grade 300W.

.5 *Beam End Plates, Ledger Angles and Miscellaneous Steel:* new material conforming to CSA G40.21-04 (R2009), Grade 300W.

.6 *Anchor Bolts:* new material conforming to CSA G40.21-04 (R2009), Grade 260W.

.7 *Bolts, Nuts and Washers:* high strength type recommended for structural steel joints, conforming to requirements of ASTM A325M-83c.

.8 *Paint for Primer:* shall be grey (unless approved otherwise) and meet requirements of one of the following:

.1 CGSB 1-GP-40d, Primer, Structural Steel, oil alkyd type.

.2 CISC/CPMA Standard 1-73a, quick drying one-coat paint for use on structural steel.

2.2 FABRICATION

.1 Fabricate structural steel members in accordance with building design drawings and all requirements of CAN/CSA S16-01. Welding to conform to CSA W59-03 (R2008) "Welded Steel Construction". Verify all dimensions prior to fabrication.

.2 No cutting of openings in structural members except as shown on structural drawings. Reinforce openings to maintain required design strength.

.3 Accurately cut and mill column ends to assure full contact of bearing surfaces.

.4 Camber horizontal members as specified on drawings. Mill camber up where not specifically detailed.

.5 All bolted connections to be "bearing" type connections except where subject to stress reversal which are to be "slip resistant" type connections.

.6 All connections showing combined axial load (tension or compression) across the joint to be designed for loads shown. Such connection to be bolted through columns only.

.7 All beams to be connected for the greater of the following conditions.

.1 Loads shown on drawings.
.2 50% of the total uniformly distributed load resistance of the member.
.3 Half depth of the connected member using M20 bolts (minimum two bolts) in double shear.

.9 Fabricate all timber brackets supported directly from structural steel. Co-ordinate design and details of connections with supplier.

.10 Tolerances

.1 Tolerances of all structural steel shall be maintained strictly in accordance with CAN/CSA S16-01.

.11 All exposed steel and all related bridging and bracing shall be fabricated with clean, neat fitting welded connections.

2.3 PAINTING

.1 All steel in contact with concrete and all faying surfaces of high strength bolted slip-resistant connections shall <u>not</u> be primed.

.2 All structural steel shall be prepared in accordance with SSPC Standard SP2 "Hand Tool Cleaning" and have one coat of specified shop applied primer.

.3 Hot dipped galvanizing zinc coating. 600 grams/m^2 to CAN/CSA G164-M92.

Part 3 Execution

3.1 ERECTION

.1 Erect structural steel in accordance with building design drawings and all requirements on CAN/CSA S16-01.

.2 Make adequate provision for all erection loads and for sufficient temporary bracing to maintain structure safe, plumb and in true alignment until completion of erection. Leave such bracing in place as long as required for safety and integrity of the structure.

.3 As erection progresses, securely bolt work to take care of full design loads and to provide structural integrity as required.

.4 Use high tensile bolts for field connections unless otherwise noted on building design drawings.

.5 Set all baseplates which are shop welded to columns to proper elevation on steel shims. Maximum tolerance from stated elevations to be ± 2mm.

.6 Tolerances

.1 Tolerance of all structural steel shall be maintained strictly in accordance with CAN/CSA S16-01.

.7 After erection, prime all welds, abrasions, bolted connections and all other surfaces not shop primed, except surfaces to be in contact with concrete.

.8 Obtain written permission of Consultant prior to altering or field welding of structural members.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this Section.

1.2 WORK INCLUDED

.1 Steel roof and floor deck, complete with cover plates, cell closures and flashings.

.2 All closure angles, channels, plates, as well as supplementary deck support or anchorage where required to provide continuous deck membrane.

.3 Contractor to study Contract Drawings and Specifications with regard to the work shown and required under this Section to ensure its completeness. Supplementary items necessary to complete the work although not specifically shown or specified shall be supplied and installed.

.4 Steel roof deck designed as a structural diaphragm. Contractor to ensure all side lap fastening and welding is as per the Drawings and Specifications.

.5 Field and shop welded composite beam studs are to be supplied and installed by the structural steel subcontractor.

1.3 REFERENCE STANDARDS

.1 Canadian Sheet Steel Building Institute (CSSBI) - "Standard Steel Roof Deck" and "Steel Roof Deck".

.2 CAN/CSA S136-07 - "Cold Formed Steel Structural Members".

.3 ASTM A446 - "Steel Sheet, Zinc Coated (Galvanized) by the Hot Dip Process, Physical (Structural Quality)".

.4 Welding to CSA W59-03 (R2008) except where specified elsewhere.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with General Conditions.

.2 Clearly indicate decking plan, deck profile, dimensions, anchorage, supports, projects, openings and reinforcement, applicable details and accessories.

.3 Clearly indicate position of temporary shoring of decking if required by design criteria.

.4 Review of shop drawings will not relieve Contractor of responsibility for general and detail dimensions and fit, or any errors or omissions.

.5 Prepare shop drawings under the direction of a professional engineer registered in the Province of Saskatchewan, Canada.

.6 Submit shop drawings stamped and signed by qualified professional engineer registered in Province of Saskatchewan, Canada.

Part 2 Products

2.1 MATERIALS/COMPONENTS

.1 *Sheet Steel:* Grade A or Grade B structural quality, conforming to ASTM A446.

2.2 DECKING/RELATED ACCESSORIES

.1 *Floor Decking:* HB938 Hi-Bond Steel Floor Deck - 38 mm deep by 914 mm wide sheets by 0.76 mm core thickness. Galvanized to ZF075 (Wipe Coat) Standard.

.2 Any substitution of specified material to be approved in writing by the Consultant.

.3 *Closure Strips, Flashings, Cover Plates and Related Accessories:* minimum 1.6 mm (16 gauge) sheet steel.

.4 *Acoustical Insulation:* fibrous glass 17.5 kg/M3 density; profiled to suit decking.

.5 *Acoustical closures:* closed cell foam rubber profiled to deck corrugations, 25 mm thick.

.6 *Primer:* Zinc rich, ready mix to CGSB-1-GP-181M.

.7 *Closures to external walls:* neoprene as recommended by manufacturer.

2.3 FABRICATION

.1 Fabricate metal decking in accordance with Drawings and as recommended by the Canadian Sheet Steel Building Institute (CSSBI) Standards. Fabricate to accommodate maximum deflections of 1/360 span.

.2 Supply steel fillers between decking and supporting members where required.

.3 Deck units to be 3 span continuous where possible; under no circumstances should deck be less than 2 span continuous except where detailed.

Part 3 Execution

3.1 INSTALLATION

.1 Erect metal decking in accordance with drawings and as recommended by the CSSBI. Properly align and level on structural supports.

.2 Allow minimum 40 mm bearing when supported by structural steel and minimum 100 mm bearing when supported by masonry or concrete.

.3 Mechanical fasten male/female side laps at maximum 300 mm.

.4 Fasten deck to ALL supporting steel with 20 mm fusion welds at maximum 300 mm on centre.

.5 Reinforce openings 150 mm to 450 mm in size with L51 x 51 x 4.8 steel angles or as indicated on the Drawings. Place angles perpendicular to flutes, extended minimum two flutes each side of openings and weld to deck.

.6 Reinforce openings over 450 mm in accordance with details indicated on Drawings.

.7 Install minimum 150 mm cover plates where deck changes direction. Spot weld in place at maximum 300 mm on centre.

.8 Install strip closures at slab edges to match thickness of slab, as required to contain poured concrete. Ensure closures are of sufficient strength to remain in place without distortion.

.9 Install acoustical closures in locations above walls and partitions in areas where partitions butt to decking.

.10 Immediately after installation, touch up welds, burned areas and damaged spots with prime paint. Use type of primer recommended for galvanized surfaces.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

- .1 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Steamless.
- .2 ASTM A276-13a, Standard Specification for Stainless Steel Bars and Shapes.
- .3 ASTM A307-12, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
- .2 CAN/CGSB-1.181-99, Ready-Mixed, Organic Zinc-Rich Coating.

.3 Canadian Standards Association (CSA International)

- .1 CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel.
- .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CAN/CSA-S16.1-01, Limit States Design of Steel Structures.
- .4 CSA W48-06(R2011), Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
- .5 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

1.2 SUBMITTALS

.1 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:
  - .1 For finishes, coatings, primers and paints.

.2 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors and locations, supports, reinforcement, details, and accessories.

1.3 QUALITY ASSURANCE

.1 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Storage and Protection:

.1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.

.2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade 300W or 350W.

.2 Steel pipe: to ASTM A53/A53M extra strong, galvanized finish.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Stainless steel: to ASTM A276, Type 304.

.7 Steel Mesh: rolled flattened steel mesh, galvanized finish.

.8 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m^2 to CAN/CSA-G164.

.2 Chromium plating: chrome on steel with plating sequence of 0.009 mm thickness of copper, 0.010 mm thickness of nickel and 0.0025 mm thickness of chromium.

.3 Shop coat primer: to CAN/CGSB-1.40.

.4 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

2.4 ISOLATION COATING

.1 Isolate aluminum from following components, by means of bituminous paint:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

.2 Concrete, mortar and masonry.

.3 Wood.

2.5 SHOP PAINTING

.1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.3 Clean surfaces to be field welded; do not paint.

2.6 STEEL ANGLE COLLARS AND BARS AT SECURE PENETRATIONS

.1 Steel angles: Refer to drawings for sizes and locations.

.2 Steel bars: Refer to drawings for sizes and locations.

.3 Pre-drill anchor holes in angles.

.4 Finish: hot dip galvanized.

2.7 FLOOR AND WALL JOINT COVER PLATE

.1 Stainless steel checker plate: Length and width to suit joints indicated on drawings. 3mm thickness.

.2 Finish: No. 4 brushed.

.3 Locations: Floors: Refer to drawings. Walls: Rooms 130, 132.

2.8 CEILING JOINT COVER PLATE

.1 Stainless steel checker plate: Length and width to suit joints indicated on drawings. 3mm thickness.

.2 Finish: No. 4 brushed.

.3 Locations: Room 130, 132.

2.9 CORNER GUARDS

.1 See Section 10 26 00 Wall & Ceiling Surface Protection.

2.10 VISION CONTROL GLAZING TRIM – ROOM 137

.1 See drawings for location and profile.

.2 Stainless steel plate: 3 mm thickness.

.3 Finish: No. 4 brushed.

2.11 DETENTION AREA DOOR FRAME TRIMS

.1 See drawing for locations and profiles.

.2 Stainless steel plate. 3mm thickness.

.3 Finish: No. 4 brushed.

2.12 SECURITY SCREENS

.1 Angles and flat bar: Refer to drawings, formed to shapes and sizes as indicated.

.2 Expanded Metal Mesh: Refer to drawings, formed to shapes and sizes as indicated.

.3 Galvanize finish.

2.13 OVERHEAD DOOR SILL – ROOM 132

.1 Stainless steel checker plate: Refer to drawings. 6 mm thickness.

.2 Finish: No. 4 brushed.

2.14 PIPE RAILINGS AND SLEEVES

.1 Steel pipe and sleeves: refer to drawings, formed to shapes and sizes as indicated.

.2 Hot dip galvanize after fabrication.

2.15 OVERHEAD DOOR OPERATOR PEDESTAL

.1 Hollow steel section: refer to drawings, formed to shapes and sizes as indicated.

.2 Steel sleeves and plates: refer to drawings, formed to shapes and sizes as indicated.

.3 Hot dip galvanize exterior after fabrication.

2.16 COUNTER SUPPORT ARM

.1 Refer to drawings for location and details.

.2 Steel plate, 6mm thick, shop primed (PT1).

2.17 BENCH SUPPORT ARMS (ROOM 101 AND 129)

.1 Refer to drawings for location and details.

.2 Steel plate, 6mm thick, shop primed (PT1).

2.18 STEEL MESH

.1 Locations: Partitions, exterior walls, ceilings, floors and skirts. Refer to drawings.

.2 Material: 19mm #9/10 rolled flattened steel mesh, hot dip galvanized.

2.19 SHEET STEEL

.1 2mm (14ga) hot rolled sheet steel, hot dip galvanized.

.2 Refer to drawings for locations and details.

2.20 CRAWLSPACE ACCESS LADDER

.1 Refer to drawings. Shop primed. (PT1)

2.21 ROOF ACCESS LADDER

.1 Refer to drawings. Shop primed. (PT1)

2.22 ROOF RESTRAINT

.1 Refer to drawings and Section 07 72 69.

2.23 SECURE BAY TRENCH GRATES, ANGLES AND PAN

.1 Refer to drawings.

2.24 VEHICULAR AND PEDESTRIAN RAMPS

.1 Refer to drawings. Hot dip galvanized.

2.25 STAIR TREADS AND STRINGERS

.1 Refer to drawings. Hot dip galvanized.

2.26 STEEL GRATING

.1 Refer to drawings. Hot dip galvanized.

2.27 DETENTION WINDOW FRAME AND SECURITY BARS - INTERIOR

.1 Interior Face Plate: Stainless steel plate. 3 mm thickness. Finish: No. 2B mill.

.2 Internal Window Frame: Plate steel. 6mm thickness. Refer to drawings. Shop primed. (PT1).

.3 Security Bars: Refer to drawings. Shop primed. (PT1).

2.28 DETENTION WINDOW FRAME - EXTERIOR

.1 Stainless steel. 6mm thickness.

.2 Finish: No. 2B mill.

2.29 SHOWER ENCLOSURE - ROOM 139

.1 Stainless steel. 3mm thickness.

.2 Fully welded water-tight enclosure at floor, walls and ceiling.

.3 Security sealant at all joints to door frame.

.4 Finish: No. 4 brushed at walls and ceiling. Slip resistant texture at floor pan.

2.26 BOLLARDS

.1 Material: 150mm diameter x 8mm thick steel pipe. Base plates: Refer to drawings.

.4 Refer to drawings for detailing.

.5 Finish: Hot dip galvanize after fabrication.

2.27 RAIN WATER LEADER AND SUPPORT BRACKETS (RWL)

.1 Hollow structural steel: 152mm x 102mm x 4.8 mm thickness.

.2 Support Brackets: Refer to drawings. 4.8 mm thickness. Prepare for 16 dia. stainless steel through bolts.

.3 Finish: Hot dip galvanized finish. Touch up galvanized finish after site weld to bracket.

2.28 EXTERIOR DOOR SILLS

.1 Stainless steel checker plate: Refer to drawings. 3 mm thickness x width to suit opening.

.2 Finish: No. 4 brushed.

2.29 SIGN POSTS

.1 Refer to drawings for size, locations and details.

.2 Finish: Hot dip galvanized.

2.30 EXTERIOR SIGNS

.1 Refer to drawings for size, locations and details.

.2 Finish: Pre-finished. Refer to drawings.

Part 3 Execution

3.1 ERECTION

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Provide components for building by other sections in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CAN/CSA-S16.1, or weld.

.7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.

.9 Touch-up galvanized surfaces with zinc rich primer and zinc finish coating where burned by field welding.

3.2 STEEL ANGLE COLLARS AND BARS AT SECURE PENETRATIONS

.1 Install angles as indicated in drawings.

3.3 FLOOR AND WALL JOINT COVER PLATE

.1 Install as indicated in drawings.

.2 Secure to floor and wall structure with flush stainless steel screws at 300 o.c. Use security screws at wall locations.

3.4 CEILING JOINT COVER PLATE

.1 Install as indicated in drawings.

.2 Secure to ceiling structure with countersunk stainless steel security screws at 300 o.c.

3.5 CORNER GUARDS

.1 See Section 10 26 00 Wall & Ceiling Surface Protection.

3.6 VISION CONTROL GLAZING TRIM – ROOM 137

.1 Fasten to wood structure with flush stainless steel security screws.

3.7 DETENTION DOOR FRAME TRIM

.1 Fasten to wood structure with flush stainless steel security screws. Refer to drawings.

.2 Security sealant full perimeter.

3.8 SECURITY SCREENS

.1 Intall security screesn as incidated in drawings.

3.9 OVERHEAD DOOR SILL – ROOM 132

.1 Grout in place. Refer to drawings.

3.10 PIPE RAILINGS AND SLEEVES

.1 Install pipe railings and sleeves as indicated in drawings.

3.11 OVERHEAD DOOR OPERATOR PEDESTAL

.1 Install as indicated in drawings.

3.12 COUNTER SUPPORT ARM

.1 Install counter support arm as indicated in drawings.

.2 Continuously weld all connections, grind smooth.

.3 Apply primer to exposed metal, finish paint support arm. (PT1)

3.13 BENCH SUPPORT ARM (ROOM 101 AND 129)

.1 Fabricate and install support arm as indicated in drawings.

.2 Continuously weld all connections, grind smooth.

.3 Apply primer to exposed metal, finish paint support arm. (PT1)

3.14 STEEL MESH

.1 Refer to Wall Types and details in drawings.

3.15 SHEET STEEL

.1 Refer to drawings.

3.16 CRAWLSPACE ACCESS LADDER

.1 Refer to drawings.

3.17 ROOF ACCESS LADDER

.1 Refer to drawings.

3.18 ROOF RESTRAINT

.1 Refer to drawings and Section 07 72 69.

3.19 SECURE BAY TRENCH GRATES, ANGLES AND PAN

.1 Refer to drawings.

3.20 VEHICULAR AND PEDESTRIAN RAMPS

.1 Refer to drawings

3.21 STAIR TREADS AND STRINGERS

.1 Refer to drawings

3.22 STEEL GRATING

.1 Refer to drawings

3.23 EXTERIOR AND INTERIOR DETENTION WINDOW FRAME AND SECURITY BARS

.1 Refer to drawings.

3.24 ROOM 139 - SHOWER ENCLOSURE

.1 Refer to drawings.

3.25 BOLLARDS

.1 Refer to drawings.

3.26 RAIN WATER LEADER AND SUPPORT BRACKETS (RWL)

.1 Refer to drawings.

3.27 EXTERIOR DOOR SILLS

.1 Refer to drawings.

3.28 SIGN POSTS

.1 Refer to drawings.

3.29 EXTERIOR SIGNS

.1 Refer to drawings.

3.30 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 17 23 – Laminated Veneer Lumber

.2 Section 06 20 00 – Finish Carpentry

.3 Section 06 40 00 – Architectural Woodwork

.4 Section 08 71 00 – Door Hardware

.5 Section 09 21 16 – Gypsum Board Assemblies

.6 Section 09 91 13 – Exterior Painting

.7 Section 10 28 10 – Toilet and Bath Accessories

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM C36/C36M-03e1, Standard Specification for Gypsum Wallboard.
- .2 ASTM E-84/UL 723, Test for Surface Burning Characteristics of Building Materials and Flammability Ratings

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
- .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 CAN/CGSB-71.26-M88, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.

.3 Canadian Standards Association (CSA International)

- .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA O112 Series-M1977(R2006), CSA Standards for Wood Adhesives.
- .4 CSA O141-05(R2009), Softwood Lumber.
- .5 CSA O151-09, Canadian Softwood Plywood.
- .6 CAN/CSA-O325.0-92(R2003), Construction Sheathing.
- .7 CAN/CSA-S406-92(R2008), Construction of Preserved Wood Foundations.
- .8 CSA O322-02(R2007), Procedure for Certification of Pressure-Treated Wood Materials for Use in Preserved Wood Foundations.

.4 Underwriters Laboratories of Canada (ULC)

- .9 CAN/ULC-S102.2-10 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies

.5 National Lumber Grades Authority (NLGA)

.10 Standard Grading Rules for Canadian Lumber 2010.

1.3 SUBMITTALS

.1 Submit Submittal submissions: in accordance with Section 01 33 00 - Submittal Procedures.

1.4 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 FRAMING AND STRUCTURAL MATERIALS

.1 Lumber: unless specified otherwise, Douglas Fir or Spruce softwood, no. 2 or better, S4S, moisture content 19% (S-dry) or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Structural Composite Lumber (SCL) in accordance with ASTM D5456.

.3 Framing and board lumber: in accordance with NBC. Douglas Fir or Spruce, No. 2 or better.

.4 Furring, blocking, nailing strips, grounds, rough bucks:

.1 Board sizes: "Standard" or better grade.

.2 Dimension sizes: "Standard" light framing or better grade.

.3 Post and timbers sizes: "Standard" or better grade.

.5 Skirting: Pressure (preservative) treated meeting CAN/CSA S406.

.6 Fire retardant treated lumber. Refer to drawings. Acceptable product: D-Blaze Fire Retardant Treated Lumber, by Chemical Specialties Inc., One Woodlawn Green, Suite 350, 200 East Woodlawn Road, Charlotte, NC. 1-800-421-8661. www.treatedwood.com .

2.2 PANEL MATERIALS

.1 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.0.

.2 Canadian softwood plywood (CSP): to CSA O151, standard construction.

.3 Interior plywood sheathing: Good one side, fire retardant douglas fir plywood, flame spread of 25 or less in all locations. Refer to drawings. Acceptable product: D-Blaze Fire Retardant Treated Plywood, by Chemical Specialties Inc., One Woodlawn Green, Suite 350, 200 East Woodlawn Road, Charlotte, NC. 1-800-421-8661. www.treatedwood.com .

.4 Skirting (interior and exterior faces): pressure (preservative) treated exterior grade plywood meeting CAN/CSA S406.

2.3 ACCESSORIES

.1 Sealants: in accordance with Section 07 92 10 - Joint Sealing.

.1 Maximum allowable VOC limit 250 g/L.

.2 Subflooring adhesive: to CGSB-71.26, cartridge loaded.

.1 Maximum allowable VOC limit 30 g/L.

.3 General purpose adhesive: to CSA O112 Series.

.1 Maximum allowable VOC limit 140 g/L.

.4 Nails, spikes and staples: to CSA B111.

.5 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.6 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

.7 Skirting: Fasteners and connectors , moisture barrier, sealant and field applied preservative: to CAN/CSA-S406.

2.4 FASTENER FINISHES

.1 Galvanizing: to CAN/CSA-G164, use galvanized fasteners for exterior work, interior highly humid areas, pressure-preservative, fire-retardant, and treated lumber.

.2 Skirting: Fasteners and connectors to CAN/CSA-S406.

Part 3 Execution

3.1 PREPARATION

.1 Store wood products in a dry location, off the ground.

3.2 INSTALLATION

.1 Comply with requirements of NBC 2010 Part 3 and Part 9 supplemented by following paragraphs.

.2 Construct and install preserved wood skirting in accordance with CAN/CSA-S406. Place cut ends up where studs cut to length.

.3 Install members true to line, levels and elevations, square and plumb.

.4 Construct continuous members from pieces of longest practical length.

.5 Install spanning members with "crown-edge" up.

.6 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.

.7 Install wall sheathing in accordance with manufacturer's printed instructions.

.8 Install interior fire retardant plywood with good side facing room. Prepare for final finish as per manufacturers written instructions. Coordinate with Room Finish Schedule.

.9 Install furring and blocking as required to space-out and support architectural woodwork, residential casework, toilet partitions, toilet and bath accessories, detention furnishings, tack boards and whiteboards, storage assemblies, miscellaneous specialties, wall and ceiling finishes, facings, electrical equipment mounting boards, and other work as required. Refer to relevant Sections.

.10 Install solid wood blocking 38mm x 152 mm in joist cavities at locations where wall mounted door stop is attached to stud wall assemblies.

.11 Install solid wood blocking 38mm x 184 mm at 400 o.c. in floor at locations where interior partitions are required to be secured to floor between floor joists.

.12 Install solid wood blocking 38mm x 184 mm between joists beneath fastening points for detention furniture. See Section 12 50 00 and drawings for locations.

.13 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.14 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

3.3 ERECTION

.1 Erect preserved wood skirting in accordance with CAN/CSA-S406. Place cut ends up where studs cut to length.

.2 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.3 Countersink bolts where necessary to provide clearance for other work.

.4 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

3.4 SCHEDULES

.1 Refer to drawings for various items requiring furring, blocking, nailing strips, grounds and rough bucks.

.2 Refer to drawings for specialized fastening and joint layouts of panel materials.

.3 Provide backing in walls for all millwork, shelving and wall mounted items requiring solid blocking.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this section.

1.2 WORK INCLUDED

.1 Supply and erect wood roof decking where shown on drawings.

1.3 REFERENCE STANDARDS

.1 CSA Standard O86-09 - Engineering Design in Wood.
.2 CSA Standard B111-1974 - Wire Nails, Spikes and Staples.
.3 CSA Standard O80 Series 08 (R2012)- Wood Preservation and Supplements.
.4 CSA Standard O141-05 (R2009) - Softwood Lumber.

1.4 PROTECTION

.1 Where decking to be exposed as a finish, handle with care during shipping and installation to maintain undamaged and unmarked exposed face. Damaged members will be rejected.

1.5 DELIVERY AND HANDLING

.1 Store wood decking well blocked off ground and separated with strippings, so air may circulate around sides of members. Cover top and sides with opaque moisture resistant membrane.

Part 2 Products

2.1 MATERIALS

.1 *Wood decking:* to be Cedar of Species Group E, select grade in accordance with the National Lumber Grades Authority - "Standard Grading Rules". Nominally 150 wide x 89 thick, double tongue and grooved with pre-drilled lateral holes 6 mm diameter at 760 mm on centre for lateral anchorage, maximum moisture content 15%.

.2 *Nails and Spikes:* conforming to requirements to CSA B111; size and type to suit application. Plain finish for interior application, galvanized for exterior use.

Part 3 Execution

3.1 PLACEMENT

.1 Placement of wood decking not to proceed until work upon which this is dependent has been inspected and approved. Advise Consultant of proposed schedule for placing deck such that wood decking and prior work may be inspected before erection commences.

.2 Place wood decking where indicated on drawings, perpendicular to support members. Lay decking with tongues in an upward position in controlled random pattern in accordance with CSA Standard O86.

.3 Secure each plank to each support with one 125 toe nail and one 150 face nail. Laterally spike planks together using one 250 spike in each pre-drilled hole.

.4 Where planks are unable to be laterally spiked due to perimeter parapet wall, connect planks together by 100 mm wide x 18 ga. galvanized metal straps face nailed to the top face of the decking at 750 mm on centre. Extend straps back to include at least the last plank which as been laterally spiked.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this Section.

1.2 WORK INCLUDED

.1 This work includes the complete furnishings and installation of all laminated veneer lumber as shown on the drawings herein specified and necessary to complete the work.

1.3 RELATED WORK

.1	Structural Steel	Section 05 12 23
.2	Rough Carpentry	Section 06 10 00
.3	Wood Trusses	Section 06 17 53
.4	Laminated Veneer Lumber	Section 06 17 23

1.4 QUALITY ASSURANCE

.1 Unless detailed otherwise, all beams to be designed to support all applicable dead loads, partition loads and all live loads for designated occupancies in accordance with current NBC.

.2 All design in accordance with Part 4 of the National Building Code 1995 and CSA O86 “Engineering Design in Wood”.

.3 Complete design calculations showing layout, forces and stress control points to be provided to Consultant for review, if requested.

.4 Design of beams to be under the direct supervision of a Professional Engineer registered in the Province of Saskatchewan.

Part 2 Products

2.1 MATERIALS

.1 Materials shall comply with CCMC Report No. 08675-R.

.2 Laminated veneer lumber shall be manufactured in a continuous process with all grain oriented parallel to the length of the member. All members are to be free of finger or scarf joints or mechanical connections in full length members.

.3 Adhesives shall be of the waterproof type conforming to the requirements of CSA O112.6-M.

2.2 FABRICATION

.1 Laminated veneer lumber shall be manufactured in a plant listed in the reports referred to above and under the supervision of an approved third-party inspection agency. It shall be manufactured in a continuous process with all grain parallel with the length of the members.

2.3 TOLERANCES

.1 Manufacture all parallel strand lumber to the following tolerances:

Finished Length (as specified):	± 6.5 mm
Depth:	± 1.5 mm
Width:	± 1.5 mm

2.4 IDENTIFICATION

.1 Each of the beams shall be identified by a stamp indicating the product type and grade, CCMC report number, manufacturer's name, plant number and the independent inspection agency's logo.

2.5 HARDWARE

.1 All hardware is to be fabricated by others according to details contained in the contract drawings.

Part 3 Execution

3.1 ERECTION AND INSTALLATION

.1 Beams shall be erected and installed in accordance with the plans, drawings and installations that may be provided.

.2 Temporary construction loads that cause stresses beyond design limits are not permitted.

.3 Holes, cuts or notches not previously approved shall not be permitted.

.4 Connections: lateral nail holding and withdrawal are as provided in the Code for Douglas Fir sawn timber (SG=0.50). Nails installed parallel to the glue lines on the narrow face shall not be spaced closer than 100 mm for 76 mm (10d) common nails and 75 mm for 63.5 mm (8d) common nails. Nails installed perpendicular to the glue lines on the wide face shall be installed in accordance with the code. These nailing specifications are based on at least a 19 mm-thick and 89 mm-wide member. The resistance of bolts installed perpendicular to the glue lines in as provided in the Code for Douglas Fir.

3.2 INSTALLATION REVIEW

.1 The Contractor shall give notification to the manufacturer, prior to enclosing the beams, to provide opportunity for review of the installation.

3.3 PERFORMANCE STANDARDS

.1 Products shall be proven by testing and evaluation in accordance with the provisions of ASTM D-5456.

3.4 WARRANTY

.1 The products delivered shall be free from manufacturing errors or defects in workmanship and material. The products, when correctly installed, shall perform to specifications for the normal and expected life of the building.

3.5 EXPOSED FINISH

.1 Laminated veneer lumber: Sand to a smooth finish ensuring identifying labeling has been removed and apply two coats semi-transparent stain. Colour by Owner.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this section.

1.2 WORK INCLUDED

.1 Supply, fabricate and erect dimensional lumber trusses shown on drawings.

.2 Examine the work upon which the work is this division depends and report any defects to the Consultant. The work of this division shall not commence until all defects have been corrected.

.3 Commencement of the work shall imply acceptance of conditions.

1.3 QUALITY ASSURANCE

.1 Unless detailed otherwise, all roof trusses to be designed to support all applicable dead loads and snow loads, including drift conditions, in accordance with current NBC.

.2 Unless detailed otherwise, all floor joists to be designed to support all applicable dead loads, partition loads, and all live loads for designated occupancies in accordance with current NBC.

.3 All design in accordance with Part 4 of the National Building Code 2010 and CAN3-086 "Engineering Design in Wood".

.4 Complete design calculations showing layout, forces and stress control points to be provided to Consultant for review prior to fabrication.

.5 Design of roof trusses to be under the direct supervision of a Registered Professional Engineer licensed for practice in Saskatchewan.

.6 Unless noted otherwise, all trusses and joists to be designed for maximum liveload deflection of L/360.

1.4 SHOP DRAWINGS

.1 Prepare and check shop drawings including anchorage and erection drawings. Clearly indicate dimensioned profiles, member sizes, connection details, spacing, material grades and other information pertinent to design. Submit shop drawings in accordance with General Conditions.

.2 Roof truss shop drawings must be reviewed by General Contractor and Mechanical Contractor to ensure that the size and locations of all duct penetrations are identified and

co-ordinated. Final roof truss shop drawings must reflect framing to accommodate all such conditions.

.3 Review of drawings to be for size and arrangement of principal and auxiliary members only. Review will not relieve Contractor of responsibility for general and detailed dimensions and fit or any errors or omissions.

Part 2 Products

2.1 MATERIALS

.1 Structural wood members to CSA Standard 0141-05"Softwood Lumber" graded in accordance with NLGA Grading Rules, or machine stress-rated material, kiln dried to maximum 19% moisture content. All joints to be full strength of section.

.2 Connection may be proprietary systems of steel to minimum ASTM A307. Material and size to requirements of design. Submit data to satisfaction of the Consultant to substantiate connection design.

.3 Pre-manufactured double-grip framing anchors, galvanized, shall be used to tie down trusses at all bearing locations.

.4 Bridging to be horizontal wood members at top and bottom chord as required by design and indicated on shop drawings. Cross-brace as required.

Part 3 Execution

3.1 STORAGE

.1 Store in vertical position and completely protected from weather. Handle in such a manner that no damage will be done to materials or structure.

3.2 FABRICATION

.1 Wood trusses to be custom design Warren, Pratt or Howe Truss with tapered and pitched profiles as detailed.

.2 Wood trusses to be manufactured in a plant subject to the approval of the Departmental Representative.

.3 All connections as detailed on approved shop drawings.

.4 Camber wood trusses for full dead load plus three-eights (⅜) live load.

.5 Supply for erection all pre-cut blocking, bridging and double-grip framing anchors.

3.3 ERECTION

.1 Erect plumb and true; use temporary bracing where required to take care of all loads to which structure may be subjected, including erection equipment, and operation of same.

.2 Wind forces on building permanently carried out by walls and decks. Provide temporary stability struts if required as work progresses and maintain in place until stability is provided by permanent structure.

.3 As erection progresses, securely fasten work by means of double-grip framing anchors to take care of all dead, wind and erection stresses.

.4 Make proper provision for safety carrying piles of material, erection equipment of other loads during erection.

.5 Manufacturer to provide fully qualified representative to ensure conformance with design intent. Manufacturer's representative to inspect completed installation and certify acceptance of work. All shop drawings to be sealed by a professional engineer registered in the Province of Saskatchewan.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Architectural woodwork and hardwood casing.

1.2 RELATED SECTIONS

.1 Section 09 91 23 – Interior Painting

1.3 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI/HPVA HP-1-2009, Standard for Hardwood and Decorative Plywood.

.2 ANSI/NPA A208.1-2009, Particleboard.

.2 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)

.1 Architectural Woodwork Quality Standards Illustrated, 2nd edition, 2014.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.

.4 Canadian Standards Association (CSA International)

.1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.

.2 CSA O112.4 Series-M1977(R2006), Standards for Wood Adhesives.

.3 CSA O121-08(R2013), Douglas Fir Plywood.

.4 CSA O141-05(R2009), Softwood Lumber.

.5 National Electrical Manufacturers Association (NEMA)

.1 ANSI/NEMA LD-3-2005, High-Pressure Decorative Laminates (HPDL).

.6 National Hardwood Lumber Association (NHLA)

.1 Rules for the Measurement and Inspection of Hardwood and Cypress 2011.

.7 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

1.4 PERFORMANCE REQUIREMENTS

.1 Perform architectural casework work in accordance with the recommendations of the "Architectural Woodwork Quality Standards Illustrated" of the Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada (AWMAC), 2014 Edition, together with authorized additions and amendments, Custom Grade.

.2 Where modifications to the AWMAC Quality Standards are included in this project specification, then such modifications shall govern in case of conflict.

.3 Materials and installation shall be in metric measurement as specified.

1.5 SUBMITTALS

.1 Provide Submittal submissions: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Provide shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.1 Indicate details of construction, profiles, jointing, fastening and other related details.

.1 Scales: profiles full size, details half full size.

.2 Indicate materials, thicknesses, finishes and hardware.

.3 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.

.3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

.1 Provide duplicate samples: sample size 300 x 300 mm or 600 mm long unless specified otherwise.

.2 Provide two (2) samples of each wood species for review.

.3 Provide duplicate colour samples of laminated plastic for colour selection.

.4 Provide duplicate samples of laminated plastic joints, edging, cutouts and postformed profiles.

.4 Quality assurance submittals:

.1 Manufacturer's Instructions: manufacturer's installation instructions.

1.6 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

.3 Delivery, Storage, and Handling:

.1 Deliver, handle, store and protect materials of this section in accordance with Section 01 61 00 - Common Product Requirements.

.1 Protect millwork against dampness and damage during and after delivery.

.2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.

.4 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Softwood lumber: unless specified otherwise, S4S, moisture content 19% or less in accordance with following standards:

- .1 CSA O141.
- .2 NLGA Standard Grading Rules for Canadian Lumber.
- .3 AWMAC custom grade, moisture content as specified.

.2 Hardwood lumber: moisture content 6% or less in accordance with following standards:

- .1 National Hardwood Lumber Association (NHLA).
- .2 AWMAC custom grade, moisture content as specified.

.3 Douglas fir plywood (DFP): to CSA O121, standard construction.

- .1 Urea-formaldehyde free.

.4 Hardwood plywood: to ANSI/HPVA HP-1.

- .1 Urea-formaldehyde free.

.5 Engineered Combination core – 5 ply veneer: to ANSI A208-1

- .1 Urea-formaldehyde free.

.6 Laminated plastic for flatwork: to NEMA LD3, Grade VGL, Type HD, 1.6 mm thick; based on solid, woodgrain, printed pattern, and metallic, colour range with satin, matt, textured, and embossed finish.

.7 Laminated plastic backing sheet: Grade BK, Type HD not less than 0.5 mm thick or same thickness and colour as face laminate.

.8 Thermofused Melamine: to NEMA LD3 Grade VGL.

- .1 High wear resistant thermofused melamine: equal or exceed 400 cycles (Minimum standard for HPL abrasion test).

.9 Nails and staples: to CSA B111.

.10 Wood screws: plain, type and size to suit application.

.11 Splines: wood and metal.

.12 Sealant: in accordance with Section 07 92 00 - Joint Sealants.

.13 Laminated plastic adhesive:

- .1 Adhesive: contact adhesive to CAN/CGSB-71.20.
  - .1 Maximum VOC limit 250 g/l.
  - .2 Adhesives urea-formaldehyde free.

2.2 HARDWOOD CASINGS, BASE AND TRIMS

.1 H1: Hardwood: Solid maple, clear finish (S1). Refer to drawings for sizes. Refer to section 09 91 23 – Interior Painting

2.3 MANUFACTURED UNITS

.1 Casework:

.1 Fabricate casework to AWMAC custom quality grade.

.2 Furring, blocking, nailing strips, grounds and rough bucks

.1 S2S is acceptable for concealed products.

.2 Board sizes: "standard" or better grade.

.3 Dimension sizes: "standard" light framing or better grade.

.4 Urea-formaldehyde free.

.3 Case bodies (ends, divisions and bottoms).

.1 Particleboard, grade, square edge, 19mm thick. Laminated with high pressure laminate on exposed ends and thermofused melamine on concealed interiors.

.4 Backs:

.1 Particleboard core, square edge, 12.7mm thick, laminated with thermofused melamine.

.5 Shelving:

.2 Particleboard, laminated with thermofused melamine, 19 mm thick.

.3 Edge banding: provide matching colour PVC, 3 mm thickness.

.6 Colors:

.1 PL-1: Wilsonart 4166-60 Pampas

.2 Thermofused Melamine: Panolam S463 Antique White

.2 Drawers:

.1 Fabricate drawers to AWMAC custom grade supplemented as follows:

.2 Sides and Backs.

.1 Thermofused melamine: 15 mm thick.

.3 Bottoms:

.1 Thermofused melamine: 15 mm thick.

.4 Fronts:

.1 Particleboard, 19 mm thick, laminated with high-pressure plastic laminate.

.1 Exposed finish: high-pressure plastic laminate

.2 Semi-exposed surface: plastic laminate.

.3 Edges: banded with 3 mm PVC edge, colour to match exposed faces.

.5 Colors:

.1 PL-1: Wilsonart 4166-60 Pampas

.2 Thermofused Melamine: Panolam S463 Antique White

.3 Casework Doors:

.1 Fabricate doors to AWMAC custom grade supplemented as follows:

.2 Particleboard, 19 mm thick, laminated with high-pressure plastic laminate.

.1 Exposed finish: high-pressure plastic laminate

.2 Semi-exposed surface: high-pressure plastic laminate.

.3 Edges: banded with 3 mm PVC edge, colour to match exposed faces.

.3 Colors:

.1 PL-1: Wilsonart 4166-60 Pampas

.4 Countertops

.1 High-pressure plastic laminate: edged with 3 mm PVC edge unless indicated otherwise on details. Backsplash and sidesplash to match countertop unless indicated otherwise on drawings.

.2 Colors:

.1 PL-2: Wilsonart 4859-60 Spiced Zephyr

.3 Solid wood nosing: Maple, semi-transparent stain with water-borne varnish, Semi-gloss finish.

.1 Finish: MPI INT6.3W Premium Grade (stain with 3 coats of varnish)

2.4 FABRICATION

.1 Assemble cabinets in flush overlay style.

.2 Set nails and countersink screws apply plain wood filler to indentations, sand smooth and leave ready to receive finish.

.3 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.

.4 Shelving to cabinetwork to be adjustable unless otherwise noted.

.5 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.

.6 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.

.7 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.

.8 Ensure adjacent parts of continuous laminate work match in colour and pattern.

.9 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 2400 mm. Keep joints 600 mm from sink cutouts.

.10 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.

.11 Apply laminate backing sheet to reverse side of core of plastic laminate work.

2.5 HARDWARE

.1 Hinges: European concealed hinges, 110 degree opening. Only screw fastened hardware will be accepted, no friction fit hardware will be accepted.Use plastic insertion dowels to receive screws of hinge baseplates.

.1 Acceptable manufacturers: Hettich, Blum, Hafele or Richelieu.

.2 Drawer slides: full extension, bearing type, secured to sides of drawers and to gable, 45kg static load capacity, integral stop, self-closing

.1 Acceptable product: Accuride 3832, or Knape & Vogt 8400.

.3 Shelf standards: Safety shelf support pin for 5mm diameter holes, steel pin with mounded on clear plastic.

.4 Pulls: Recessed metal pull.

.1 Acceptable product: Richelieu 616743128174, or Hettich Zinc Modern 043 981.

.5 Cabinet locks: Cam type cylinder lock. Satin nickel finish. Install where shown on details. Key locks that are in the same room alike.

.6 Clear plastic silencers to be installed on all cabinet doors.

.7 Closet Rod and Shelf: See Section 10 90 00 Ventilated Metal Shelf Type 1.

Part 3 Execution

3.1 INSTALLATION

.1 Do architectural woodwork to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.

.2 Install prefinished millwork at locations shown on drawings. Position accurately, level, plumb straight.

.3 Fasten and anchor millwork securely. Provide heavy duty fixture attachments for wall mounted cabinets.

.4 Use draw bolts in countertop joints.

.5 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.

.6 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of sealant.

.7 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.

.8 Fit hardware accurately and securely in accordance with manufacturer's written instructions.

.9 Site apply laminated plastic to units as indicated. Adhere laminated plastic over entire surface. Make corners with hairline joints. Use full sized laminate sheets. Make joints only where indicated or approved. Slightly bevel arises.

.10 For site application, offset joints in plastic laminate facing from joints in core.

.11 Install wood window sills as noted in drawing.

.12 Coordinate installation of continuous wood blocking behind adjustable shelving units. Attach standards to studs at a maximum spacing of 400mm on centre. Adjustable shelf shall extend a maximum of 100mm beyond the final standard, install standard as required.

3.2 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Clean millwork and cabinet work, inside cupboards and drawers and outside surfaces.

.3 Remove excess glue from surfaces.

3.3 PROTECTION

.1 Protect millwork and cabinet work from damage until final inspection.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 27 00 - Air and Vapour Barrier

.3 Section 07 46 13 – Preformed Metal Siding

.4 Section 07 54 23 – Thermoplastic Polyolefin Roofing

1.2 REFERENCES

.1 Underwriters Laboratories of Canada (ULC)

.1 ASTM C612-[04], Standard Specification for Mineral Fibre Block and Board Thermal Insulation.

.2 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.

.3 CAN/ULC-S702- 97, Thermal Insulation, Mineral Fibre, for Buildings.

.4 CAN/ULC-S704-03, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01300 Submittals. Indicate VOC's insulation products and adhesives.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.3 Shop Drawings

.1 Provide layout for roof insulation.

1.4 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

.1 Mineral fibre insulation must be formaldehyde free.

Part 2 Products

2.1 INSULATION

.1 Skirt: Extruded polystyrene (XPS): to CAN/ULC-S701.

.1 Type: 4.

.2 Thickness: as indicated in drawings.

.3 Edges: shiplapped.

.2 Roof: Rigid Cellular Polyisocyanurate:

.1 Refer to Section 07 54 23 – Thermoplastic Polyolefin Roofing

.2 Faced: to CAN/ULC C-S704-11.

.1 Closed cell polyisocyanurate foam core bonded to inorganic glass fibre reinforced faces, 2 sides per ASTM C1289 Type II, Class 1, Grade 2.

.2 Shape: flat.

.3 RSI (R-Value): as indicated on drawings.

2.2 ADHESIVE

.1 Adhesive (for polystyrene): to CGSB 71-GP-24.

.2 Compatible with roofing membrane and polystyrene insulation

2.3 ACCESSORIES

.1 Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 WORKMANSHIP

.1 Install insulation after building substrate materials are dry.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN4-S604 type A chimneys and CAN/CGA-B149.1 and CAN/CGA-B149.2 type B and L vents.

.5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.6 Offset both vertical and horizontal joints in multiple layer applications.

.7 Do not enclose insulation until it has been inspected and approved by Consultant.

3.3 EXAMINATION

.1 Examine substrates and immediately inform Consultant in writing of defects.

.2 Prior to commencement of work ensure:

.1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.4 RIGID INSULATION INSTALLATION

.1 Apply adhesive to insulation board in accordance with manufacturer's recommendations.

.2 In addition to adhesive, install insulation boards with insulation clips and disk, 2 per 600 x 1200 mm board minimum, fit boards tight, cut of fastener spindle 3 mm beyond disk.

3.5 ROOF INSULATION INSTALLATION

.1 Rigid Cellular Polyisocyanurate

.1 Refer to Section 07 54 23 – Thermoplastic Polyolefin Roofing.

3.6 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 27 00 – Air Barriers

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C553-02, Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S702-1997, Standard for Mineral Fibre Insulation.

.2 CAN/ULC S102 – Surface Burning Characteristics

Part 2 Products

2.1 INSULATION

.1 Mineral Fibre Batt Insulation

.1 Mineral Fibre batt: to CAN/ULC S702.

.1 Type: 1

.2 Interior Partition Applications: Density 40kg/m3.

.3 Exterior Wall Applications: Density 32kg/m3.

.4 RSI Values and Thickness: as indicated on drawings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSULATION INSTALLATION

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C1320.

.2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.3 Do not compress insulation to fit into spaces.

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 Type A chimneys and CAN/CGA-B149.1 and CAN/CGA-B149.2 Type B vents.

3.3 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 07 27 00 – Air and Vapour Barriers.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S702-2012 , Standard for Mineral Fibre Insulation for Buildings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for loose fill insulation and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Test Reports:

.1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.

1.4 QUALITY ASSURANCE

.1 Provide 2 copies of Certification of Coverage and Application Chart in accordance with CAN/ULC-S702 to Departmental Representative, certified by Applicator's signature that the information is correct.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect specified materials in accordance with manufacturer’s recommendaitons.

.3 Replace defective or damaged materials with new.

1.6 SITE CONDITIONS

.1 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

.2 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of insulation materials.

.3 Ventilation:

.1 Ventilate area of work in accordance with manufacturer’s written instructions by use of approved portable supply and exhaust fans.

.4 Protection:

.1 Provide temporary enclosures to prevent dust from contaminating air beyond application area.

.2 Protect adjacent surfaces and equipment from damage by fall-out, and dust.

Part 2 Products

2.1 MATERIALS

.1 Mineral fibre insulation: to CAN/ULC-S702, asbestos-free mineral fibre.

.1 Type 5 - blowing wool, suitable for application by means of pneumatic equipment.

.2 Refer to drawings for RSI values.

.2 Vapour retarder: in accordance with Section 07 27 00 Air and Vapour Barriers.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for loose fill insulation application in accordance with manufacturer's written instructions.

3.2 LOOSE FIBRE INSTALLATION

.1 Pneumatically place loose fibre insulation above ceiling between and over joists to provide minimum thermal resistance value RSI as indicated.

.2 Ensure ceiling areas exposed to outside air are insulated.

.3 Ensure unobstructed air circulation to eave vents.

.4 Install baffles to prevent insulation from spilling over top of exterior wall and causing blockage of soffit vents, and to prevent displacement of insulation by wind entering vents.

.5 Keep insulation minimum 75 mm from heat emitting devices and recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 chimneys and CSA B149.2 type B and L and CSA B149.1 vents.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.1 Remove insulation material spilled during installation and leave work area ready for application of wall board.

.3 Waste Management: in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 01 00 05 - General Requirements

.2 Section 06 10 00 – Rough Carpentry

1.2 REFERENCES

.1 American Society for Testing and Materials

.1 ASTM E 96/E 96 M, Water Vapor Transmission of Materials, desiccant method.

.2 Canadian Urethane Foam Contractors' Association Inc. (CUFCA)

.3 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S705.1-01, Standard for Thermal Insulation Spray Applied Rigid Foam, Medium Density, Material Specification.

.2 CAN/ULC-S705.2-02, Standard for Thermal Insulation Spray Applied Rigid Foam, Medium Density, Installer's Responsibilities-Specification.

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data

.1 Submit manufacturer's instructions, printed product literature and data sheets for including product characteristics, performance criteria and limitations.

.2 Submit proof of License of the Contractor by CUFCA (Canadian Urethane Foam Contractors Association Inc.) prior to commencing the work. Licensing is required by CAN/ULC S705.2-05 Installation Standard.

.3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Maintenance Manuals:

.1 Conform to Section 01 78 00 – Closeout Submittals.

1.2 MOCK-UP

.1 Construct on site a mock-up in accordance with Section 01 45 00.

.2 The mock-up area shall be minimum 5 m² and include components of the work such as attachments, penetrations and corners.

.3 The mock-up shall be reviewed by the Departmental Representative to verify conformance with the specification, workmanship and appearance. Recommended changes to installation methods and procedures may be agreed to at this time.

.4 The mock-up may be part of the finished work.

.5 This mock-up shall constitute a standard of acceptance for the remaining work.

1.3 QUALITY ASSURANCE

.1 Applicators to conform to Canadian Urethane Foam Contractors Association Quality Assurance Program.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with with manufacturer's written instructions.

.2 Materials are to be delivered in original containers and packaged with appropriate MSDS and labels.

1.5 SAFETY REQUIREMENTS

.1 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations.

1.6 PROTECTION

.1 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and 24 hour after application to maintain non-toxic, unpolluted, safe working conditions.

.2 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.

.3 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.

1.7 ENVIRONMENTAL CONDITIONS

.1 Apply spray polyurethane foam when chemical, atmospheric and cavity/surface temperatures are within the limitations required by the CAN/ULC S705.2-05 Installation Standard and as recommended by the manufacturer.

PART 2 Products

2.1 MATERIALS

.1 Insulation: 2 component spray polyurethane to CAN/ULC-S705.1.

.2 Composition: Medium-density closed cell foam. Minimum in-place core density 32.0 kilograms per cubic meter (2 lb/ft3)

.3 Primers: in accordance with manufacturer's recommendations for surface conditions.

.4 Low expansion foam: closed cell, one-component moisture cure polyurethane. Must not contain urea formaldehyde or formaldehyde. Core density not less than 23kg/m3 (1.44 lbs/ft3)

PART 3 Execution

3.1 EXAMINATION

.1 Verify that surfaces and conditions are suitable to accept work as outlined in this section.

.2 Prior to commencement of work report in writing to the consultant any defects in surfaces or conditions that may adversely affect the performance of products installed under this section.

3.2 PREPARATION

.1 Mask and cover adjacent areas to protect from over spray.

.2 Ensure any required foam stop or back up material are in place to prevent over spray and achieve complete seal.

.3 Seal off existing ventilation equipment. Install temporary ducting and fans to ensure exhaust fumes. Provide for make-up air.

.4 Erect barriers, isolate area and post warning signs to advise non-protected personnel to avoid the spay area.

3.3 APPLICATION

.1 Do not install product after expiry date on the container.

.2 Manufacture of material on site by qualified installer trained to spray urethane foam insulation in accordance with CAN/ULC-S705.2

.3 Apply insulation to clean surfaces in accordance with CAN/ULC-S705.2 and manufacturer's printed instructions. Use primer where recommended by manufacturer.

.4 Apply spray foam in accordance with ASTM E 96/E 96 M if the spray foam is to act as a vapour barrier.

.5 Apply sprayed foam insulation in thickness and in locations as indicated in drawings.

.6 Apply in consecutive lifts as recommended by manufacturer to thickness indicated on drawings. Lifts shall be not less than 15mm and not greater than 50mm. Allow to cure between lifts.

.7 Maintain minimum 75mm clearance from heat-emitting devices.

.8 Finished surface of foam insulation to be free of voids and imbedded foreign objects.

.9 Trim, as required, any excess thickness that would interfere with the application of cladding/covering system by other trades.

3.4 LOW EXPANSION FOAM

.1 Install low expansion foam appropriate to the installation between door and window frames and the adjacent structure to avoid causing pressure on the frame due to the expansion of the foam.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.6 TOLERANCES

.1 Maximum variation from indicated thickness: minus (-) 6mm; plus (+) 12mm.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.1 Remove insulation material spilled during installation, clean affected surfaces.

3.8 SCHEDULE

.1 Between window and door frames and adjacent structure.

.2 Full perimeter of joints between modules.

.3 Refer to drawings for other locations.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Vapour permeable air barrier (police building), vapour barrier (police building), crawlspace vapour barriers (police building), self-adhering sheet waterproofing at skirting (police building). Air and vapour barrier membrane for roofing is specified in Section 07 54 23 – Thermoplastic Polyolefin Roofing.

1.2 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 46 13 – Preformed Metal Siding

.3 Section 07 46 46 – Cementitious Siding

.4 Section 07 54 23 – Thermoplastic Polyolefin Roofing

.5 Section 07 92 00 - Joint Sealants

.6 Section 08 54 13 – Fiberglass Windows

.7 Section 087 90 10 – Door, Frame & Hardware Schedule

1.3 REFERENCES-

.1 ASTM International

- .1 ASTM C920; Standard Specification for Elastomeric Joint Sealants
- .2 ASTM C1193; Standard Guide for Use of Joint Sealants
- .3 ASTM D882; Test Method for Tensile Properties of Thin Plastic Sheeting
- .4 ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics
- .5 ASTM E84; Test Method for Surface Burning Characteristics of Building Materials
- .6 ASTM E96; Test Method for Water Vapor Transmission of Materials
- .7 ASTM E1677; Specification for Air Retarder Material or System for Framed Building Walls
- .8 ASTM E2178; Test Method for Air Permeance of Building Materials
- .9 ASTM E1677; Specification for Air Retarder Material or System for Framed Building Walls
- .10 ASTM E154-99 (2005) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls or as Ground Cover
- .11 ASTM E96-05 Standard Test Methods for Water Vapor Transmission of Materials
- .12 ASTM F1249-06 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.

.2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

.3 AATCC – American Association of Textile Chemists and Colorists

.1 Test Method 127 Water Resistance: Hydrostatic Pressure Test

.4 TAPPI

.2 Test Method T-410; Grams of Paper and Paperboard (Weight per Unit Area)

.3 Test Method T-460; Air Resistance (Gurley Hill Method)

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheets.

.2 Submit summary of test results as per paragraph 8.3 of ASTM E 1745.

1.5 QUALITY ASSURANCE

.1 Mock-Ups:

.1 Submit mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Convene pre-installation meeting prior to construction of mock-up, include major sub-trades..

.3 Install mock-up using approved air barrier assemblies including seaming, fasteners, flashing, tape and related accessories per manufacturer’s current printed instructions and recommendations.

.1 Mock-up size: approximately 4 meters by 4 meters including wall opening.

.4 Mock-up will be used to judge workmanship, substrate preparation, and material application.

.5 Installation shall be in accordance with manufacturer’s installation guidelines and recommendations.

.6 Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.

.2 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

.3 Allow 48 h for inspection of mock-up by Consultant before proceeding with air/vapour barrier Work.

1.6 SEQUENCING

.1 Sequence work to permit installation of materials in conjunction with related materials and seals.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.

.2 Store weather barrier materials as recommended by system manufacturer

Part 2 Products

2.1 Air and Vapour Barrier membrane for Roofing is specified in Section 07 54 23 – Thermoplastic Polyolefin Roofing

2.2 POLYETHYLENE VAPOUR BARRIER

.1 Polyethylene film: to CAN/CGSB-51.34, 0.15 mm thick.

2.3 CRAWLSPACE VAPOUR BARRIER

.1 Multi-layer plastic extrusion, continuously sealed, sheet-style vapour barrier for use as crawlspace ground cover.

.2 Vapour barrier must have all of the following qualities:

.1 Permeance of less than 0.01 Perms [grains/(s.f.*hr*inHg)] as tested in accordance with ASTM E 1745 Section 7.1.

.2 Strength: ASTM E 1745 Class A.

.3 Compatible and available tapes, sealants, vapour-proofing mastic, pipe boots for continuous seal.

.3 Acceptable products:

.1 Basis of Design: Stego Industries: Stego Wrap Vapour Barrier (15 mil) by Stego Industries LLC, www.stego industries.com

.2 Approved equivalent

2.4 VAPOUR PERMEABLE AIR BARRIER

.1 Self-adhered water resistive, vapour permeable, air barrier membrane to ASTM E 2178. Consisting of tri-laminate of modified polyolefin with two layers of non-woven polyethylene, suitable for full wall assemblies. Permeable self-adhesive layer with release film. Refer to details on drawings for locations and assembly.

.1 Henry Company: BlueskinVP 160

.2 Approved equivalent

2.5 SELF-ADHERING SHEET WATERPROOFING (SKIRT)

.1 Self-adhered water proofing membrane consisting of SBS modified bitumen with a cross-laminated polyethylene film suitable for below grade waterproofing application on a preserved wood panel substrate. Refer to details on drawings for locations and assembly.

.2 Waterproofing membrane must have all of the following properties:

.1 Thickness: 1.5 mm (60 mils) min.,
.2 Flexibility: Pass @ -40 degrees C to ASTM D1970,
.3 Vapour permeance: 2.8 ng/Pa.s.m² (0.05 perms) to ASTM E96,
.4 Tensile strength (membrane): 2.24 MPa to ASTM D412,
.5 Tensile strength (film): 34.5 MPa to ASTM D882,
.6 Elongation: 300% to ASTM D412,
.7 Puncture resistance: 222 N min. to ASTM E154.

.3 Acceptable products:

.1 Basis of Design: Henry Company: Bakor Blueskin WP 200

.2 Approved equivalent

.3

2.6 ACCESSORIES – POLYETHYLENE VAPOUR BARRIER

.1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.

.2 Sealant: compatible with vapour retarder materials, recommended by vapour retarder manufacturer. To Section 07 92 00 - Joint Sealing .

.3 Staples: minimum 6 mm leg.

.4 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

2.7 ACCESSORIES- CRAWLSPACE VAPOUR BARRIER AND VAPOUR PERMEABLE AIR BARRIER

.1 Sealant: compatible with air barrier materials, recommended by sheet barrier manufacturer. Refer to Section 07 92 00 - Joint Sealing.

.2 Vapour-proof mastic: compatible with sheet barrier materials, recommended by sheet barrier manufacturer.

.3 Seaming tape: compatible with sheet barrier materials, recommended by sheet barrier manufacturer.

.4 Pipe boots: compatible with sheet barrier materials, recommended by sheet barrier manufacturer.

.5 Foam Seal: Spray-applied medium density spray polyurethane foam insulation/air/vapour barrier compatible with sheet barrier manufacturer.

.6 Sheet steel: Galvanized steel, Z275 zinc coating; 0.8 mm thick core steel.

.7 Attachments: Galvanized steel bars and anchors.

.7 Primer: Appropriate to application.

2.8 ACCESSORIES- SELF-ADHERING SHEET WATERPROOFING

.1 Liquid Sealant and Termination Sealant: compatible with self-adhering waterproofing sheet and as recommended by sheet barrier manufacturer.

.2 Prefabricated Drainage Board (vertical): prefabricated composite drain board, compatible with self-adhering waterproofing sheet complete with polypropylene core board with polypropolyne fabric attached, having following physical properties:

.1 Flow rate: 223 L/min/m

.2 Compressive Strength: 11,000 psf

.3 Thickness: 10mm

.4 Accessories: Securement bars, moulding strip and drain board plugs and nails as per manufacturer's written recommendations.

.3 Securement Bars and Fasteners: Galvanized steel bars and anchors as recommended by manufacturer, pre-drilled for non-corrosive screw attachment.

.4 Primer: compatible with self-adhering waterproofing sheet and as recommended by sheet barrier manufacturer

Part 3 Execution

3.1 EXAMINATION

.1 Verify substrate and surface conditions are in accordance with manufacturer recommended tolerances prior to installation of barrier and accessories.

3.2 INSTALLATION - POLY VAPOUR BARRIER

.1 Refer to Wall Types and details on drawings for location and assembly.

.2 Ensure services are installed and inspected prior to installation of retarder.

.3 Install sheet vapour retarder on warm side of exterior wall and ceiling assemblies prior to installation of gypsum board to form continuous retarder.

.4 Use sheets of largest practical size to minimize joints.

.5 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

.6 Exterior Surface Openings

.1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame using sealant recommended by manufacturer.

.7 Perimeter Seals

.1 Seal perimeter of sheet vapour barrier as follows:

.1 Apply continuous bead of sealant, minimum 6mm wide and high, to substrate at perimeter of sheets.

.2 Lap sheet over sealant and press into sealant bead.

.3 Install staples through lapped sheets at sealant bead into wood substrate.

.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

.8 Lap Joint Seals

.1 Seal lap joints of sheet vapour barrier as follows:

.1 Attach first sheet to substrate.

.2 Apply continuous bead of sealant over solid backing at joint.

.3 Lap adjoining sheet minimum 150 mm and press into sealant bead.

.4 Install staples through lapped sheets at sealant bead into wood substrate.

.5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

.9 Electrical Boxes

.1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:

.1 Install moulded box vapour barrier Wrap boxes with film sheet providing minimum 300 mm perimeter lap flange.

.2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

3.3 INSTALLATION - VAPOUR PERMEABLE AIR BARRIER

Refer to Wall Types and drawings for locations of vapour permeable air barrier.

.1 Preparation

.1 Remove loose or foreign matter which might impair adhesion of materials.

.2 Ensure all substrates are clean of oil or excess dust; all masonry joints struck flush, and open joints filled; and all concrete surfaces free of large voids, spalled areas or sharp protrusions.

.3 Ensure all substrates are free of surface moisture prior to application of self-adhesive membrane and primer.

.4 Ensure metal closures are free of sharp edges and burrs.

.5 Prime substrate surfaces to receive adhesive in accordance with manufacturer's instructions.

.2 Installation

.1 Install materials in accordance with manufacturer's instructions to create a continuous seal between all material junctions within the building envelope.

.2 Apply sealants and primers within recommended application temperature ranges. Consult manufacturer when products cannot be applied within these temperature ranges.

.3 Install membrane using a consecutive weatherboard method starting at base of wall and working upward, provide minimum 50mm side laps and 80mm end laps.

.4 Position membrane for alignment, remove protective film and firmly apply pressure to ensure adhesion. Eliminate all gaps and wrinkles.

.5 Roll entire membrane surface, including seams, to ensure full contact and adhesion.

.6 Seal membrane terminations, heads of mechanical fasteners, masonry tie fasteners, around penetrations, duct work, electrical and other apparatus extending through the water resistive air barrier membrane and around the perimeter edge of membrane terminations at window and door frames with manufacturer recommended sealant.

3.4 INSTALLATION - CRAWLSPACE VAPOUR BARRIER

.1 Preparation

.1 Ensure that base material is approved by Architect or Geotechnical Engineer.

.2 Level and compact base material

.2 Installation

.1 Install vapour barrier in accordance with manufacturer's written instructions and ASTM E 1643.

.2 Unroll vapour barrier with the longest dimension parallel with the longest direction of the crawlspace.

.3 Lap vapour barrier over footings and/or seal to foundation walls. See drawings.

.4 Overlap joints 150mm (6 inches) and seal with manufacturer's seaming tape.

.5 Seal all penetrations (including pipes) per manufacturer's written instructions.

.6 No penetration of the vapour barrier is allowed except for permanent utilities and radon exhaust pipes.

.7 Repair damaged areas by cutting patches of vapour barrier, overlapping damaged area 150 mm (6 inches) and taping all sides with manufacturers' seaming tape.

3.5 INSTALLATION – SELF-ADHERING WATERPROOFING MEMBRANE

Refer to drawings for locations of self-adhering waterproofing membrane.

.1 Preparation

.1 Remove loose or foreign matter which might impair adhesion of materials.

.2 Fill spalled areas in substrate to provide an even plane.

.3 Ensure all substrates are clean of oil or excess dust; and substrate is cleared of sharp protrusions.

.4 Ensure all substrates are free of surface moisture, frost and other contaminants prior to application of suitable waterproofing membrane primer as recommended by manufacturer based on air and surface temperature at time of application.

.5 Pre-treat cracks in substrate, horizontal to vertical inside corner transitions and outside corners in substrate as per manufacturer's written instruction.

.6 Where three or more planes come into contact, reinforce with cut sections of waterproofing membrane reinforcing sheet as per manufacturer's instructions.

.7 At projections, extend waterproofing membrane tight to projection and seal with liquid membrane as per manufacturer's written instructions.

.8 Prime substrate surfaces to receive adhesive in accordance with manufacturer's instructions.

.2 Installation - Waterproofing Membrane – Vertical Application

.1 Prime substrate surfaces to receive adhesive in accordance with manufacturer's instructions.

.2 Install materials in accordance with manufacturer's instructions to create a continuous waterproofing barrier.

.3 Apply sealants and primers within recommended application temperature ranges. Consult manufacturer when products cannot be applied within these temperature ranges.

.4 Apply waterproofing membrane to prepared substrate in lengths of 2400 mm or less.

.5 Provide 65 mm laps at both sides and ends. Position for alignment and remove protective film. Press firmly into place. Promptly roll entire membrane surface, all laps and seams, with a counter top roller to effect seal and to eliminate all gaps and wrinkles. If more than one length is required on a vertical surface, apply in a shingle fashion.

.6 Terminate membrane using termination mastic or termination bar, reglet or counter flashing as indicated. Refer to manufacturers standard details.

.7 All laps within 300 mm of a 90 degrees change in plane are to be sealed with termination sealant.

.8 Seal membrane terminations, heads of mechanical fasteners, masonry tie fasteners, around penetrations, duct work, electrical and other apparatus extending through the water resistive air barrier membrane and around the perimeter edge of membrane terminations at window and door frames with manufacturer recommended sealant.

.3 Installation - Drainage Board – Vertical Application

.1 Align and hang drainage up to foundation wall. Position bottom edge of drainage board to be at base of skirt.

.2 Mechanically fasten drainage board to foundation wall with non-corrosive fasteners with spacing as per manufacturer's written instructions.

.3 Align and install termination strip along top edge with non-corrosive mechanical fasteners spaced as per manufacturer's written instructions and seal with termination sealant.

.4 Align and install moulding strip over completed top edge detail.

.5 Overlap end laps, pull back loose fabric to expose drain core and position core of second panel over the overlap flange of first panel.

.6 Bend drain board to create inside corners and cut board to create outside corners, provide 75 mm of extra fabric to wrap corner.

.7 Stagger or offset joints of drain board sheets as per manufacturer's written instructions.

.8 Place all subsequent sheets in an overlapping single fashion.

.9 Backfill bottom edge. Refer to drawings for details.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for preformed metal siding at exterior walls.

1.2 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 27 00 – Air and Vapour Barriers

.3 Section 07 62 00 – Sheet Metal Flashing and Trim.

.4 Section 07 92 00 - Joint Sealing.

1.3 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B18.6.3-2011, Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series).

.2 ASTM International

.1 ASTM D2369-10e1, Test Method for Volatile Content of Coatings.

.2 ASTM D2832-92(2011), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.

.3 ASTM D5116-10, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-93.3-M91, Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet for Residential Use.

.2 CAN/CGSB-93.4-92, Galvanized and Aluminum-Zinc Alloy Coated Steel Siding Soffits and Fascia, Prefinished, Residential.

.3 CAN/CGSB-93.5-92, Installation of Metal Residential Siding, Soffits and Fascia.

.4 CSA International

.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Components: Design and size to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of panel as calculated in accordance with National Building Code of Canada.

.2 Maximum Allowable Deflection of Panel: 1/180.

.3 Movement: Accommodate movement within system without damage to system, components, or deterioration of seals; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal siding and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, metal furring, and related work.

.4 Samples:

.1 Submit duplicate 300 x 300 mm samples of siding material, of colour and profile specified.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal siding from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 STEEL CLADDING AND COMPONENTS

.1 Panel siding: to CAN/CGSB-93.4; Class: plain.

.1 Thickness: 0.61 mm base metal thickness.

.2 Profile: 38 mm deep by 935 wide panels to match Vicwest CL 7040 profile or approved equivalent. Orientation as per drawings.

.3 Finish: factory prefinished 2 coat system.

.1 Base metal: ASTM A653 / ASTM A653M for Zinc coated steel (galvanized).

.2 Film thickness: To ASTM A755/A755M and AAMA 621-02. Minimum topcoat dry film thickness of 18microns (0.7 mils) and 5microns (0.2 mils) primer.

.3 Film hardness: to ASTM D3363.

.4 Gloss: to ASTM D523

.5 Humidity resistance: to ASTM D2247

.6 Film integrity: no evidence of cracking, flacking, or checking that is apparent on ordinary outdoor observations for first 40 years.

.7 Product Attributes: minimum of 70% Kynar 500 or Hylar 5000 PVDF resins, 10000 Series.

.1 Medium gloss.

.2 Colour 1- 16084 Navy Blue

.3 Colour 2 – 16080 Bright Red

.4 Colour 3 – 16070 Gold

.2 Internal and External Corners: Same material, thickness, and finish, colour as adjacent sheets; profile to suit system; shop cut and factory mitered to required angles as recommended by manufacturer.

2.2 FASTENERS

.1 Nails: CSA B111. Screws: ASME B18.6.3. Purpose made stainless steel

2.3 CAULKING

.1 Sealants:as recommended by manufacturer and in accordance with Section 07 92 00 - Joint Sealants.

2.4 ACCESSORIES

.1 Exposed trim: inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip and window/door trim of same material, colour gloss as adjacent cladding, with fastener holes pre-punched.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable in accordance with manufacturer's written instructions.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 INSTALLATION

.1 Install cladding in accordance with CGSB 93.5 and manufacturer's written instructions.

.2 Install cladding in locations and orientations indicated in drawings.

.3 Install continuous starter strips, inside and outside corners, edgings, soffit, drip, cap, sill and window/door opening flashings as indicated.

.4 Install outside corners, fillers and closure strips with carefully formed and profiled work.

.5 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.

.6 Attach components in manner not restricting thermal movement.

.7 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07 92 00 - Joint Sealants.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by preformed metal siding installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Cementitious panel cladding at skirt of police building.

1.2 RELATED SECTIONS

.1 Section 01 00 05 - General Requirements

.2 Section 06 10 00 – Rough Carpentry

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM C 1186-08 (2012) Standard Specification for Flat Fibre-Cement Sheets

.2 ASTM C 1325-14 Standard Specification for Non-Asbestos Fibre-Mat Reinforced Cementitious Backer Units

.3 ASTM D 226: Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

.4 ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

.5 ASTM E119: Test Method for Fire Tests of Building Construction and Materials.

.6 ASTM C 954: Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 inch to 0.110 inch in Thickness.

.7 ASTM C 1002: Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.8 ASTM C 1280: Standard Specification for Application of Gypsum Sheathing.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 01 00 05 General Requirements.

.2 Product Data:

.1 Submit manufacturer's printed product literature and specifications.

.2 Submit manufacturer's printed Material Safety Data Sheet.

.3 Shop Drawings:

.1 Provide detailed shop drawings of cementitious siding materials application including trim around openings, panel joints, butting to different material and flashing details.

.4 Samples

.1 For each finish product specified, provide two samples, minimum size 100 by 150 mm, representing actual product, colour, and patterns.

1.5 QUALITY ASSURANCE

.1 Installer Qualifications: Company experienced in installation of cementitious siding with minimum five years documented experience.

.2 Mock-Ups:

.1 Submit mock-ups in accordance with Section 01 00 05 General Requirements

.2 Mock-up will be used to judge workmanship, substrate preparation, and material application and detailing.

.1 Locate where directed by Departmental Representative.

.3 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Store products in manufacturer's unopened packaging until ready for installation.

.2 Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

1.7 PROJECT CONDITIONS

.1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

.1 Product Warranty: Standard manufacturer’s product warranty against manufacturing defects.

Part 2 Products

2.1 PRODUCTS

.1 Cementitious Panels (Skirt Cladding)

.1 Non-combustible, glass-fibre reinforced, non-asbestos, cementitious board suitable for unfinished weather-exposed exterior applications. No labels showing on exterior exposed face.

.2 Type: Type A suitable for exterior application.

.3 Thickness: 13 mm (1/2”) with reinforced edge.

.4 Sheet Size: 1219 mm (4’) wide x 2440 mm (8’). Refer to drawings. Cut to suit.

.5 Finish: None.

.6 Joints: Butt joints. No flashing or caulking.

.7 Color: selected by Departmental Representative from manufacturer’s standard range.

2.2 FASTENERS

.1 Skirt Cladding

.1 Exposed stainless steel screws complete with washers.

Part 3 Execution

3.1 EXAMINATION

.1 Do not begin installation until substrates have been properly prepared.

.2 If framing preparation is the responsibility of another installer, notify Consultant of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

.1 Follow all safety procedures recommended by the manufacturer

.2 Install materials in strict accordance with manufacturer's installation instructions.

.3 Do not install cementitious panels or planks directly against concrete or brick. Isolate panels or planks with metal flashing as indicated on drawings.

.4 Skirt Cladding

.1 Install 1200 mm wide panels. Length varies.

.2 Place fasteners no closer than 9.5 mm (3/4") from panel edges and 50 mm (2") from panel corners.

.3 Joint treatment: None. Butt joints. Refer to drawings for layout.

3.3 CLEANING

.1 Wash down surfaces to remove any surface dirt.

3.4 PROTECTION

.1 Protect finished Work from damage.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Thermoplastic Polyolefin Membrane Roofing.

.2 Membrane Flashings.

1.2 RELATED SECTIONS

.1 Section 06 10 00 - Rough Carpentry.

.2 Section 07 21 13 - Board Insulation.

.3 Section 07 27 00 - Air and Vapour Barriers.

.4 Section 07 62 00 - Sheet Metal Flashing and Trim.

1.3 REFERENCES

.1 ASTM International Inc.

.2 ASTM International (ASTM):

.1 ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

.2 ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

.3 ASTM D 6878 - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.

.4 ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.

.3 Canadian Roofing Contractors' Association (CRCA)

.1 CRCA Roofing Specification Manual 1997.

.4 Canadian Standards Association (CSA International)

.1 CSA A123.21-04, Standard Test Method for the Dynamic Wind Uplift Resistance of Mechanically Attached Membrane-Roofing Systems

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.2 CAN/ULC-S704-03, Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.4 DESIGN CRITERIA

.1 Wind Uplift Resistance testing will be in accordance with CSA123.21

.2 Building parameters

.1 Geometry: Low rise, low slope roof.

.2 Exposure: Open.

.3 Openings: Category 2

.4 Importance: High

.3 Roof assembly will be designed to be installed on a modular building that will be transported along roads to the final site. Roof assembly must be capable of withstanding wind loads occurring during transportation. The modular buildings will be assembled on site. The roof membrane will be seamed as necessary to provide a complete assembly and waterproof membrane in accordance with the stipulated warranty.

.4 Submit a report, issued by a certified materials testing laboratory, showing the roofing system offered was tested in accordance with CSA A 123.21-10, Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane Roofing Systems. Test results shall demonstrate the roofing system provides a Dynamic Uplift Resistance pressure for the field, edges and corners of the roof that satisfy the wind load requirements per the National Building Code of Canada.

.5 Compatibility between components of roofing system is essential. Provide written declaration to Consultant stating that materials and components, as assembled in system, meet this requirement.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheets for boards, membranes, fasteners, adhesives and accessories to be incorporated into the Work. Include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.

.3 Provide shop drawings:

.1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan, Canada.

.2 Indicate membrane, vapour barrier, insulation, flashing, control joints, penetrations field fabricated seams details.

.3 Provide details indicating connections at parapets and scuppers.

.4 Test and Evaluation Reports: submit laboratory test reports certifying compliance of roofing membrane with specification requirements.

.1 Compatibility of materials: submit written declaration to Departmental Representative and Consultant as described in PART 2, PERFORMANCE CRITERIA.

.5 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.

.6 Field Quality Control: at completion of Work provide a letter from membrane manufacturer stating membrane assembly including all material from roof membrane to vapour barrier inclusive have been installed according to manufacturer's written requirements and approved shop drawings.

1.6 QUALITY ASSURANCE

.1 Installer qualifications: company or person specializing in application of Thermoplastic-polyolefin roofing systems with written approved by manufacturer.

.2 Mock-ups:

.1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.

.2 Construct mock-up 10 m^2 minimum size showing typical lap joint, one inside corner and one outside corner.

.3 Construct mock-up where directed.

.4 Mock-up will be used:

.1 To judge workmanship, substrate preparation, operation of equipment and material application.

.5 Allow 48 hours for inspection of mock-up by Departmental Representative and Consultant before proceeding with roofing work.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this work.

.7 Approved mock-up may remain as part of finished Work.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.

.2 Storage and Handling Requirements:

.1 Provide and maintain dry, off-ground weatherproof storage.

.2 Store materials on supports to prevent deformation.

.3 Remove only in quantities required for same day use.

.4 Store uncured flashing and jointing materials to prevent premature curing and freezing.

.5 Store insulation protected from weather and deleterious materials.

.6 Store roofing materials in accordance with manufacturer's written instructions, to prevent damage or loss of performance.

1.8 SITE CONDITIONS

.1 Ambient Conditions:

.1 Apply thermoplastic polyolefin membrane only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

.2 Install thermoplastic polyolefin membrane on dry substrate, free of snow and ice. Use only dry materials and apply only during weather that will not introduce moisture into system.

1.9 WARRANTY

.1 For the Work of this Section 07 54 23 - thermoplastic polyolefin, 12 months warranty period is extended to 60 months.

Part 2 Products

2.1 DESCRIPTION - ROOFING SYSTEM

.1 Roof System: Provide a waterproof roof system, capable of withstanding uplift forces as specified in the PART 1, DESIGN CRITERIA.

.2 Base Flashing: Provide a waterproof, fully adhered base flashing system at all penetrations, plane transitions and terminations.

2.2 PERFORMANCE CRITERIA

.1 Compatibility between components of system and adjacent materials is essential.

.1 Provide a written declaration to Departmental Representative and Consultant stating that all materials and components, as assembled in system, meet this requirement.

.2 Roofing system: to CSA A123.21 for wind uplift resistance.

2.3 VAPOUR RETARDER

.1 Self-adhering Modified Bitumen Membrane.

.1 Self adhesive styrene butadiene styrene (SBS) modified bituminous membrane, polyester reinforced, bottom surface with a release sheet, conforming to CGSB 37-GP-56M, Membrane Modified, Bituminous, Prefabricated and Reinforced for Roofing.

.2 Thickness: 1 mm (40 mil) minimum.

2.4 MEMBRANE

.1 Roof System: Sloped wood deck on sleepers, vapour barrier, board insulation,

.1 Membrane Attachment: Fully Adhered.

.2 Base Flashing: Provide a waterproof, fully adhered base flashing system at all penetrations, plane transitions and terminations.

.3 Membrane Thickness: 60 mil nominal.

.1 Thickness over Scrim: 0.020 inches (0.508mm).

.2 Breaking Strength (ASTM D 751): 250 lbf/in (1.1 kN/m) minimum.

.3 Tear Resistance (ASTM D 751): 55 lbf/in (245 N/m) minimum.

.4 Elongation (ASTM D 751): 25 percent.

.5 Field Sheet Dimensions:

.1 Width: maximum width available to minimize seams.

.2 Length: maximum length available to minimize seams.

.6 Colour: white.

2.5 BOARD INSULATION

.1 Refer to section 07 21 13 Board Insulation.

.1 Rigid Cellular Polyisocyanurate:

.1 Shape: flat as required to suit roof drainage slopes and plan.

.2 Average RSI (R-Value): as noted in drawings.

.2 Approved product:

.1 Compatible with roof membrane system and acceptable to membrane manufacturer as part of the specified extended warranty.

.2 Adhere insulation to meet requirements of CSA 123.21 and in accordance with manufacturer's written instructions.

2.6 OVERLAY BOARD

.1 11 mm Oriented strand board sheathing.

.2 Mechanically fastened as recommended by manufacturer.

2.7 FLASHING ACCESSORIES

.1 Inside Corners: Pre-molded corner flashing for inside corners. 60 mil thickness. Color to match membrane.

.2 Outside Corners: Injection molded corner used for flashing outside corners. 60 mil thickness. Color to match membrane. Special colors require custom fabrication process.

.3 TPO T-Joint Covers: Injection molded 60 mil thick TPO formed into a 114mm (4.5 inch) diameter circle used to seal step-offs at splice intersections. Color to match membrane. Special colors require custom fabrication process.

.4 TPO Curb Wrap Corners: Pre-fabricated corner flashings made from 45 mil thick reinforced membrane.

.5 Molded Pipe Seals: A pre-molded flashing and clamping ring used for pipe penetrations.. Color to match membrane.

.6 TPO Square Tubing Wraps: Pre-fabricated flashings made of 45 mil thick reinforced Sure-Weld membrane for square tubing.

.7 Pressure-Sensitive Cover Strip: A nominal 152mm (6 inch) wide by 40 mil thick non-reinforced TPO membrane laminated to nominal 35-mil thick cured synthetic rubber pressure-sensitive adhesive. Color to match membrane.

.8 Heat Weldable Walkway Rolls: Minimum 850 mm wide, nominal 180 mils thick. Color : Gray.

.9 Non-Reinforced Flashing: Non-reinforced TPO flashing, 60-mil thick non-reinforced TPO based membrane where the use of pre-molded or pre-fabricated accessories are not feasible. Color: to match field membrane.

2.8 ADHESIVE

.1 As recommended by manufacturer to meet PART 1, DESIGN CRITERIA.

2.9 FASTENING COMPONENTS

.1 As recommended by manufacturer to meet PART 1, DESIGN CRITERIA.

.2 Insulation Fastening Plates: A nominal 76mm (3 inch) diameter metal plate used for insulation attachment in conjunction with the appropriate fastener.

2.10 EDGINGS AND TERMINATIONS

.1 Coated metal sheets made from 24 gauge galvanized steel with a minimum 0.9mm (.035 inch) thick non-reinforced laminate. Color to match membrane.

.2 Termination Bar: minimum 13 mm (1 inch) wide, 2.5mm (.098 inch) thick extruded aluminum bar with sealant ledge to support sealant.

2.11 SOURCE QUALITY CONTROL

.1 Provide laboratory test reports certifying compliance of roofing materials with specification requirements as described in PART 1, ACTION AND INFORMATIONAL SUBMITTALS/QUALITY ASSURANCE.

Part 3 Execution

3.1 QUALITY OF WORK

.1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

.2 Do examination, preparation and roofing Work in accordance with Roofing Manufacturer's Specification Manual and CRCA Roofing Specification Manual .

3.2 SUBSTRATE EXAMINATION

.1 Verification of Conditions: examine substrates and immediately inform Departmental Representative and Consultant in writing of defects.

.2 Evaluation and Assessment: prior to beginning work ensure:

.1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris.

.2 Curbs have been built.

.3 Drains have been installed at proper elevations relative to finished surfaces.

.4 Plywood and lumber nailer plates have been installed to walls and parapets as indicated.

3.3 PROTECTION OF IN-PLACE CONDITIONS

.1 Cover walls, walks , sloped roofs and adjacent work where materials hoisted or used.

.2 Use warning signs and barriers:

.1 Maintain in good order until completion of Work.

.3 Dispose of rain water away from face of building until drains or hoppers installed and connected.

.4 Protect from traffic and damage:

.1 Comply with precautions deemed necessary by Departmental Representative and Consultant.

.5 Place plywood runways over work to enable movement of material and other traffic.

.6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.

.7 Seal and ballast exposed edges.

.8 If metal connectors used, treat connectors and decking with rust proofing or galvanization.

3.4 VAPOUR RETARDER (WOOD DECK)

.1 Self-adhered as per manufacturer’s written instructions.

3.5 INSULATION: MECHANICALLY FASTENED APPLICATION

.1 Mechanically fasten insulation using screws and pressure distribution plates as recommended by manufacturer.

.2 Number and pattern of screws per board to meet stipulated Performance Requirements.

.3 Place boards in parallel rows with ends staggered, and in firm contact with one another.

.4 Cut end boards to suit.

3.6 MEMBRANE PLACEMENT AND ATTACHMENT (FULLY ADHERED)

.1 Position membrane over the acceptable substrate. Fold membrane sheet back lengthwise so half the underside of the membrane is exposed.

.2 Apply adhesive in accordance with the manufacturer's published instructions, to the exposed underside of the membrane and the corresponding substrate area. Do not apply adhesive along the splice edge of the membrane to be hot air welded over the adjoining sheet. Allow the adhesive to dry until it is tacky but will not string or stick to a dry finger touch.

.1 Roll the coated membrane into the coated substrate while avoiding wrinkles. Brush down the bonded section of the membrane sheet immediately after rolling the membrane into the adhesive with a soft bristle push broom to achieve maximum contact.

.2 Fold back the unbonded half of the sheet lengthwise and repeat the bonding procedures.

.3 Position adjoining sheets to allow a minimum overlap of 2 inches.

3.7 SEAM WELDING

.1 Hot-air weld membrane using an Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's current guidelines. At all splice intersections, roll the seam with a silicone roller to ensure a continuous hot air welded seam.

.2 Overlay all splice intersections with Sure-Weld T-Joint Cover.

.3 Probe all seams once the hot air welds have thoroughly cooled (approximately 30 minutes).

.4 Repair all seam deficiencies the same day they are discovered.

.5 Apply Cut Edge Sealant on all cut edges of reinforced membrane (where the scrim reinforcement is exposed) after seam probing is complete. Cut Edge Sealant is not required on vertical splices

3.8 FLASHING

.1 Flashing of parapets, curbs, expansion joints and other parts of the roof must be performed using reinforced membrane or prefabricated accessories. Sure-Weld non-reinforced membrane may be used for flashing pipe penetrations, Sealant Pockets, and scuppers, as well as inside and outside corners, when the use of pre-molded or prefabricated accessories is not feasible.

.2 Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.

3.9 WALKWAYS

.1 Install walkways at all traffic concentration points (such as roof hatches, access doors, rooftop ladders, etc.) and all locations as identified on the Contract Drawings.

.2 Hot-air weld walkway pads to the membrane in accordance with the manufacturer's current application guidelines.

3.10 FIELD QUALITY CONTROL

.1 Inspection:

.1 Inspection and site testing of thermoplastic polyolefin membrane roofing membrane application will be carried out by roof membrane manufacturer.

3.11 CLEANING

.1 Clean Work in accordance with Section 01 74 11 - Cleaning.

.2 Check drains to ensure cleanliness and proper function, and remove debris, equipment and excess material from site.

3.12 PROTECTION

.1 Protect installed products until completion of project.

.2 Touch-up, repair or replace damaged products before Substantial Completion

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for sheet metal roofing and associated air barrier for conventional installation on sloped wood deck on Outbuilding 165.

1.2 RELATED SECTIONS

.1 Section 07 62 00 – Sheet Metal Flashing and Trim.

.2 Section 07 72 53 – Snow Guards

.3 Section 07 92 00 - Joint Sealants.

1.3 REFERENCES

.1 ASTM International

.1 ASTM A653/A653M-10, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM A792/A792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.

.3 ASTM D523-89(2008), Standard Test Method for Specular Gloss.

.4 ASTMC1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

.5 ASTM D1970, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

.2 Canadian Sheet Steel Building Institute Standards

.1 CSSBI S8-2001, Quality & Performance Specification for Prefinished Sheet Steel Used for Building Products

.2 CSSBI 10M and 20M.

1.4 ROOF DESCRIPTION

.1 Roof Type R11 as noted on drawings.

1.5 DESIGN CRITERIA

.1 Roofing Panels manufactured, fabricated and installed to withstand structural and thermal movement, wind load, snow build-up and weather exposure without defects, damage, and infiltration of water.

.2 Design roof system in accordance with:

.1 CAN/CSA Standard S136 latest edition for the Design of Cold Formed Steel Structural Members.

.2 Canadian Sheet Steel Building Institute Standards 10M and 20M.

.3 National Building Code of Canada (latest edition).

.3 Design fastener systems to withstand wind uplift on the roof and sliding forces induced by environmental loads.

.4 Select ridge ventilation products in coordination with Section 07 62 00 to ensure soffit and roof ventilation products provide the required net free ventilated area to suit National Building Code requirements.

.5 This section is responsible to provide a snow guard designed specifically for this roof by a professional engineer registered in the province of Saskatchewan.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for sheet metal roofing and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate arrangement of prefinished roof sheets including joints, types and locations of supports, fasteners, sealants and all metal components related to the roof installation.

.3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan, Canada.

.4 Samples:

.1 Submit duplicate 300 x 300 mm samples of each sheet metal material.

1.7 QUALITY ASSURANCE

.1 Manufacturer and installer of the metal roof system must have a minimum of 5 years' experience in fabrication and installation of architectural metal roofing projects similar in scope.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect sheet metal roofing from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Do not install roofing materials or adhesives when temperature is below manufacturer's recommendations.

.2 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.

1.10 QUALIFICATIONS

.1 Applicator: Company specializing in performing work of this section with minimum 5 years documented experience in installation of roof systems. roofing contractor will supply and install materials to acceptance of manufacturer in order to qualify for manufacturer's warranty.

1.11 WARRANTY

.1 Contractor shall warrant that the sheet metal roofing and companion flashing and snow guard will stay in place and remain leakproof in accordance with the General Conditions, but for two years.

Part 2 Products

2.1 COMPATIBILITY

.1 Compatibility between components of system and adjacent materials is essential. Provide a written declaration to Consultant stating that materials and components, as assembled in system, meet this requirement and are eligible for system warranty.

2.2 SHEET METAL MATERIALS

.1 Aluminum-zinc alloy coated steel sheet: to ASTM A792/A792M, Grade 230, with AZ150 coating (Galvalume), regular spangle surface, unoiled, thermally cured clear organic resin passivation coating for unpainted finish.

2.3 PROFILE

.1 Profile equivalent to Vicwest, "Prestige 16" or approved equivalent.

.2 Single skin system on rigid decking.

.1 Snap-In/Interlocking Progressive System; thermal clip; standing seam-style seam, 38mm high, 400mm (15.75") wide panels.

.2 No exposed fasteners.

.3 Finish: Weather X.

.4 Colour: 16154 Metro Brown

2.4 UNDERLAYMENT MEMBRANE

.1 Self-adhered water resistive, high heat resistant, air and moisture barrier membrane to ASTM E 2178. Consisting of butyl rubber based adhesive with protective plastic release liner backed with a layer of high density cross laminated polyethylene, suitable for roof

underlayment. Min. 0.76mm thickness (30 mils). Permeable self-adhesive layer with release film. Refer to details on drawings for locations and assembly.

.1 Grace Company: Grace Ultra

.2 Approved equivalent

2.5 ACCESSORIES

.1 Roof Panel Support System: Hidden fastener, purpose-made, thermally responsive full height clip system, designed to accommodate full thermal expansion and contraction of the exterior roof sheet. Clips to be fabricated from a minimum of 0.61mm steel, with minimum Z275 galvanized coating.

.2 Roof fasteners as specified by manufacturer to resist wind uplift and sliding snow forces.

.3 Flashing: in accordance with Section 07 62 00 and manufacturer recommendations. Color: To match Metal Roofing Sheet. Formed from same materials (thickness and finish) as the Metal Roofing Sheet. Flashings to be custom fabricated to suit architectural details, as required.

.4 Snow guard: Refer to Section 07 72 53 – Snow Guards.

.5 Closures: Foam and metal closures to suit profiles selected, to manufacturer's recommendations.

.6 Sealants: In accordance with manufacturer's recommendation and Section 07 92 00.

.7 Isolation coating: alkali resistant bituminous paint.

.8 Touch-up paint: as recommended by sheet metal roofing manufacturer.

.9 Ridge vent: VicWest Field Notched Ridge Cap. Color to match roofing panels.

2.6 FABRICATION

.1 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.2 Fabricate Metal Roofing System components to comply with dimensions, profiles, gauges and details as shown on the approved shop drawings, including all companion flashings.

.3 Fabricate all components of the system in the factory, ready for field installation.

.4 Provide roof sheet and all accessories in longest practicable length to minimize field lapping.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sheet metal roofing installation in accordance with manufacturer's written instructions.

.1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 UNDERLAYMENT MEMBRANE

.1 Install as per manufacturer's written instructions.

3.3 INSTALLATION – ROOF PANEL SYSTEM

.1 Provide metal roofing sheets in longest standard length available from manufacturer.

.2 Install exterior prefinished roof panels on panel support clips, using manufacturer's proper construction procedure. Ensure metal roofing sheet side-lap is positively retained by clips, and proper sheet coverage is maintained.

.3 Install the seam-cap at all side laps as shown on the approved shop drawings. Add sealant as required. Mitre snap-cap as required to resist water entry.

.4 Where indicated on approved shop drawings, secure the end-lap of metal roofing sheets in accordance with the manufacturers specifications and details to provide a weather-tight seal. Exposed fasteners to match colour of the roof sheet.

.5 Provide notched and formed closures, sealed against weather penetration, at changes in pitch, at ridges and eaves and vertical walls where required.

.6 Install all companion flashing as shown on the shop drawings. Use concealed fasteners when possible. Exposed fasteners to match colour of roof sheet.

3.4 SNOW GUARDS

.1 Install snow guards in accordance with approved engineered shop drawings.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by sheet metal roofing installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 05 50 00 – Metal Fabrications

.2 Section 07 46 13 – Preformed Metal Siding

.3 Section 07 54 23 – Thermoplastic Membrane Roofing

.4 Section 07 61 00 – Sheet Metal Roofing.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International)

.1 ASTM A653/A653M-01a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian Roofing Contractors Association (CRCA)

.1 Roofing Specifications Manual 1997.

.3 Canadian Standards Association (CSA International)

.1 CSA B111-1974 (R1998), Wire, Nails, Spikes and Staples

1.3 SAMPLES

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit duplicate 100 x 100 mm samples of each type of sheet metal material, colour and finish.

1.4 DESIGN CRITERIA

.1 Select soffit ventilation products in coordination with Section 07 61 00 to ensure soffit and roof ventilation products provide the required net free ventilated area to suit National Building Code requirements.

1.5 WARRANTY

.1 Contractor shall warrant that sheet metal flashings will stay in place and remain leakproof in accordance with General Conditions (GC) - CCDC GC 12.3 , but for two years.

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: 0.8 mm thickness, commercial quality to ASTM A653/A653M, with Z275 designation coating.

2.2 PREFINSIHED STEEL SHEET

.1 Prefinished steel with factory applied silicone modified polyester finish.

.1 Stelco / Dofasco 8000 Series

.2 Colours : vary – see below.

2.3 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB 37.5.

.3 Sealants: two component polyurethane, colour to match adjacent materials.

.4 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

.5 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.

.6 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.7 Solder: to ASTM B32, alloy composition.

.8 Touch-up paint: as recommended by prefinished material manufacturer.

2.4 METAL FLASHINGS, CAP FLASHINGS AND FASCIAS

.1 Form flashings, copings and fascias to profiles indicated of 0.8mm thick prefinished steel.

.2 Police Building: Perimeter Cap Flashing: Colour to match VicWest 16084 Navy Blue. Interior Cap Flashing: Selected by Consultant from manufacturer's standard range of colours.

.3 Police Building: Colour of miscellaneous prefinished metal flashings: Match color of adjacent metal siding.

.4 Outbuilding 165: Colour of fascia: White.

2.5 EAVES TROUGHS AND DOWNPIPES – Outbuilding 165

.1 Form eaves troughs and downpipes from prefinished steel, 28 gauge.

.2 Clip hanger: galvanized metal hanger and stainless steel screws as recommended by eave trough manufacturer.

.3 Sizes and profiles as indicated. Color: White.

.4 Provide goosenecks, outlets, strainer baskets and necessary fastenings.

2.6 RAIN WATER LEADERS (RWL) AND SUPPORT BRACKETS – Police Building

.1 See drawings and Section 05 50 00.

2.7 SCUPPERS – Police Building

.1 Form scuppers from 1.2mm thick prefinished metal. Scuppers fully welded.

.2 Sizes and profiles as indicated in drawings.

.3 Provide necessary fastenings.

.4 Colour to match adjacent metal siding.

.5 Provide transition from eave trough to HSS rainwater leader. Refer to Section 05 50 00 Metal Fabrications.

2.8 VENTILATED SOFFIT –Building 165

.1 Colour: Bright White.

.2 Size: 407 mm (16”) x 3700 mm (12’-1 5/16”)

.3 Style: 2 Panel Heavy Gauge Aluminum.

.1 Acceptable products: Gentek 1607 Vented or approved alternate. Coordinate with Section 07 61 00 to ensure soffit and roof ventilation products provide the required net free ventilated area to suit National Building Code requirements.

Part 3 Execution

3.1 FABRICATION

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details as indicated.

.2 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.

.3 Hem exposed edges on underside 12 mm. Mitre and seal corners with sealant.

.4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

.6 Coordinate with Section 07 61 00 to ensure soffit and roof ventilation products provide the required net free ventilated area to suit National Building Code requirements.

3.2 INSTALLATION

.1 Install sheet metal work in accordance with CRCA FL series details, FL Aluminum Sheet Metal Work in Building Construction and as detailed.

.2 Use concealed fastenings except where approved before installation.

.3 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock forming tight fit over hook strips, as detailed.

.4 "S-Lock" end joints and caulk with sealant.

.5 Install metal flashing under cap flashing to form weather tight junction.

3.3 EAVES TROUGHS AND DOWNPIPES –Building 165

.1 Install eaves troughs and secure to building at 750 mm on centre with strap anchors.

.1 Slope eaves troughs to downpipes as indicated.

.2 Match exposed screw heads to colour of eave trough.

.3 Seal joints watertight.

.2 Install downpipes and provide goosenecks back to wall.

.1 Secure downpipes to wall with straps at 1800 mm on centre; minimum two straps per downpipe. Color: White.

.3 Install splash pans as indicated.

3.4 RAIN WATER LEADERS (RWL) AND SUPPORT BRACKETS – Police Building

.1 Refer to Section 05 50 00.

.2 Fabricate down spouts as indicated on drawings.

.3 Install down spouts as indicated on drawings.

.4 Install splash pads as indicated.

3.5 SCUPPERS – Police Building

.1 Form scuppers from 1.2 mm prefinished metal. Provide fasteners as required to secure scupper in wall. Scuppers shall be formed in a box shape and shall be continuous through entire depth of wall. Transition to hollow steel section rain water leaders.

.2 Install in locations indicated on drawings.

3.6 VENTILATED SOFFIT

.1 Install as indicated on drawings as per manufacturer's written instructions.

END OF SECTION

PART 1 General

1.1 SECTION INCLUDES

.1 Floor and roof access hatches.

1.2 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 21 13 – Board Insulation

.3 Section 07 27 00 – Vapour Retarders

.4 Section 07 54 23 – Thermoplastic Polyolefin Roofing

.5 Section 07 62 00 – Sheet Metal Flashing and Trim

1.3 REFERENCES

.1 ASTM International

.1 ASTM A506-12, Standard Specification for Alloy and Structural Alloy Steel, Sheet and Strip, Hot-Rolled and Cold-Rolled.

.2 ASTM B370-11e1, Standard Specification for Copper Sheet and Strip for Building Construction.

.3 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 CSA International

.1 CSA B111-1974(R2005), Wire Nails, Spikes and Staples.

1.4 DESIGN REQUIREMENTS

.1 Cover shall be reinforced to support a minimum live load of 195 kg/m2 (40 psf) with a maximum deflection of 1/150th of the span or 98 kg/m2 (20 psf) wind uplift.

.2 Operation of cover to be smooth and easy with controlled operation throughout entire arc of opening and closing.

.3 Operation of cover to be unaffected by temperature.

.4 Entire roof hatch shall be watertight with fully welded joints on cover and curb.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00, Submittals.

.2 Indicate size and description of components, location, materials, attachment devices, description of frame and finish, and construction interface details, dimensions.

1.6 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for hardware complete with pertinent details, spare parts lists and warnings against harmful maintenance materials and practices for incorporation into manual specified in Section 01 33 00, Submittals.

PART 2 Products

2.1 ACCEPTABLE PRODUCTS / MAUNFACTURERS

.1 ROOF ACCESS HATCH

.1 Basis of Design: Bilco Canada Type S-50T Ladder Access Enhanced Performance Roof Hatch or approved equal.

.2 Size: 762mm x 915mm (30" x 36"). Flange Depth: See drawings.

.3 RSI Value: RSI 2.1 (R12) minimum

.4 Approved equal.

.5 Hatch Cover:

.1 Metal Cover: Preformed, prefinished sheet aluminum, insulated sandwich construction.

.2 Lockable by means of ower's padlock from interior.

.6 Curbed Frame:

.1 Preformed metal curb: insulated sandwich construction, with deck flange for attachment.

.7 Accessories

.1 Safety post: manufacturer's standard.

.2 CRAWLSPACE ACCESS HATCH

.1 Basis of Design: Bilco Canada Type T Floor Access Door or approved equal.

.2 Size: Single leaf. 914mm x 914mm (36" x 36"). Flange Depth: See drawings.

.3 Hatch Cover:

.1 Metal Cover: Shall be 6mm aluminum smooth pattern plate with extruded aluminum molding 3mm height fastened to the cover to receive floor covering.

.2 Shall be reinforced to support a minimum live load of 150 psf (732 kg/m^2) with a maximum deflection of 1/150th of the span.

.3 Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing. Operation of the cover shall not be affected by temperature

.4 Frame:

.1 Frame shall be extruded aluminum with strap anchors bolted to the exterior.

.5 Hinges: Shall be specifically designed for horizontal and shall be bolted to the underside of cover.

.6 Lifting mechanisms: Cam-action hinges shall pivot on torsion bars to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing.

.7 A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the cover.

.8 Hardware:

.1 Hinges: Cast steel cam-action hinges which pivot on torsion bars shall be provided.
.2 Cover shall be equipped with a steel hold open arm that automatically locks the cover in the open position.
.3 Cover shall be fitted with the required number and size of torsion bars.
.4 A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover.
.5 Hardware: shall be zinc plated and chromate sealed. Type 316 stainless steel hardware is available for installation in corrosive environments.

.9 Finishes: Factory finish shall be mill finish aluminum with bituminous coating applied to the exterior of the frame.

2.2 FABRICATION

.1 Fabricate components free of twists, bends, or visual distortion and insulated. Weld corners and joints.

.2 Assemble roof hatch components as indicated.

.3 Ensure continuity of weather-tight seal.

.4 Design flashings to collect and lead off accumulated condensation.

.5 Zinc plate hardware and attachments and shop prime ready for field painting.

PART 3 Execution

3.1 INSTALLATION

.1 Erect components plumb, level and in proper alignment.
.2 Ensure continuity of building envelope air barrier and vapour retarder systems.
.3 Adjust and seal assembly with provision for expansion and contraction of components.
.4 Secure prefabricated curb assembly to structure.
.5 Coat aluminum and copper in contact with dissimilar materials, with isolation coating.
.6 Secure and seal frame to curb.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 07 61 00 - Sheet Metal Roofing

1.2 REFERENCES

.1 Conform to the current edition of the following codes and standards:

.1 Aluminum Association (AA) - Aluminum Standards and Data, 2003 Edition.

.2 ASTM International (ASTM):
.1 B85-03 - Standard Specification for Aluminum-Alloy Die Castings.
.2 B221-04a - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.4 SYSTEM DESCRIPTION

.1 Snow fence designed by a professional engineer registered in the province of Saskatchewan. Refer to Section 07 61 00 – Sheet Metal Roofing.

.2 Loading: Supplier to Design the 'Snow Guard System' to meet all applicable codes and loading requirements.

.3 Factor of safety: Utilize a factor of safety 2 to determine allowable loads from ultimate tested clamp tensile load values.

.4 Attachment system to provide attachment to standing seam metal roof:

.1 With only minor dimpling of panel seams.
.2 Without penetrations through roof seams or panels.
.3 Without use of sealers or adhesives.
.4 Without voiding roof warranty.

1.5 SUBMITTALS

.1 Submittals for Review:
.1 Shop Drawings: Show locations of snow guards on roof and attachment spacing.
.2 Product Data: Include product description and installation instructions.
.3 Samples:
.1 Clamp samples.
.2 24 inch long cross member samples including coupler and other hardware.

.2 Quality Control Submittals:
.1 Test results: Results of product load testing, issued by a recognized independent testing laboratory, showing load-to-failure value of attachment.

.3 Closeout Submittals:

.1 Certification: Installer's certification that snow guard system was installed in accordance with manufacturer's instructions and approved Shop Drawings.

Part 2 Products

2.1 COMPONENTS

.1 Clamps:

.1 Manufactured from 6061-T6 aluminum extrusions conforming to ASTM B221 or aluminum castings conforming to ASTM B85 and to AA Aluminum Standards and Data.

.2 Clamp model: clamp suitable for the standing seam metal roofing. Non-penetrating.

.3 Set screws: 300 Series stainless steel, 18-8 alloy, 3/8 inch diameter, with round nose point.

.4 Attachment bolts: 300 Series stainless steel, 18-8 alloy, 10 mm diameter, with flat washers.

.2 Brackets:

1. Manufactured from 6061-T6 alloy and temper aluminum extrusions conforming to ASTM B221 and AA Aluminum Standards and Data or cast aluminum.
2. Screws for attachment of brackets to roof: Stainless steel of type best suited to application.

.3 Cross Members:

.1 Manufactured from 6061-T6 alloy and temper aluminum extrusions conforming to ASTM B221 and AA Aluminum Standards and Data.

.2 Receptacle in face to receive color-matched metal strips.

.3 Provide splice connectors ensuring alignment and structural continuity at end joints.

.4 Colour Strips: Same material and finish as roof panels; obtained from the roof panel manufacturer.

.5 Snow and Ice Clips: Aluminum, with rubber foot, minimum 3 inches wide. The number of clips to be as per manufacturers recommendations.

2.2 ACCEPTABLE MANUFACTURERS

.1 Metal Roof Innovations, Ltd.- S-5! ColorGard complete with S-5! Clamps compatible with roof panel system

.2 Approved equivalent

Part 3 Execution

3.1 EXAMINATION

.1 Prior to beginning installation, verify that:

.1 Panel seaming is complete.

.2 Panel attachment is sufficient to withstand loads applied by snow guard system.

3. Installation will not impede roof drainage.

3.2 PREPARATION

.1 Clean areas to receive attachments; remove loose and foreign matter that could interfere with installation or performance

3.3 INSTALLATION

.1 Install system in accordance with manufacturer's instructions and approved Shop Drawings.

.2 Place clamps as required by design engineer.

.3 Place clamps in straight, aligned rows.

.4 Place both set screws on same side of clamp.

.5 Tighten set screws to manufacturer's recommended torque. Randomly test set screw torque using calibrated torque wrench.

.6 Insert color-matched metal strips into cross members, staggering strips to cover cross member joints.

.7 Attach cross members to clamps; tighten bolts to manufacturer's recommended torque.

.8 Install couplers at cross member end joints.

.9 Do not cantilever cross members more than 4 inches beyond last clamp at ends.

.11 Install SnoClips at spacings indicated on shop drawings.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for roof anchors and safety restraints at the Police Building.

1.2 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 05 50 00 – Metal Fabrications

.3 Section 07 54 00 – Thermoplastic Membrane Roofing

1.3 REFERENCES

.1 CSA International

.1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel.

.3 CSA W55.3-08, Certification of Companies for Resistance Welding of Steel and Aluminum.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for roof anchors and safety restraints and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan, Canada.

.1 Indicate component profiles, sizes, connection attachments, reinforcing, anchorage, flashing, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

.2 Indicate welded connections using standard welding symbols include net weld lengths.

.2 Submit design data and calculations.

.3 Submit load test results and certification.

1.5 QUALITY ASSURANCE

.1 Design structural support framing components under direct supervision of Professional Structural Engineer experienced in design of this Work and licensed in the Province of Saskatchewan of Canada.

.2 Qualifications:

.1 Welder's qualifications: welders certification to CSA W55.3

.1 Employ qualified and licensed welders possessing certificates for each procedure to be performed.

.3 Load testing

.2 Following installation of roof anchors perform load test on each roof anchor to verify anchor is capable of meeting specified load requirements.

.3 Load test to be performed by trained personnel certified to perform load testing.

.4 Submit report to Departmental Representative certifying test results and indicating pass or fail for each anchor.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect roof anchors and safety restraints from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Personal Restraint Assembly: Posts and attachments to resist lateral forces of 24.03 kN at any point and in all directions, without damage or permanent set.

2.2 MATERIALS

.1 Steel Sections and Plates: CSA G40.20M/G40.21.

.2 Steel Tubing: ASTM A500/A500M, Grade B, hot dipped galvanized.

.3 Steel Rings: Type 304 stainless steel, forged, ring thickness determined by imposed loads.

.4 Cap: Stainless steel, type 304.

.5 Stack Flashing: aluminum flashing with TPO pressure seal grommet. Sealing of unit cannot rely on caulking.

.6 Bolts, Nuts, and Washers for Stainless Steel: stainless steel, matte finish.

.7 Gaskets Under Anchors: neoprene pads, compatible with roof membrane, cut to size.

.8 Welding Materials: CSA W47.1 for materials being welded.

.9 Shop Primer: Shop Primer: Epoxy, anti-corrosive type, two coats.

2.3 FABRICATION

.1 Fit and shop assemble items in largest practical sections, for delivery to site.

.2 Fabricate items with joints tightly fitted and secured.

.3 Anchor types to suit roof assembly construction.

.4 Continuously seal joined members by intermittent welds and plastic filler.

.5 Grind exposed joints flush and smooth with adjacent finish surface.

.1 Make exposed joints butt tight, flush, and hairline.

.2 Ease exposed edges to small uniform radius.

.6 Fill hollow steel support post with urethane insulation.

.7 Exposed Mechanical Fastenings: screws or bolts; consistent with design of component.

.8 Furnish and install components required for anchorage of fabrications.

.9 Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.4 FABRICATION TOLERANCES

.1 Squareness: 3 mm maximum difference in diagonal measurements.

.2 Maximum Deviation from Plane: 1.5 mm from 1 m.

2.5 FINISHES

.1 Concealed steel anchors, clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

.2 Do not prime surfaces in direct contact with concrete or where field welding is required.

.3 Concealed Structural Components and Anchors: galvanize after fabrication to ASTM A123/A123M to minimum 600 g/sq m galvanized coating.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for roof anchors and safety restraint installation in accordance with manufacturer's written instructions.

.2 Verify dimensions, tolerances, and method of attachment with other work.

3.2 PREPARATION

.1 Supply and install steel items required to be attached to steel framing as clean uncoated metal, with setting templates to appropriate sections.

3.3 ERECTION TOLERANCES

.1 Maximum Variation from Plumb: 6 mm.

3.4 INSTALLATION

.1 Install items plumb and level, accurately fitted, free from distortion or defects.

.2 Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

.3 Field weld components as indicated on shop drawings.

.4 Obtain approval from Consultant prior to site cutting or making adjustments not scheduled.

.5 After erection, apply primer in accordance with MPI Painting Manual to: welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.5 LOAD TESTING

.1 Perform load test on each roof anchor.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by roof anchors and safety restraint installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 09 21 16 - Gypsum Board Assemblies

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 Underwriter's Laboratories of Canada (ULC)

.1 ULC-S115-2011, Fire Tests of Fire stop Systems.

1.3 DEFINITIONS

.1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.

.2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.

.3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.

.4 Tightly Fitted; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction.

.1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

.3 Shop Drawings:

.1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.

.2 Construction details should accurately reflect actual job conditions.

.4 Samples:

.1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.

.5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.

.1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company or person specializing in fire stopping installations with 5 documented years experience.

.2 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.

.1 Upon completion of Work, after cleaning is carried out.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.

.2 Storage and Protection:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

.3 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.

.1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended.

.2 Fire stop system rating: as indicated in drawings.

.2 Re-penetrable fire rated cable pathway system for power and communication cables.

.1 Square profile, heavy gauge galvanized steel with intumescent material for rapid expansion.

.2 Wall and floor applications.

.3 Accessories including manufactured multi-gang plates, brackets, extensions and multi-slot frames.

.4 Minimum fire rating of 4 hours.

.5 Approved systems:

.1 ETI EZ Path 44+ fire rated pathway system complete with all accessories

.3 Service penetration assemblies: systems tested to CAN-ULC-S115.

.4 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.

.5 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.6 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.7 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

.8 Fire stopping and smoke seal system at module joints: engineered judgement by manufacturer.

.9 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.10 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.11 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.12 Sealants for vertical joints: non-sagging.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.

.1 Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

.1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.4 SPECIAL REQUIREMENTS

.1 Location of special requirements for fire stopping and smoke seal materials at openings and penetrations in fire resistant rated assemblies are as follows:

.1 Design firestopping system to be re-penetrable at all data and communications cable penetrations.

.2 Fire stopping system at building module joints to be engineered by firestop manufacturer.

3.5 SEQUENCES OF OPERATION

.1 Proceed with installation only when submittals have been reviewed by Departmental Representative.

.2 Install floor fire stopping before interior partition erections.

.3 Mechanical pipe insulation: certified fire stop system component.

.1 Ensure pipe insulation installation precedes fire stopping.

3.6 FIELD QUALITY CONTROL

.1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.8 SCHEDULE

.1 Fire stop and smoke seal at:

.1 Penetrations through fire-resistance rated gypsum board partitions and walls.

.2 Top of fire-resistance rated gypsum board partitions.

.3 Intersection of fire-resistance rated gypsum board partitions.

.4 Control joints in fire-resistance rated gypsum board partitions and walls.

.5 Penetrations through fire-resistance rated floor assemblies.

.6 Openings and sleeves installed for future use through fire separations.

.7 Around mechanical and electrical assemblies penetrating fire separations.

.8 Rigid ducts: greater than 129 cm^2 : fire stopping to include bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation. Submit ULC listed assembly as per Section 01 33 00.

.9 Joints between modules at the floor, walls, ceiling, door openings, interior window openings and all other exposed joints between modules.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials, preparation and application for caulking and sealants.

1.2 RELATED SECTIONS

.1 Section 06 40 00 - Architectural Woodwork.

.2 Section 07 27 00 – Air and Vapour Barriers

.3 Section 07 62 00 – Sheet Metal Flashing and Trim

.4 Section 08 54 13 – Fiberglass Windows

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).

.2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).

.4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

.5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data

.1 Manufacturer's product to describe.

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.2 Submit manufacturer's instructions in accordance with Section 01 33 00 - Submittal Procedures.

.1 Instructions to include installation instructions for each product used.

.3 Samples:

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit duplicate samples of each type of material and colour.

.3 Submit cured samples of exposed sealants for each color where required to match adjacent material.

.4 Maintenance Manuals:

.1 Conform to Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.6 PROJECT CONDITIONS

.1 Environmental Limitations:

.1 Do not proceed with installation of joint sealants under following conditions:

.1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 5 degrees C.

.2 When joint substrates are wet.

.2 Joint-Width Conditions:

.1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

Part 2 Products

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which offgass to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

.3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT TYPES

.1 Type 1 -Urethanes Three Part.

.1 Non-Sag to CAN/CGSB-19.24, Type 2, Class B, colour as selected by Consultant from standard range of manufacturer's colours.

.1 Acceptable material: Tremco "Dymeric 240",

.2 Or equivalent.

.2 Type 2 -Urethanes One Part.

.1 Non-Sag to CAN/CGSB-19.13, Type 2, colour as selected by Consultant from standard range of manufacturer's colours.

.1 Acceptable material: BASF "Sonolastic NP 1".

.2 Or equivalent.

.3 Type 3 -Silicones One Part.

.1 To CAN/CGSB-19.13. Colour as selected by Consultant from standard range of manufacturer's colours.

.1 Acceptable material: Dow Corning "Tub, Tile & Ceramic Silicone Sealant".

.2 Or equivalent.

.4 Type 4 -Acrylic Latex One Part.

.1 To CAN/CGSB-19.17.

.5 Type 5 -Acoustical Sealant.

.1 To ASTM C919.

.6 Type 6 –Single Component Silicone Rubber sealant

.1 Self-leveling elastomeric polyurethane to ASTM C 920 Type S, Grade P. Colour as selected by Consultant from standard range of manufacturer's colours.

.1 Acceptable material: BASF "Silcoferm S".

.2 Or equivalent.

.7 Type 7 –Epoxy Adhesive – Security Sealant

.1 Acceptable material: “Dynapoxy EP-430 Fast”

.2 No substitutions permitted.

.3 Refer to drawings and schedule at the end of this section for locations.

2.3 PREFORMED COMPRESSIBLE AND NON-COMPRESSIBLE BACK-UP MATERIALS.

.1 Polyethylene, Urethane, Neoprene or Vinyl Foam.

.1 Extruded open closed cell foam backer rod.

.2 Size: oversize 30 to 50 %.

.2 Neoprene or Butyl Rubber.

.1 Round solid rod, Shore A hardness 70.

.3 High Density Foam.

.1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m^3 density, or neoprene foam backer, size as recommended by manufacturer.

.4 Bond Breaker Tape.

.1 Polyethylene bond breaker tape which will not bond to sealant.

2.4 SEALANT SELECTION

.1 Exterior sealant: Sealant type: 1 or 2 (colour to be selected by consultant).

.2 Perimeters of exterior openings where door and window frames meet exterior facade of building : Sealant type: 1 or 2.

.3 Seal interior perimeters of exterior openings: Sealant type: 3.

.4 Poly Vapour Barrier: Sealant type: 5.

.5 Perimeters of interior window and door frames, base of interior door frames between frame and floor finish: Sealant type: 4.

.6 Tops and bottoms of acoustic walls. Sealant type: 5.

.7 Perimeters of countertop edges, Sealant type: 4.

.8 Perimeter of fixtures (e.g. sinks, urinals, waterclosets, basins, vanities): Sealant type: 3.

.9 In additional locations as noted on the drawings: confirm with Consultant.

2.5 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.2 Primer: as recommended by manufacturer.

Part 3 Execution

3.1 PROTECTION

.1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter that may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

.1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

.1 Refer to referenced Sections for specific installation instructions.

.2 General Installation.

.1 Apply sealant in accordance with manufacturer's written instructions.

.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.

.3 Apply sealant in continuous beads.

.4 Apply sealant using gun with proper size nozzle.

.5 Apply sufficient pressure to fill voids and joints solid.

.6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.7 Tool exposed surfaces before skinning begins to give slightly concave shape.

.8 Remove excess compound promptly as work progresses and upon completion.

.3 Curing.

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place.

.4 Cleanup.

.1 Clean adjacent surfaces immediately and leave Work neat and clean.

.2 Remove excess and droppings, using recommended cleaners as work progresses.

.3 Remove masking tape after initial set of sealant.

3.7 SCHEDULE – SEALANT TYPE 7

.1 Apply Type 7 sealant to all gaps within scheduled rooms including, but not limited to toilet/sink, light fixtures, door frames, air grilles, smoke detector covers, and security camera housings.

.2 Room schedule:

129,130,130.1,130.2,130.3,130.4,131,133,134,135,136,137,138,139,141,144,145,146,147,

149,150,151,156

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for metal doors and frames in the police building and Building 165.

1.2 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 46 13 – Preformed Metal Siding

.3 Section 08 14 16 – Flush Wood Doors

.4 Section 08 34 74 – Acoustic Steel Door and Frame Assemblies

.5 Section 08 71 00 - Door Hardware.

.6 Section 08 90 10 - Door, Frame, and Hardware Schedule.

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM C591-13, Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

.3 ASTM C1289-13e1, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA International)

.1 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door Manufacturers' Association (CSDMA)

.1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.

.2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 2009.

.5 National Fire Protection Association (NFPA)

.1 NFPA 80-2013, Standard for Fire Doors and Fire Windows.

.2 NFPA 252-2013, Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC S104-10, Standard Method for Fire Tests of Door Assemblies.

1.4 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.

.2 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC S104 for ratings specified or indicated.

.3 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC S104, ASTM E152 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

1.5 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.

.3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan, Canada.

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, louvred, arrangement of hardware and fire rating and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing, fire rating, and finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

Part 2 Products

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

2.2 DOOR CORE MATERIALS

.1 Honeycomb construction:

.1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m^3 minimum sanded to required thickness.

.2 Insulated core:

.1 Polyisocyanurate: Rigid, modified polyisocyanurate, closed cell board. Density; 32 kg/m^3 (2.0 pcf) minimum, thermal values; RSI 1.9 (R 11.0) minimum, in accordance with ASTM C591 (un-faced) or C 1289 (faced).

.3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door. Core to be tested as part of a complete door assembly, in accordance with CAN/ULC S104, ASTM E152 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

2.3 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.1 Adhesive: maximum VOC content 50 g/L.

.2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

2.4 PRIMER

.1 Touch-up prime CAN/CGSB-1.181.

.1 Maximum VOC limit 50 g/L.

2.5 PAINT

.1 Factory paint steel doors and frames in accordance with Sections 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

2.6 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior and interior top and bottom caps: steel.

.3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

.4 Metallic paste filler: to manufacturer's standard.

.5 Fire labels: metal riveted.

.6 Sealant: in accordance with Section 07 92 00 – Joint Sealants.

.1 Maximum VOC limit 250 g/L.

.7 Glazing: in accordance with Section 08 80 50 - Glazing.

.8 Make provisions for glazing as indicated and provide necessary glazing stops.

.1 Provide removable 0.9mm formed steel channels, 16mm high for use with glazing tapes and compounds and secured with countersunk stainless steel screw.

.2 Design exterior glazing stops to be tamperproof.

2.7 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Exterior frames: 1.6 mm welded, thermally broken type construction using rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19MA.

.4 Interior frames: 1.6 mm welded type construction.

.5 Strike bucket: accept a 25 mm throw dead bolt. Grout or wedge in the area of the strike bucket to prevent spreading.

.6 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.7 Protect mortised cutouts with steel guard boxes.

.8 Prepare frame for door silencers, 3 for single door, 2 at head for double door.

.9 Manufacturer's nameplates on frames and screens are not permitted.

.10 Conceal fastenings except where exposed fastenings are indicated.

.11 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.12 Insulate exterior frame components with polyurethane insulation.

.13 Prepare frames to receive electronic monitoring and security devices. Refer to Section 08 71 10 - Door Hardware and Section 08 90 10 - Door, Frame and Hardware Schedule. Coordinate frame preparation with Electrical Divisions 26 and 28.

.14 Frames to be prepped to accommodate

2.8 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

.4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 FRAMES: WELDED TYPE

.5 Welding in accordance with CSA W59.

.6 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.7 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.8 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.9 Securely attach floor anchors to inside of each jamb profile.

.10 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.10 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

.2 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.3 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.4 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.5 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.6 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.7 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN/ULC S104, ASTM E152, or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.8 Manufacturer's nameplates on doors are not permitted.

2.11 DOORS: CONSTRUCTION

.1 Form face sheets for interior doors from 1.6 mm sheet steel with honeycomb core laminated under pressure to face sheets.

.2 Form face sheets for exterior doors from 1.6mm sheet steel with insulated core laminated under pressure to face sheets.

2.12 THERMALLY BROKEN DOORS AND FRAMES

.1 Fabricate exterior doors as thermally broken doors by using polyisocyanurate insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.

.2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate exterior frames as thermally broken frames separating exterior parts form interior parts with continuous interlocking thermal break.

.4 Apply insulation.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continuity of air barrier and vapour retarder.

3.4 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.

- .1 Hinge side: 1.0 mm.
- .2 Latchside and head: 1.5 mm.
- .3 Finished floor, top of carpet, and thresholds: 13 mm.

.3 Adjust operable parts for correct function.

.4 Install louvres.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.6 GLAZING

.1 Install glazing for doors and frames in accordance with Section 08 80 50 - Glazing.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 11 – Rough Carpentry

.2 Section 06 40 00 - Architectural Woodwork.

.3 Section 07 92 00 – Joint Sealing

.4 Section 08 80 50 – Glazing

1.2 REFERENCES

.1 Aluminum Association (AA).

.1 DAF 45-03, Designation System for Aluminum Finishes.

.2 American Architectural Manufacturers Association (AAMA).

.1 AAMA CW-10, Care And Handling of Architectural Aluminum from Shop to Site

.2 AAMA 611, Voluntary Specifications for Anodized finishes Architectural Aluminum

.3 AAMA 609-93, Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.

.3 American Society for Testing and Materials International, (ASTM).

.1 ASTM B209M, Aluminum and Aluminum-Alloy sheet and Plate Metric

.2 ASTM E330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit catalogue details for each type of frame illustrating profiles, dimensions and methods of assembly.

.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.1 Indicate materials and profiles and provide scaled details of components for each type of door and frame.

.3 Closeout Submittals

.1 Conform to Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Protection:

.1 Apply temporary protective coating to finished surfaces. Remove coating after erection. Do not use coatings that will become hard to remove or leave residue.

.2 Leave protective covering in place until final cleaning of building.

Part 2 Products

2.1 MATERIALS

.1 Aluminum extrusions: Aluminum Association alloy AA6063-T5 anodizing quality.

.2 Fasteners: stainless steel where exposed

.3 Isolation coating: bituminous paint.

.4 Glass: refer to Section 08 80 50 – Glazing

2.2 ALUMINUM FRAMES

.1 Interior aluminum frames:

.1 Extruded aluminum frames nominal size 100 x 45 mm, front glazed system.

.2 Thickness: 3 mm

.3 Kawneer: Trifab 450 series or approved alternate.

2.3 ALUMINUM WINDOW FRAME HARDWARE (ANTI-VAULT)

.1 All components to be heavy duty.

.2 Horizontal Sliding Panel: Suspended by two heavy duty roller brackets, each having self-lubricating nylon wheel and ball bearing assembly; running in an extruded aluminum track assembly. Provide continuous extruded aluminum door glides and retainer clips along bottom for positive guide no-sway operation.

.3 Recessed pull handle (installed on office side).

.4 Cylinder thumb turn (non key design) locking device with one hand operation. Interior side Locking device to be self-activating upon closing, slam latch operation.

.1 Device: Spring loaded Transcom latch Model #865 manufactured by Sbinco (as supplied by Anotec MFG Inc.)

.2 Locate lock so it cannot be reached through the adjacent opening. Confirm location with Consultant.

.5 Pass through latch: Heavy duty, spring loaded mechanical latch.

.6 Rubber faced door stop to restrict window movement at maximum window opening.

2.4 HARDWARE

.1 Hardware to match colour of aluminum frames.

2.5 ALUMINUM FINISHES

.1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.

.1 Finish: Clear anodized AA-M12C22A31, 0.7 mil thickness, Class 1.

2.6 FABRICATION

.1 Framing to be by same manufacturer.

.2 Fabricate frames to profiles and maximum face sizes as shown. Provide minimum 22 mm bite for insulating glazed units.

.3 Reinforce mechanically joined corners and components areas of aluminum framing with interior steel clips to provide strength, stiffness and rigidity in the completed installation.

.4 Fit joints tightly and secure mechanically.

.5 Conceal fastenings.

.6 Mortise, reinforce, drill and tap frames and reinforcements to receive hardware.

.7 Isolate aluminum from direct contact with dissimilar metals, concrete and masonry.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 WINDOW INSTALLATION

.1 Install windows in accordance with manufacturer's instructions. Set frames plumb, square, level at correct elevation in alignment with adjacent work.

.2 Anchor securely.

.3 Adjust operable parts for correct function and smooth friction free operation.

.4 Make allowances for deflection of structure to ensure that structural loads are not transmitted to frames.

.5 Seal joints between window frame and other building components with clear silicone caulking.

3.3 GLAZING

.1 Glaze aluminum doors and frames in accordance with Section 08 80 50 – Glazing.

3.4 CAULKING/SEALING

.1 Apply sealant in accordance with Section 07 92 00 - Joint Sealing. Conceal sealant within the aluminum work except where exposed use is permitted by Consultant.

3.5 CLEANING

.1 Perform cleaning of aluminum components in accordance with AAMA 609.1 - Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.

.2 Clean aluminum with damp rag and approved non-abrasive cleaner.

.3 Remove traces of primer, caulking, epoxy and filler materials; clean doors and frames.

.4 Clean glass and glazing materials with approved non-abrasive cleaner.

.5 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for flush wood doors at the police building.

1.2 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 08 34 74 – Acoustic Steel Door and Frame Assemblies

.3 Section 08 71 00 - Door Hardware.

.4 Section 08 80 50 – Glazing.

.5 Section 08 90 10 – Door, Frame and Hardware Schedule.

.6 Section 09 91 23 - Interior Painting.

1.3 REFERENCES

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC).

.1 Quality Standards for Architectural Woodwork, 1st edition, 2009.

.2 Canadian Standards Association (CSA International).

.1 CAN/CSA O132.2 Series-90(R1998), Wood Flush Doors.

.2 CAN/CSA-O132.5-M1992(R1998), Stile and Rail Wood Doors.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:

.1 For caulking materials during application and curing.

.2 For door materials and adhesives.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate door types and cutouts for lights and louvres, sizes, core construction, transom panel construction and cutouts.

1.5 QUALITY ASSURANCE

.1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Protection:

.1 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.

.2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.

.3 Protect doors from scratches, handling marks and other damage. Wrap doors.

.4 Store doors away from direct sunlight.

Part 2 Products

2.1 WOOD FLUSH DOORS

.1 Solid core: to CAN/CSA-O132.2.1.

.2 Grade: AWMAC “Custom” grade unless otherwise noted.

.3 Performance Duty Level: AWMAC “Extra Heavy Duty” level unless otherwise noted

.1 Construction:

.1 Solid particleboard core: grade LD-1 or LD-2, stile and rail frame bonded to particleboard core with wood lock blocks and top blocks, 5-ply construction, 45 mm thickness. Door core and all materials shall contain no urea formaldehyde.

.2 Face Panels:

.1 Hardwood; veneer grades: Grade I (Premium), flat sliced Maple species.

.3 Adhesive: Type II (water resistant) for interior doors.

.4 Finish: Stain and clear varnish finish on site. Refer to Section 09 91 23 – Interior Painting.

2.2 ACCESSORIES

.1 Door Seals: in accordance with Section 08 34 74 – Acoustic Steel Door and Frame Assembles and as required to meet specified STC rating.

.2 Threshold: in accordance with Section 08 34 74 – Acoustic Steel Door and Frame Assemblies and as required to meet specified STC rating.

2.3 GLAZING

.1 Glass: in accordance with Section 08 80 50 - Glazing.

.2 Accessories: in accordance with Section 08 80 50 - Glazing.

2.4 FABRICATION

.1 Vertical edge strips solid hardwood compatible with face veneer. AWMAC edge type 2.

.2 Prepare doors for louvres and glazing. Provide hardwood species to match face veneer and glazing stops with mitred corners.

.3 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Unwrap and protect doors in accordance with CAN/CSA-O132.2 Series, Appendix A.

.2 Install doors and hardware in accordance with manufacturer's printed.

.3 Adjust hardware for correct function.

.4 Install glazing in accordance with Section 08 80 50 - Glazing.

.5 Install louvres and stops.

3.3 ADJUSTMENT

.1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

3.4 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking; clean doors and frames.

.3 Clean glass and glazing materials with approved non-abrasive cleaner.

.4 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Mechanical Contractor to provide access doors for mechanical components for installation by contractor under section erecting associated walls or ceilings.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit catalogue details for each type of door illustrating profiles, dimensions and methods of assembly.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for cleaning and maintenance of stainless steel finishes for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

2 Products

2.1 ACCESS DOORS

.1 Sizes: Except as indicated otherwise, to be minimum sizes as follows:
- .1 For service entry: 600 x 600 mm.
- .2 For visual inspection: 300 x 300 mm.

.2 Construction: Rounded safety corners, concealed hinges, screwdriver latch, anchor straps, able to open 180 degrees.

.3 Materials
- .1 Tiled or marble surfaces and other special areas: Stainless steel with brushed satin or polished finish as directed by Departmental Representative.
- .2 Other areas: Prime coated steel.

.4 Access doors in ductwork, refer to 23 33 00 Ductwork Accessories.

3 Execution

3.1 LOCATION

.1 Location: Ensure that equipment is within view and accessible for operating, inspecting, adjusting, servicing without using special tools.

.2 Provide adequately sized access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, humidifiers, at fire dampers, and elsewhere as indicated. Review locations prior to fabrication.

.3 Provide 100 x 100 mm (4"x 4") quick opening access doors for inspection of balancing dampers.

3.2 LOCATION

.1 Location: Ensure that equipment is within view and accessible for operating, inspecting, adjusting, servicing without using special tools.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 08 90 10 – Door, Frame and Hardware Schedule

.3 Section 09 96 53 – Elastomeric Coatings.

.4 Hollow Metal Door & Pressed Steel Frame Shop Drawings, Sept. 26, 2007

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A568/A568M-13ae1, Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.

.2 ASTM A924/A924M-13, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.3 ASTM A1008/A1008M-13, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

.4 ASTM F1450-12a, Standard Test Methods for Hollow Metal Swinging Door Assemblies for Detention Facilities.

.5 ASTM F1643 - 05 Standard Test Methods for Detention Sliding Door Locking Device Assembly

.2 Canadian Standards Association (CSA International)

.1 CSA-G40.20/G40.21M-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59-13, Welded Steel Construction (Metal Arc Welding)

.3 Canadian Steel Door Manufacturers Association (CSDMA),

.1 Selection and Usage Guide for Steel Doors and Frames, 2009.

.4 National Association of Architectural Metal Manufacturers (NAAMM)

.1 NAAMM HMMA 840-07, Installation and Storage of Hollow Metal Doors and Frames.

.2 NAAMM HMMA 841-07, Tolerances and Clearance for Commercial Hollow Metal Doors and Frames.

.3 NAAMM HMMA 863-04, Guide Specification for Detention Security Hollow Metal Doors and Frames.

.5 Owner’s Door and Frame Shop Drawings

.1 ‘Hollow Metal Door & Pressed Steel Frame Shop Drawings’ are appended to provide supplementary detailed requirements for sliding cell doors. In the event of conflict with these specifications the appended Shop Drawings will govern.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit proof of manufacturer's written certification in accordance with requirements of NAAMM HMMA 863 and ASTM F1450 for static load, rack, impact load and removable glazing stop tests.

.2 Provide performance testing data prior to fabrication. Failure to provide required testing data or submission of misrepresented testing data would result in disqualification. In the event of disqualification substitute an acceptable alternate manufacturer or subcontractor, at no additional cost to the Departmental Representative.

.3 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.

.4 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

.1 Indicate each type of door, material, internal reinforcement, mortise reinforcements, anchor types, closure methods, fastener locations, location of cut-outs for hardware, location of cut-outs for glazing, and finishes.

.2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors, and finishes.

.3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

.4 Submit test and engineering data, and installation instructions.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide documentation including:

.1 Hardware identification including part numbers, manufacturer, and source of supply.

.2 Provide to the Departmental Representative a recommended spare parts list for maintenance purposes.

.3 Complete operation, adjustment, maintenance, and repair procedures.

.4 Name, address, and telephone numbers of product supplier and installing Subcontractor.

.3 Provide two sets of Special Tools for installation and removal of each type of security screws in accordance with Section 01 78 00 - Closeout Submittals.

.4 Sign off and verification of the detention door and hardware system is required during the Commissioning process.

1.5 QUALITY ASSURANCE

.1 Perform Work to requirements of CSDMA (Canadian Steel Door Manufacturers Association) and HMMA (Hollow Metal Manufacturers Association) standards.

.2 Manufacturer:

.1 Minimum 5 years documented experience designing and manufacturing detention hollow metal door assemblies.

1.6 MOCK-UP

.1 Provide a full size mock-up in accordance with Section 01 45 00 – Quality Control for one sliding cell door.

.2 Show complete installation including door, frame, glazing, hardware and operating system. Door and controls to be indicative of final installation in every aspect with all functions operable for inspection.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Comply with HMMA 840.

.3 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.8 WARRANTY

.1 Provide Manufacturer's five (5) year warranty from date of substantial completion, covering material and workmanship.

Part 2 Products

2.1 MATERIALS

.1 Face Sheet Steel:

.1 Commercial grade steel to ASTM A568/A568M, Class 1, hot dipped galvanized to ASTM A568/A568M, commercial quality coating designation to ASTM A924/A924M, ZF075.

.2 Steel plate, shapes and bars:

.1 Structural quality to CAN/CSA-G40.20/G40.21, type 230G or 260W; free of scale, pitting and other surface blemishes.

.3 Accessories:

.1 Floor anchors, channel spreaders, tee anchors, and wall stud anchors zinc coated to ASTM A1008M, coating designation ZF075, drill stud anchors to wire tie to studs, lag bolts, shields , and bushings for existing openings.

.4 Guard boxes:

.1 ZF075 coating designation zinc finish, 1.6 mm core thickness steel unless noted otherwise.

.5 Door insulation:

.1 Fibre board insulation for sound deadening, minimum 24 kg/m density.

.6 Filler: Polyester type automotive body spot filler compound.

.7 Isolation coating: Alkali resistant bituminous paint.

2.2 DETENTION DOORS

.1 Conforming to Level 3 requirements of ANSI/NAAMM/HMMA 863 and ASTM F1450.

.2 Galvanized Steel

.1 Steel sheet faces: 2.0 mm thick (14ga.), wipecoat, flush design.

.2 Core: 2.75mm (12ga.) stiffened core in conformance with HMMA 863 standards.

.3 Epoxy primed.

.4 Mortised to accept deadlatch hardware.

.3 Fabrication Tolerances: To HMMA 841.

.4 Lexan View Lite complete with Operable Viewport Shutter

.1 In accordance with appended Owner's Door and Frame Shop Drawings.

.2 Lexan View Lite:

.1 Size: 192 x 524mm,

.2 Material: one layer of 6.35mm mar-resistant Lexan flush with inmate side of door sandwiched to one layer of 19mm Lexan on corridor side, nylon gaskets behind, and set into steel frame

.3 Operable Viewport Shutter:

.1 Material: 2.78mm (12ga.) stainless steel plate complete with 25 x 51 x 12.7mm thick stainless steel plate handle, set in 2.54mm thick steel tracks with plastic U-channel, tamper resistant screws fastened to steel door.

.2 Locate as close to door hinge side as possible.

.5 Food Pass Flap

.1 In accordance with appended Owner's Door and Frame Shop Drawings.

.2 Size: 309 x 120mm clear opening,

.3 Material: 1.99mm (14ga.) steel plate welded to 2.75mm (12ga.) steel plate reinforcement on guard side of door steel.

.4 Fabricate food pass assembly and latch, flush with inmate side of door.

2.3 DETENTION FRAMES

.1 Galvanized Steel

.1 Steel sheet: 2.75mm thick (12ga.), wipecoat.

.2 Epoxy primed.

.3 Prepared to accept heavy- weight track and hardware as indicated in appended Owner's Door and Frame Shop Drawings.

.4 Frame must be prepared for correct anchoring system compatible with the wall type.

.2 Fabrication Tolerances: To HMMA 841.

2.4 SLIDING DETENTION DOOR LOCKSET

.1 Conforming to ASTM F1643.

.2 Mechanical Detention Lockset:

.1 Five Tumbler Paracentric Mechanical Deadbolt, combination spring and deadlock, keyed one side.

.2 Heavy duty, maximum security, paracentric keyed, lever tumbler deadlock, locks and unlocks by key only.

.3 The lock must NOT automatically latch upon closing. Lock shall unlock with a half turn of the key and deadlock the latchbolt with a full turn of the key.

.4 The locks must come complete with mounting plate, strike and escutcheon.

.1 Sliding cell door: double wing escutcheon, 3 mm thick stainless steel

.5 All fasteners must be Torx Tamperproof, flat head machine screws.

.6 Sliding Door acceptable manufacturers and model numbers:

.1 Chubb 1030D-1

.2 Folger Adams 32D

.3 Southern Steel 1030D-1

.4 RR Brick 7030D.

2.5 ACCESSORIES

.1 All screws must be flathead undercut Torx Tamperproof screws. Screws must be supplied compatible with the material they are fastening, as well as the material they are securing into.

2.6 DETENTION DOORS FABRICATION

.1 Door Edge Construction: Longitudinal edges welded, filled and sanded with no visible edge seams.

.2 Door Core Construction: Stiffened with continuous steel sections, spaced with interior webs not more than 152mm apart, which upon assembly span the full thickness of the interior of the door.

.3 Top and Bottom Channels: Inverted, recessed, welded steel channels.

.4 Reinforce doors where surface mounted hardware is required

.5 Drill and tap for mortised, templated hardware.

.6 Fabricate doors with hardware reinforcement plates welded in place.

2.7 DETENTION FRAMES FABRICATION

.1 Welding in accordance with CSA W59.

.2 Welded type construction, mitred corners, securely weld on inside of profile.

.3 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to a uniform smooth finish.

.4 Factory assemble and weld frames.

.5 Fabricate frames with hardware reinforcement plates welded in place.

.6 Reinforce frames wider than 1200 mm with roll formed steel channels fitted tightly into frame head, flush with top.

2.8 FINISHES

.1 Galvanized Steel Finish: Factory applied epoxy primer to be applied to all exposed surfaces. Touch-up only, where product has been welded and ground smooth.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 63 – Detention Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor

.1 Sliding detention doors:

.1 Hinge side, latch side, and head: 3.0 mm maximum.

.2 Finished floor: 19 mm maximum.

.3 Adjust operable parts for correct function.

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Epoxy caulk perimeter of frames. Install caulking at a 45 degree angle with a consistent width and height.

3.4 ERECTION TOLERANCES

.1 Installation tolerances of installed frame for squareness, alignment, twist and plumbness are to be no more than ± 1.5mm in compliance with HMMA 841.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

.3 Remove all burrs and sharp edges after installation.

END OF SECTION

Hollow Metal Door & Pressed Steel Frame Shop Drawings

Project: SLIDING AND SWINGING CELL DOORS
LEVEL 3 NAAMM 863-98 ASTM F1450-97 PERFORMANCE CRITERIA

Prepared By: CATRIONA L JOHNSON

Date: SEPTEMBER 26, 2007

FINAL

GENERAL NOTES: PLEASE READ

1) FABRICATION OF HOLLOW METAL DOORS & FRAMES WILL NOT COMMENCE UNTIL THE FOLLOWING IS RECEIVED:
   A) APPROVED HARDWARE SCHEDULE
   C) ALL NECESSARY HARDWARE TEMPLATES
   NOTE: LEAD TIMES VARY SO THIS INFORMATION IS CRITICAL

2) THESE DRAWINGS ARE FOR THE RCMP USE ONLY. RCMP WILL NOT ACCEPT ANY RESPONSIBILITY DUE TO ERRORS CAUSED BY THE USE OF THESE DRAWINGS BY OTHER TRADES.

3) DOORS AND FRAMES TO BE REINFORCED FOR SURFACE MOUNTED HARDWARE AS REQUIRED. DRILLING AND TAPPING FOR ATTACHING OF SURFACE MOUNTED HARDWARE BY OTHERS. DOORS AND FRAMES WILL BE BLANKED, REINFORCED, DRILLED AND TAPPED FOR MORTISED TEMPLATED HARDWARE. TRIM MOUNTING HOLES AND ALL HOLES Ø1/2" [13 mm] & LESS, BY OTHERS.

4) MAXIMUM ALLOWABLE DISTANCE BETWEEN THE SLIDING DOOR AND THE FRAME MUST BE LIMITED TO 1/8" [3 mm]. FIELD SHIMMING MAY BE REQUIRED ON SITE BY THE INSTALLATION CONTRACTOR TO OBTAIN THE DESIRED CLEARANCES.

5) ALL DOORS AND FRAMES TO BE MARKED WITH THE DOOR MANUFACTURER'S NAME AND PRODUCT NUMBER ON THE SECOND HINGE FROM THE TOP UNLESS SPECIFIED OTHERWISE.

6) ALL HOLLOW METAL FRAMES SHALL BE OF WELDED CONSTRUCTION UNLESS NOTED OTHERWISE.

7) ALL SWING TYPE FRAMES TO BE PREPARED FOR PUSH-IN TYPE SILENCERS, 3 PER STRIKE JAMB FOR SINGLE FRAMES OR 2 PER HEAD FOR DOUBLE FRAMES.

8) ALL HARDWARE LOCATIONS ON THE DOORS & FRAMES TO BE AS PER THE FOLLOWING DRAWINGS, UNLESS ADVISED OTHERWISE.

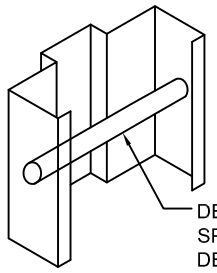
9) GENERAL CONTRACTOR IS RESPONSIBLE TO ENSURE THAT FRAMES AND DOORS ARE SET PLUMB, SQUARE, LEVEL AND THAT WALLS AND FRAME ARE FULLY GROUTED. THE MANUFACTURER OF HOLLOW METAL DOORS AND/OR PRESSED STEEL FRAMES CAN NOT CONTROL THE QUALITY OF EITHER THE HARDWARE, THE FIELD INSTALLATION OF HARDWARE, OR THE PROPER ERECTION OF FRAMES IN THE WALL.

10) ALL BURRS AND SHARP EDGES MUST BE REMOVED AFTER INSTALLATION.

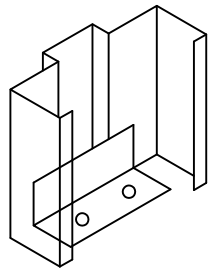
11) THE FOLLOWING SHOP DRAWINGS REFLECT A STANDARD 195 mm BLOCK WALL CONSTRUCTION, SITE CONDITIONS MAY VARY.

REVISIONS:	NOTES:		JOB:		
REVISION AS PER THE MEETING ON JULY 20, 2006		FINAL	CONTRACTOR:		
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007	
			W.O.#:	FILE NUMBER:	PG.#: 2

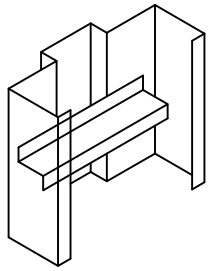
A-3 ANCHOR TYPES



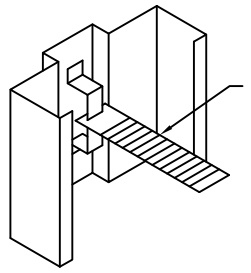
WELDED ROD ANCHOR



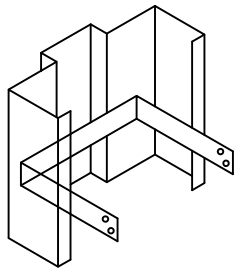
STANDARD FIXED BASE ANCHOR



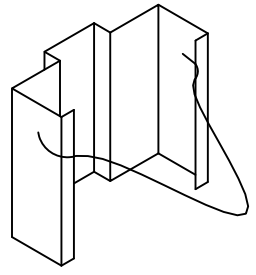
STEEL STUD ANCHOR



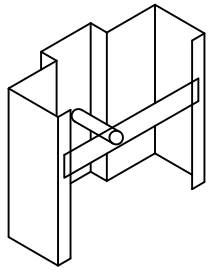
CORRUGATED TAIL ANCHOR



WOOD STUD ANCHOR



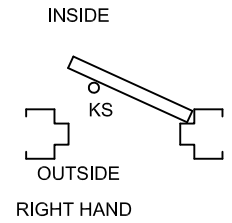
CONCRETE BLOCK WALL WIRE ANCHOR



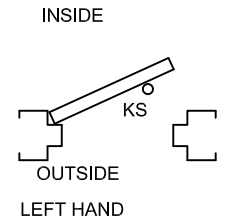
EXISTING WALL ANCHOR

B-3 DOOR AND FRAME HANDING CHART

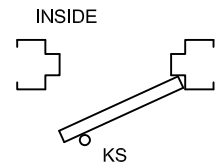
TO DETERMINE HAND(SWING) OF DOOR AND FRAME STAND OUTSIDE - FACING DOOR



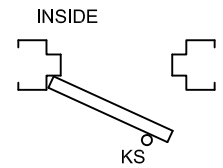
RIGHT HAND



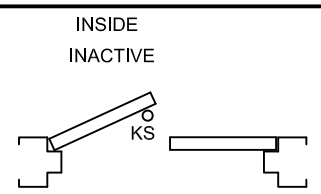
LEFT HAND



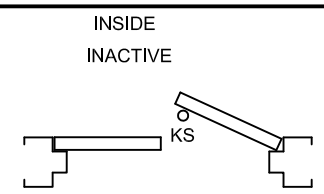
OUTSIDE
RIGHT HAND REVERSE



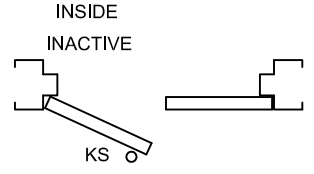
OUTSIDE
LEFT HAND REVERSE



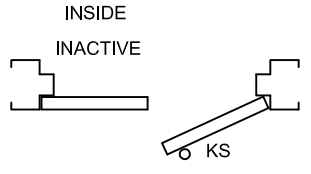
OUTSIDE
PAIR OF DOORS
LH ACTIVE



OUTSIDE
PAIR OF DOORS
RH ACTIVE



OUTSIDE
PAIR OF DOORS
LHR ACTIVE



OUTSIDE
PAIR OF DOORS
RHR ACTIVE

* KS IS THE KEY SIDE OF DOOR (PLEASE CHECK ALL SWINGS TO ENSURE KEY IS ON PROPER SIDE OF DOOR)

FIRE RATING LABELS

A - 3 HOUR
B - 1 1/2 HOUR
C - 45 MINUTE
20M - 20 MINUTE

DOOR MATERIALS

HM - HOLLOW METAL DOOR - HONEYCOMB
IHM - INSULATED HOLLOW METAL DOOR - POLYSTYRENE
SLH - STEEL STIFFENED (LAMINATED-HONEYCOMB)
SLP - STEEL STIFFENED (LAMINATED-POLYSTYRENE)
SWF - STEEL STIFFENED (WELDED-FIBREGLASS)
SCW - SOLID CORE WOOD DOOR
HCW - HOLLOW CORE WOOD DOOR
PLM - PLASTIC LAMINATED

REMOVABLE STOPS

PL - PULL SIDE OF DOOR
PS - PUSH SIDE OF DOOR

ANCHOR TYPES

SS - STEEL STUD ANCHOR
CT - CORRUGATED TAIL ANCHOR
WS - WOOD STUD ANCHOR
EWA - EXISTING WALL ANCHOR
CB - CONCRETE BLOCK WIRE ANCHOR
BA - BASE ANCHOR
WR- WELDED ROD ANCHOR

HARDWARE

PP - PUSH & PULL
RIM - RIM PANIC
VR - VERTICAL ROD
FB - FLUSH BOLT
R/F - REINFORCE
CVR - CONCEALED VERTICAL ROD

DOOR SWINGS

LH - LEFT HAND
LHR - LEFT HAND REVERSE
RH - RIGHT HAND
RHR - RIGHT HAND REVERSE

REVISIONS:

REVISION AS PER THE MEETING ON JULY 20, 2006

NOTES:

FINAL

JOB:

CONTRACTOR:

DRAWN BY: CL JOHNSON

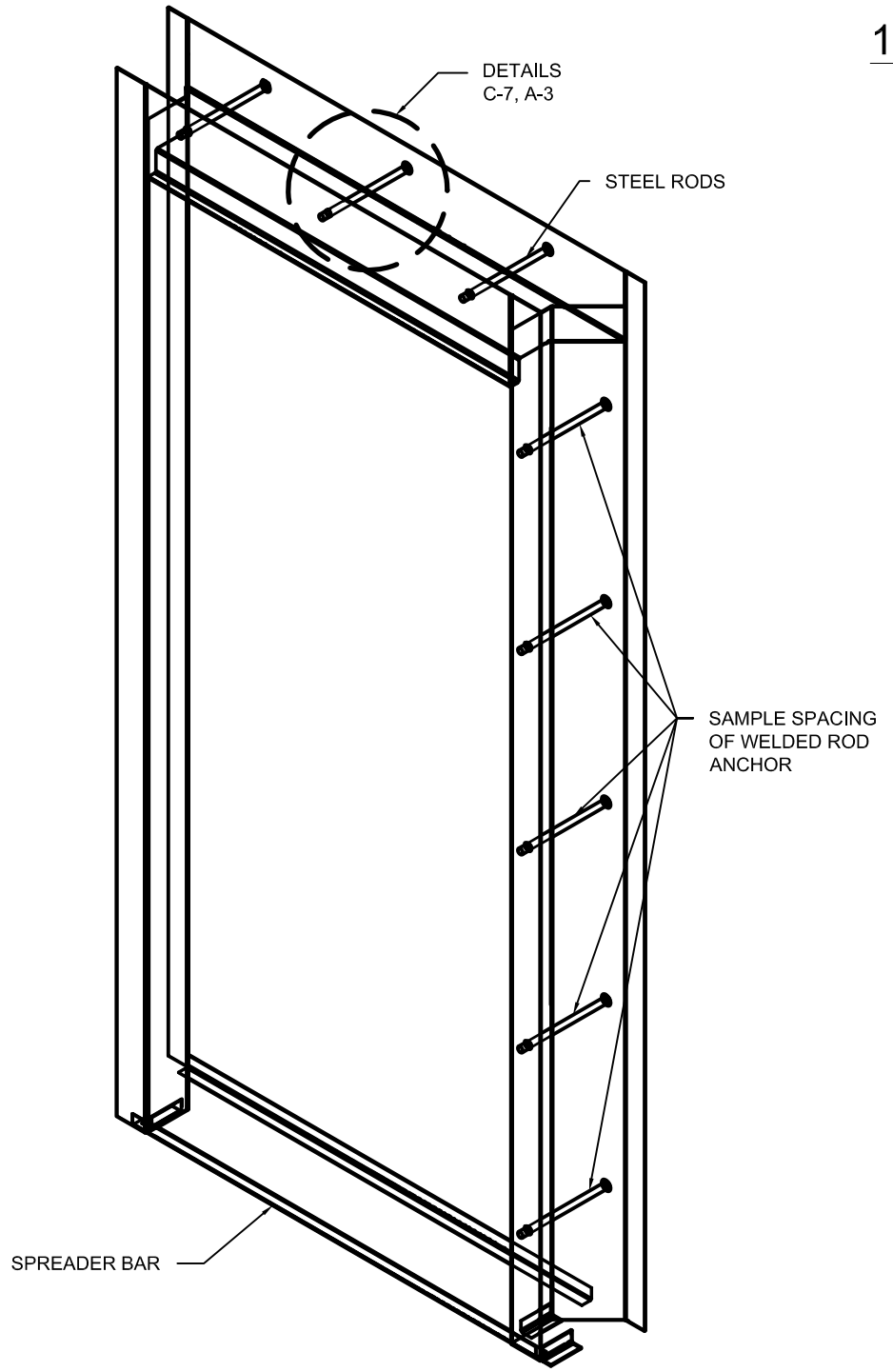
DATE: 9/26/2007

W.O.#:

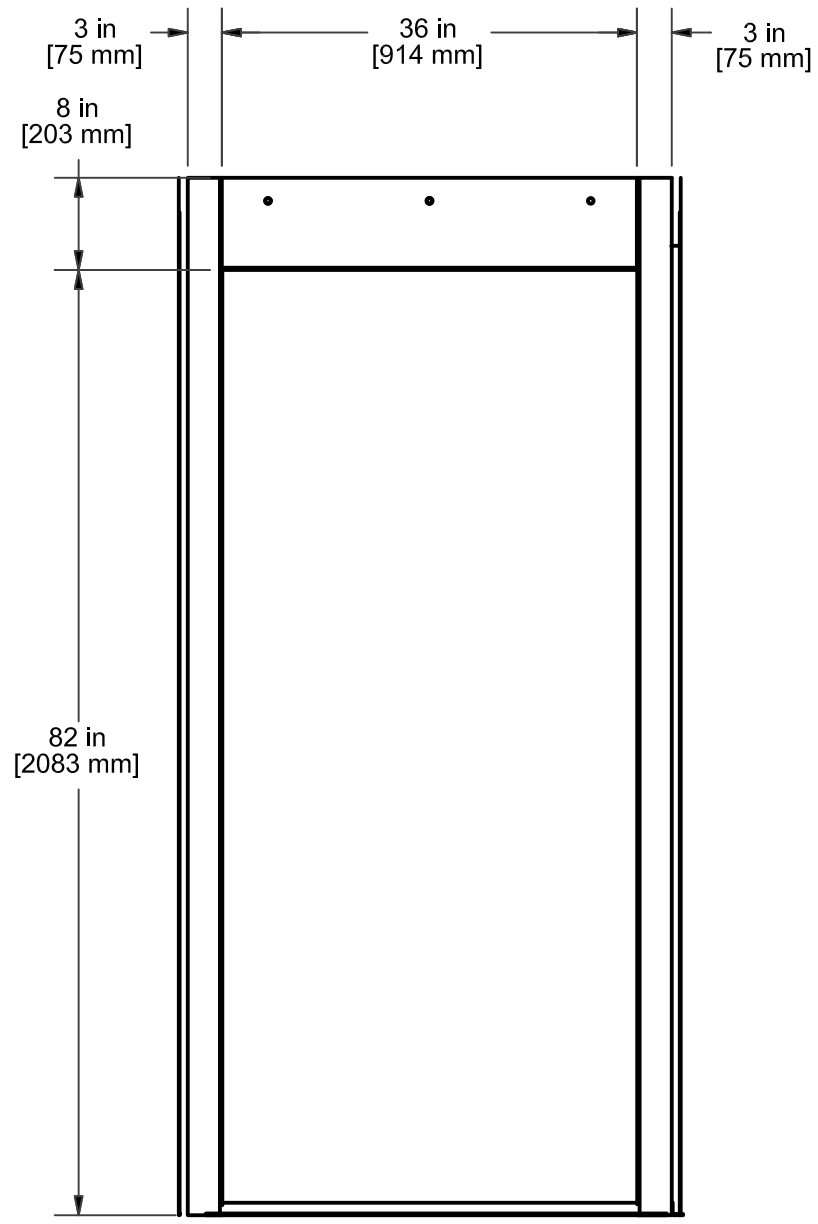
FILE NUMBER:

PG.#: 3

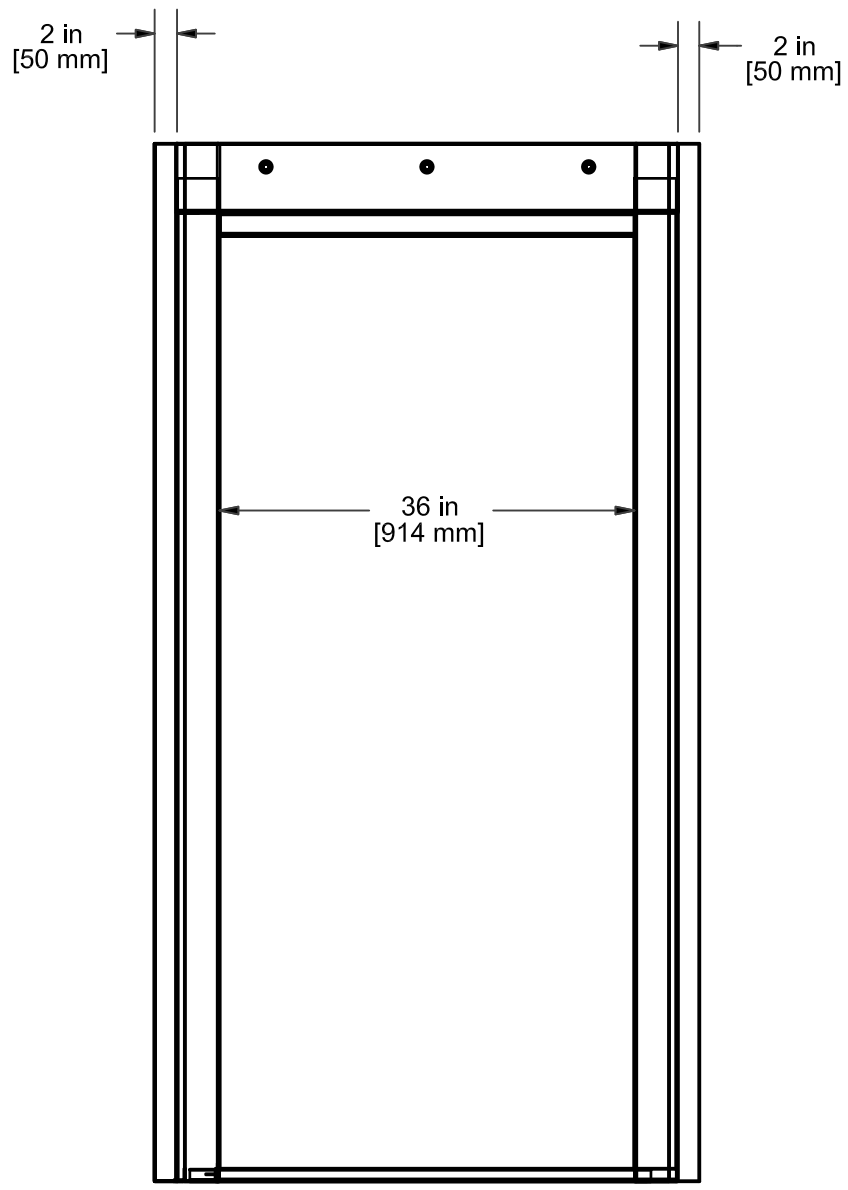
12GA. FRAME FOR SLIDING DOOR



A-4 ISOMETRIC VIEW



B-4 CORRIDOR SIDE



C-4 DETAINEE SIDE

REVISIONS:	NOTES:		JOB:		
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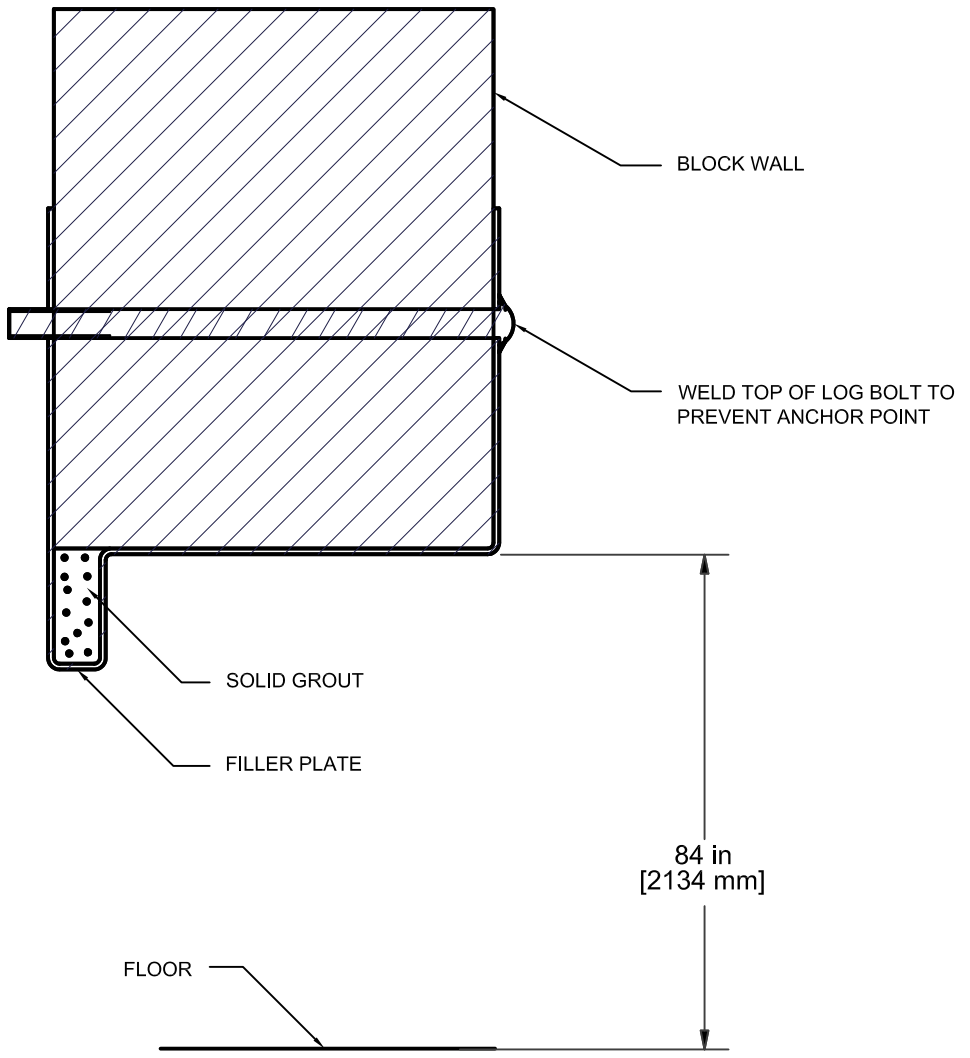
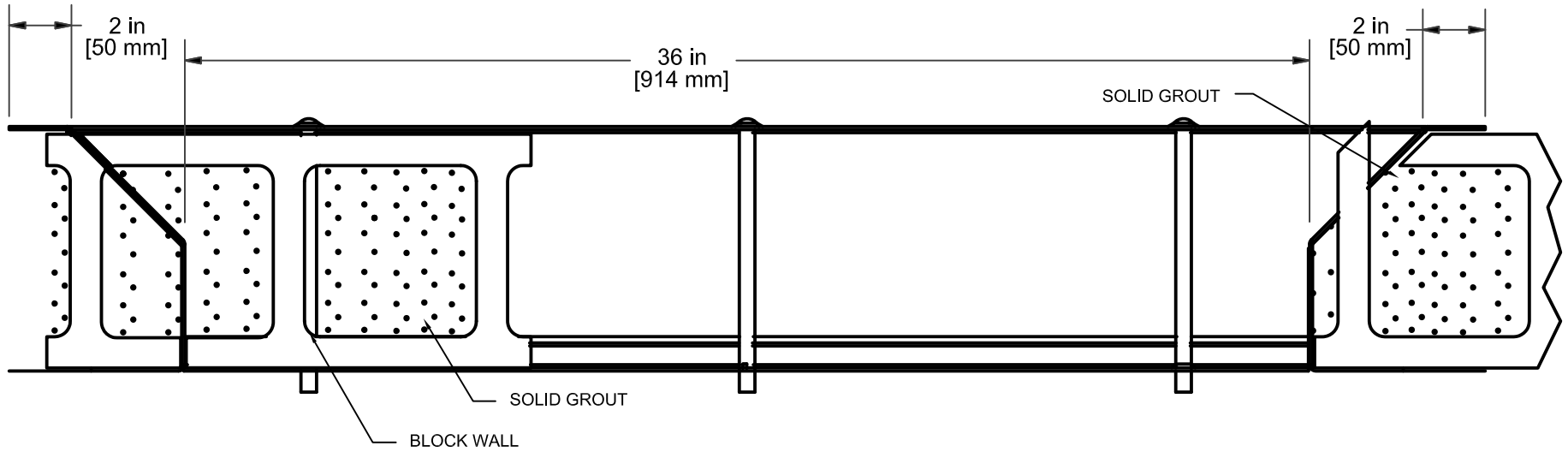
NOTE: FRAME MUST BE FULLY GROUTED FOR PROPER SLIDING ASSEMBLY INSTALLATION

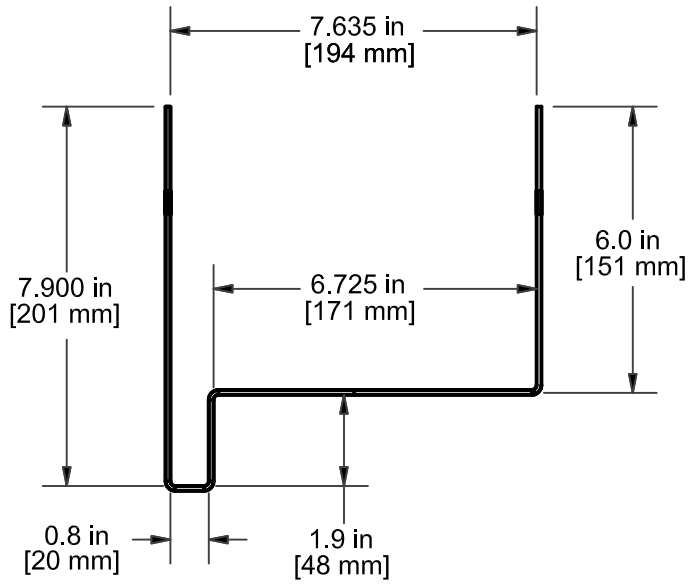
NOTE: OPTIONAL 2" LENGTH X 3/16" [51 x 5 mm] FILLER PLATE CONTINUALLY WELDED TO HEADER AND SIDES OF FRAME.

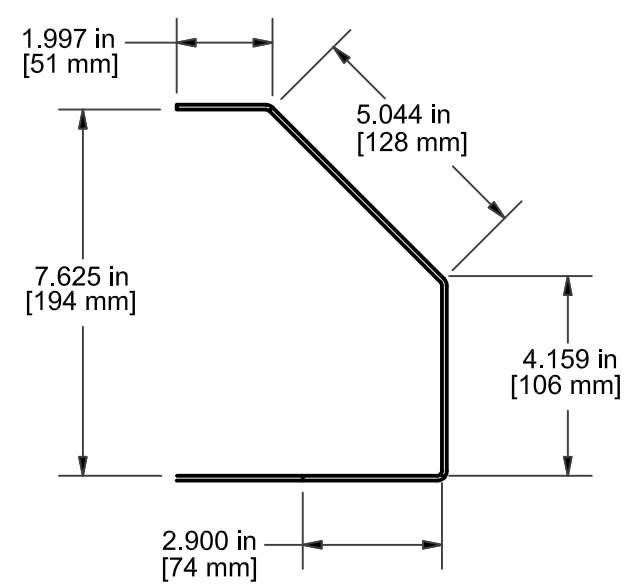


A-5 SECTION THROUGH FRAME



B-5 CROSS SECTION THROUGH JAMBS & HEADER





C-5 JAMB PROFILES FOR BENDING

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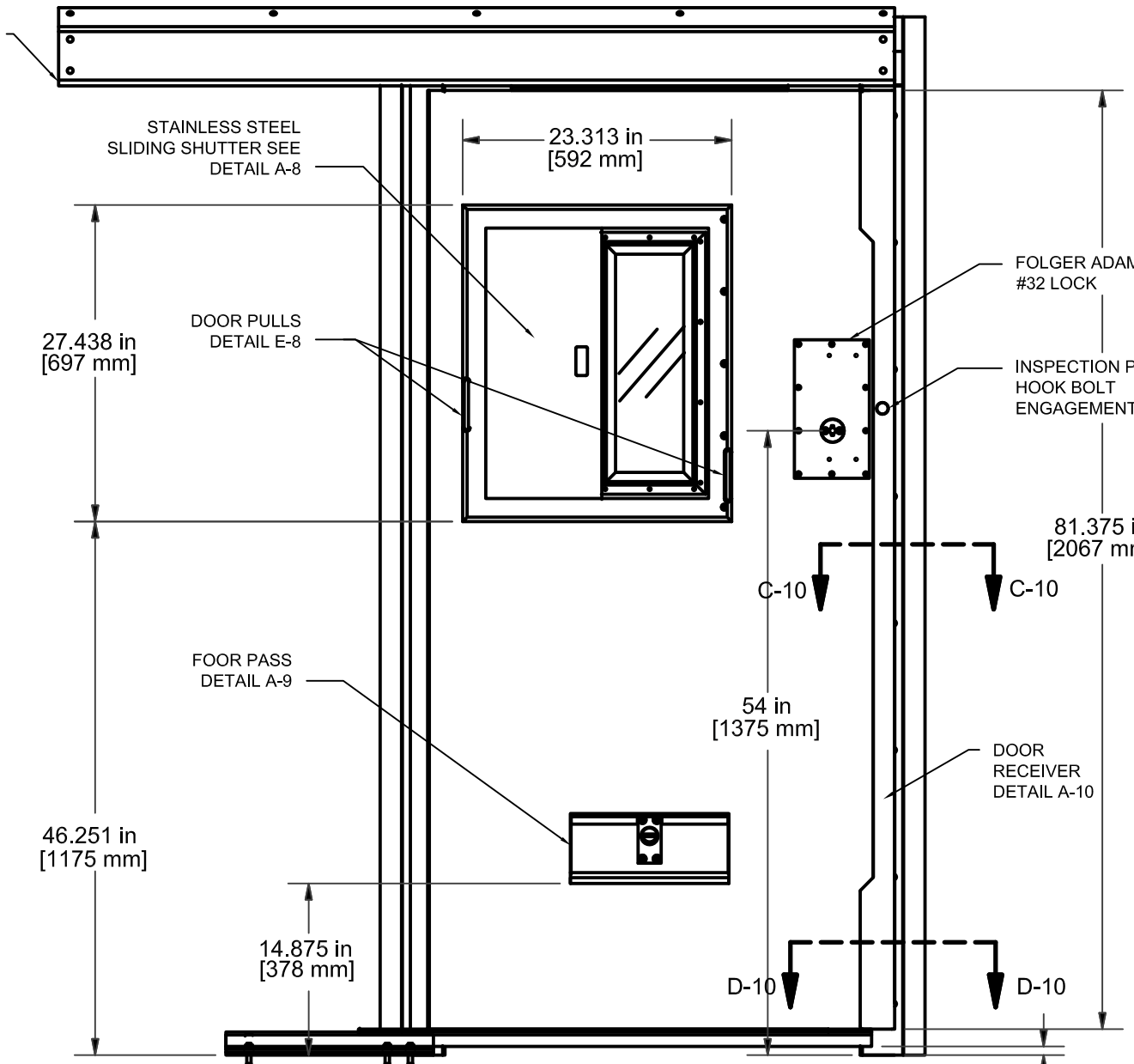
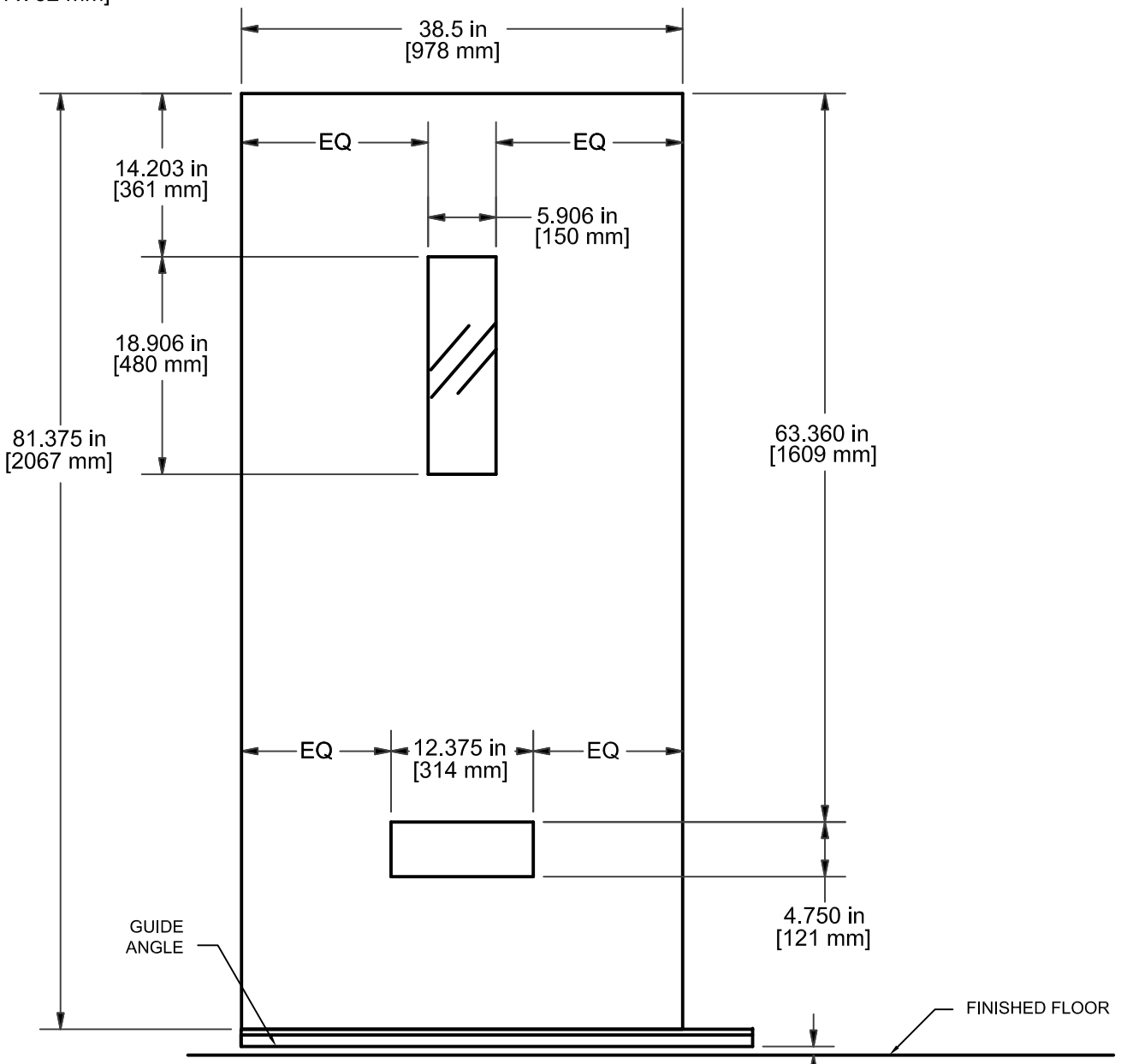
			W.O.#:	FILE NUMBER: / PG.#: 5

TYPE A CELL DOOR (SLIDING)

12GA. FRAME & 14GA. STEEL STIFFENED DETENTION DOOR
LEVEL 3 NAAMM 863-98 AND ASTM - F1450-97 PERFORMANCE CRITERIA
FOR STATIC LOAD, RACK, IMPACT, & EDGE CRUSH TESTS
3'-0" x 7'-0" x 2" [914 x 2134 x 52 mm]



A-6 VIEW FROM CORRIDOR SIDE



B-6 VIEW FROM DETAINEE SIDE

REVISIONS:	NOTES:		JOB:		
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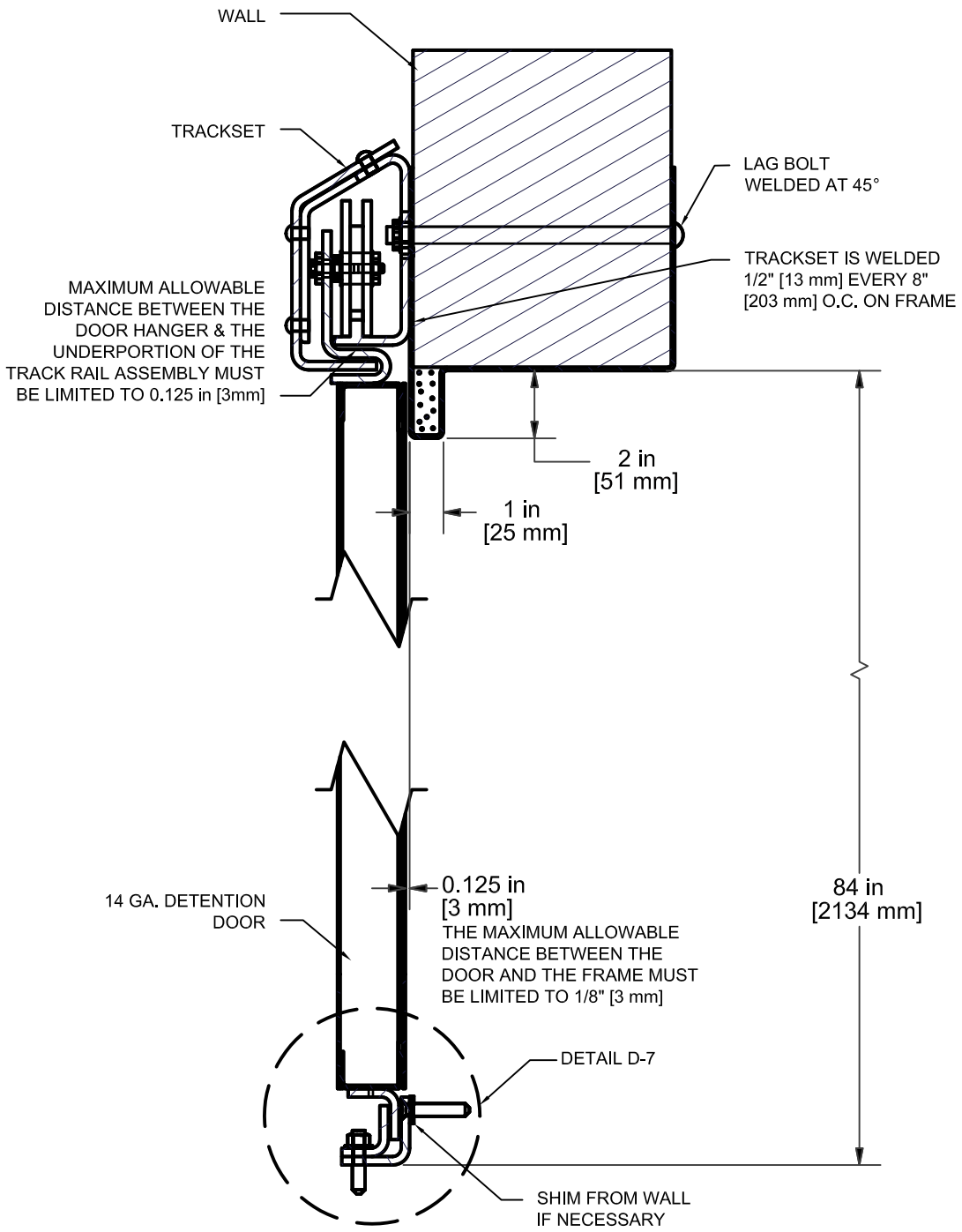
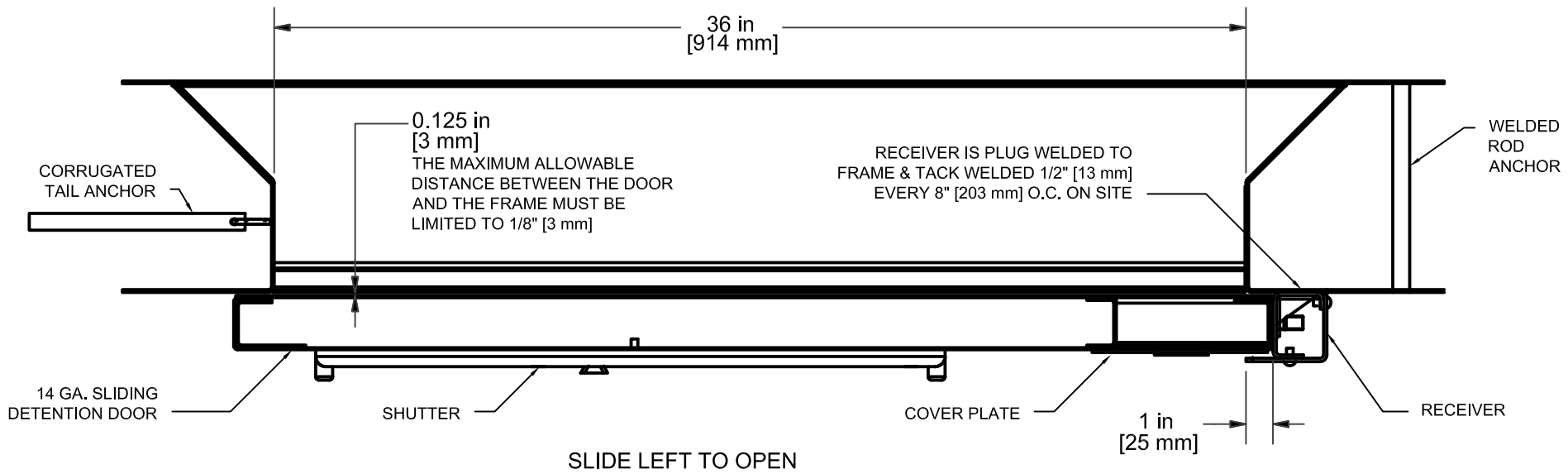


A-7 SECTION THROUGH TRACKSET AND DOOR

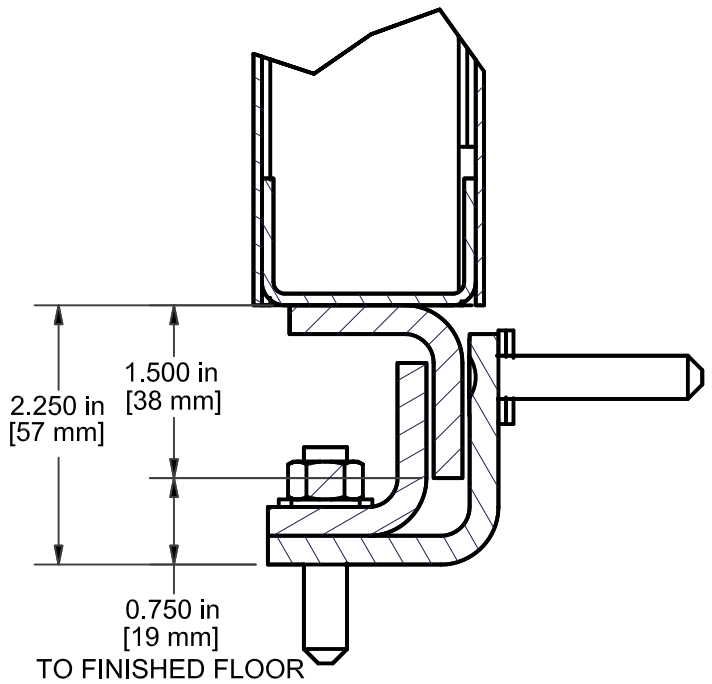
CROSS SECTION THROUGH DOOR AND RECEIVING ENCLOSURE



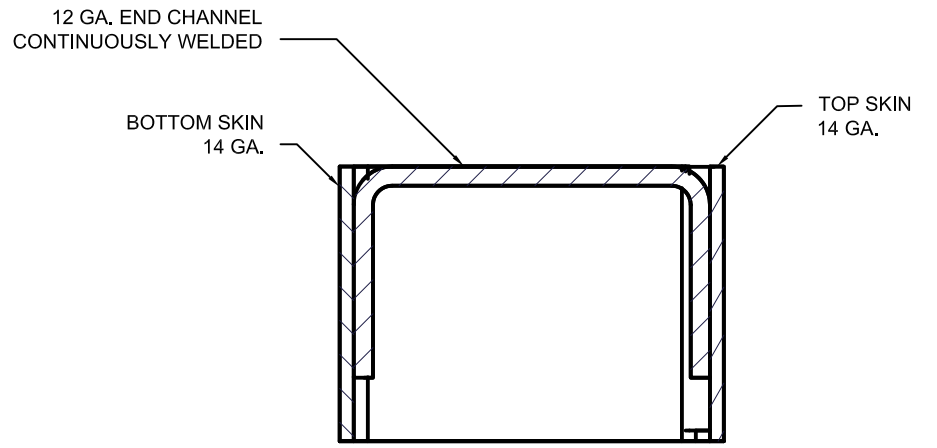
SLIDE LEFT TO OPEN

B-7 CT ANCHOR

C-7 WR ANCHOR



D-7 DETAIL



E-7 DETAIL TOP & BOTTOM END CHANNEL

REVISIONS:	NOTES:		JOB:	
REVISION AS PER THE MEETING ON JULY 20, 2006	SEE A-3 FOR ADDITIONAL ANCHOR OPTIONS	FINAL	CONTRACTOR:	
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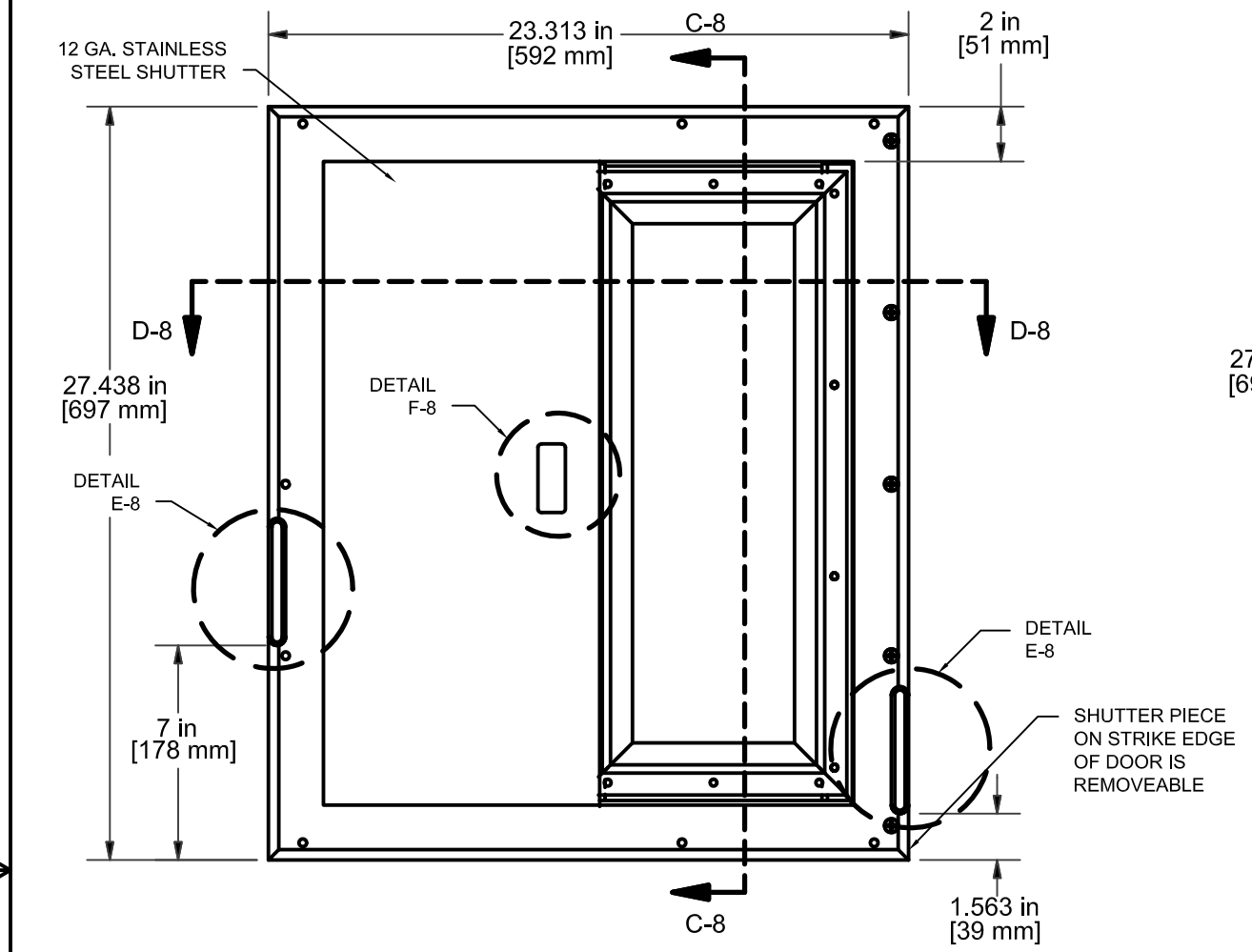
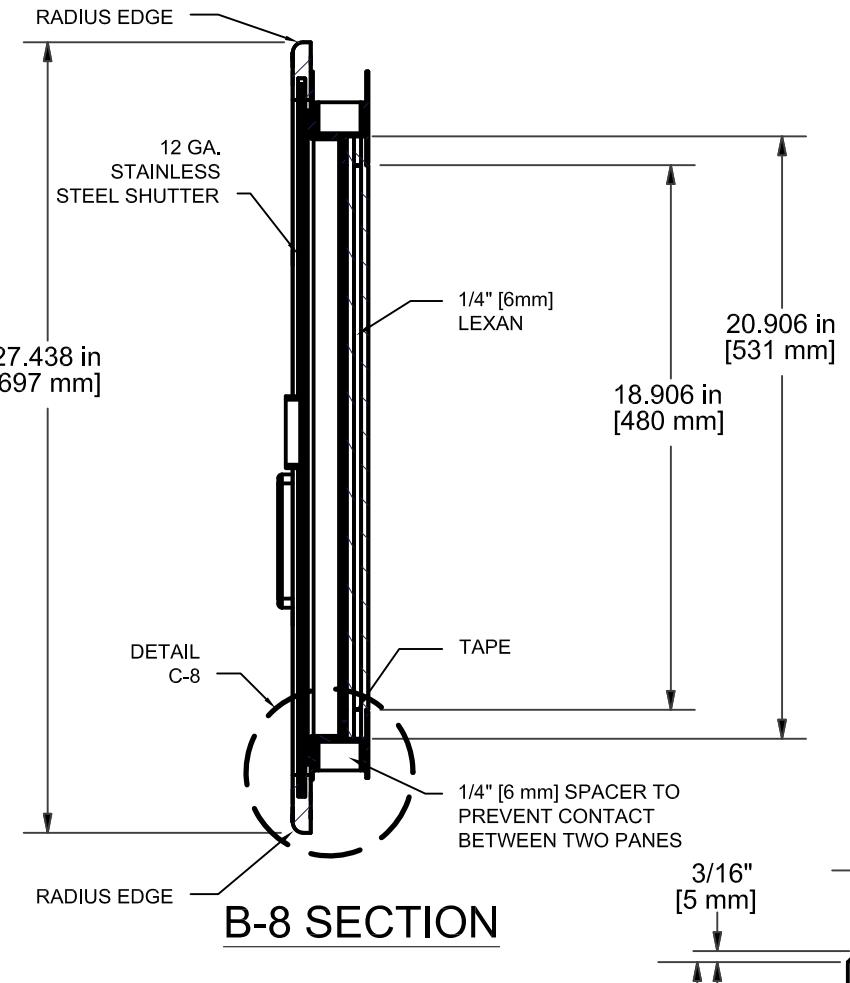
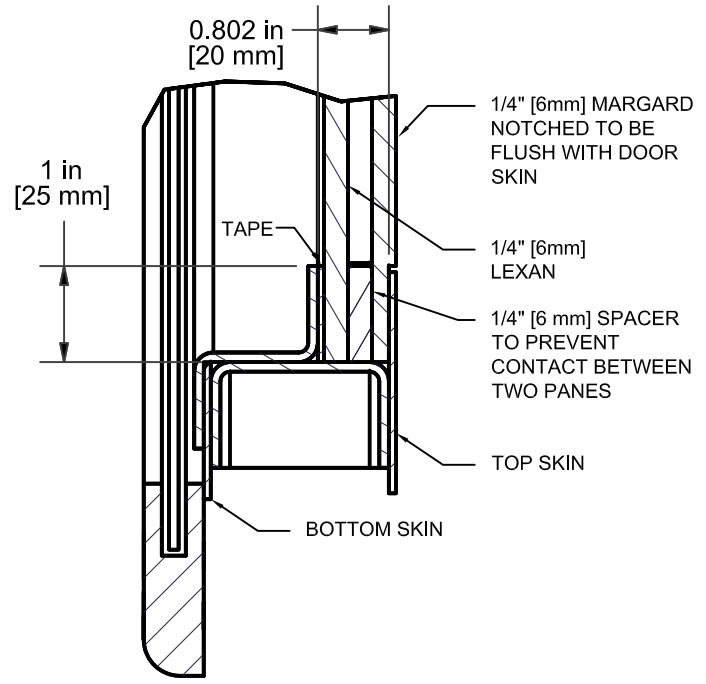


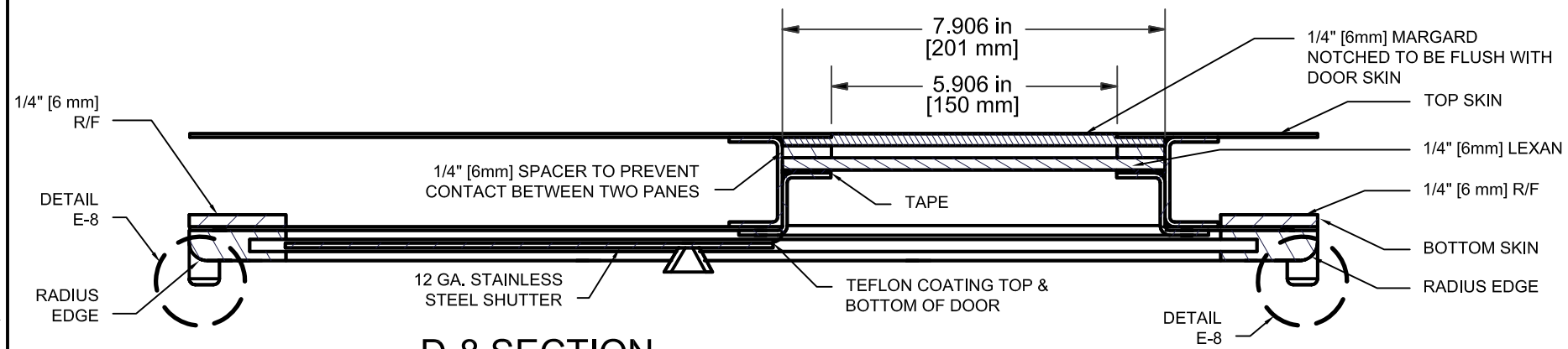
A-8 SLIDING SHUTTER



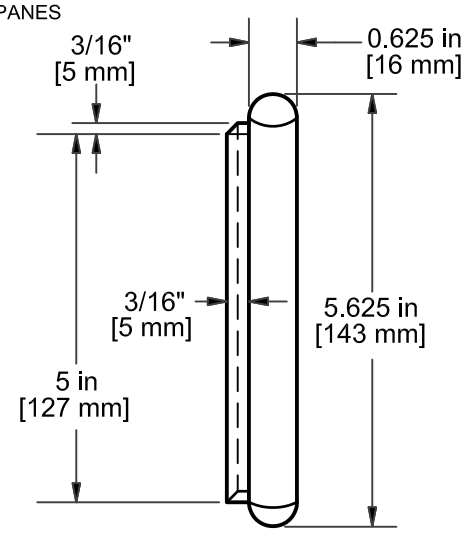
B-8 SECTION



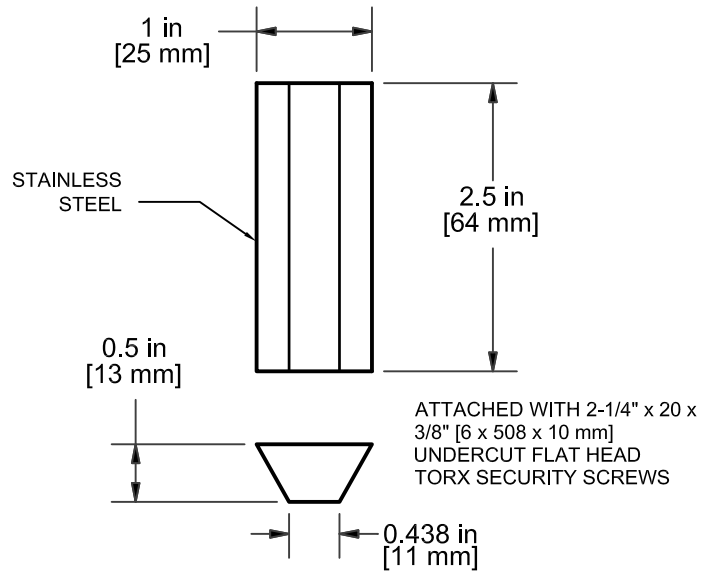
C-8 GLAZING DETAIL



D-8 SECTION



E-8 SLIDING DOOR HANDLE DETAIL



F-8 SHUTTER HANDLE DETAIL

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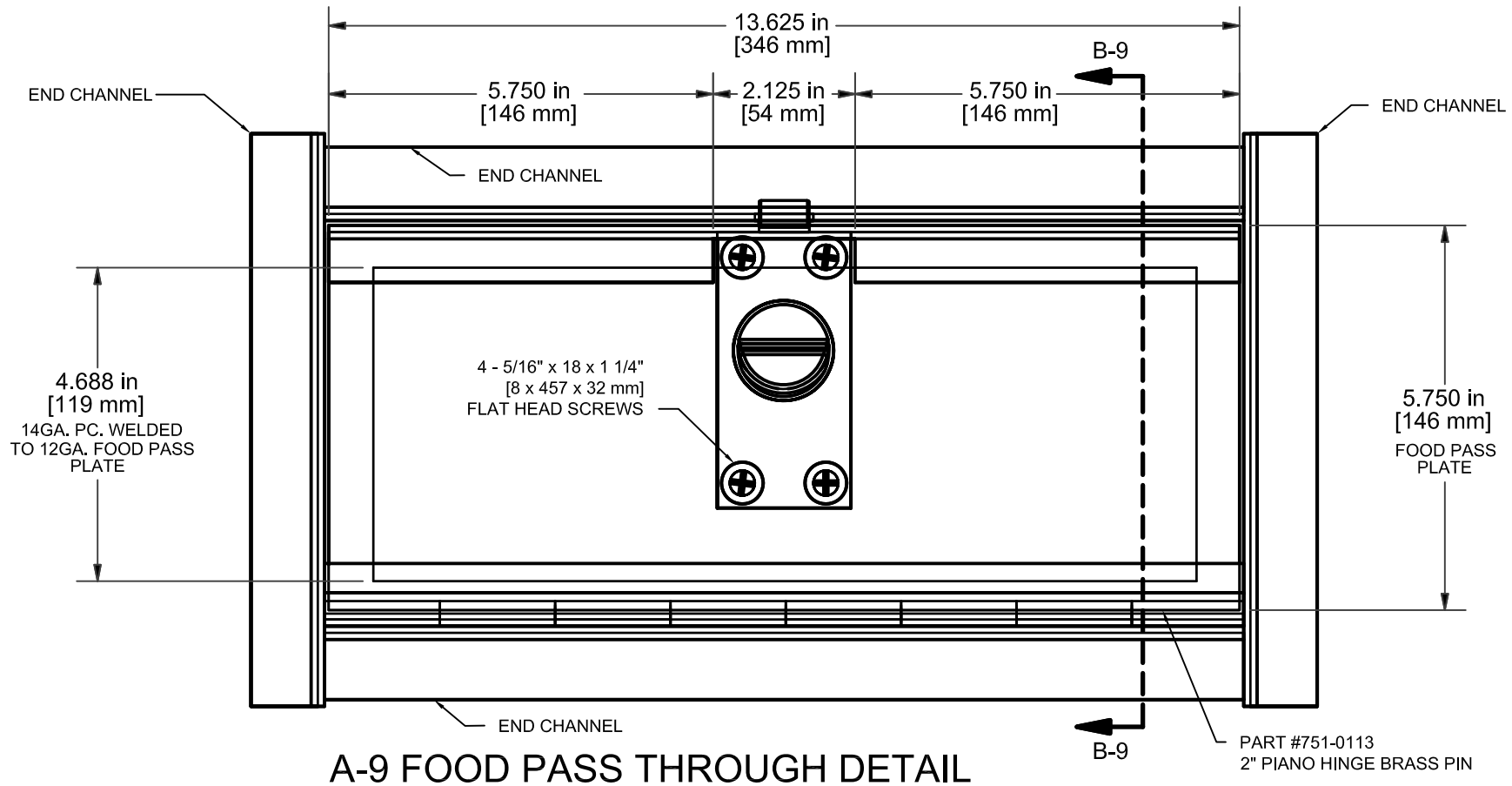
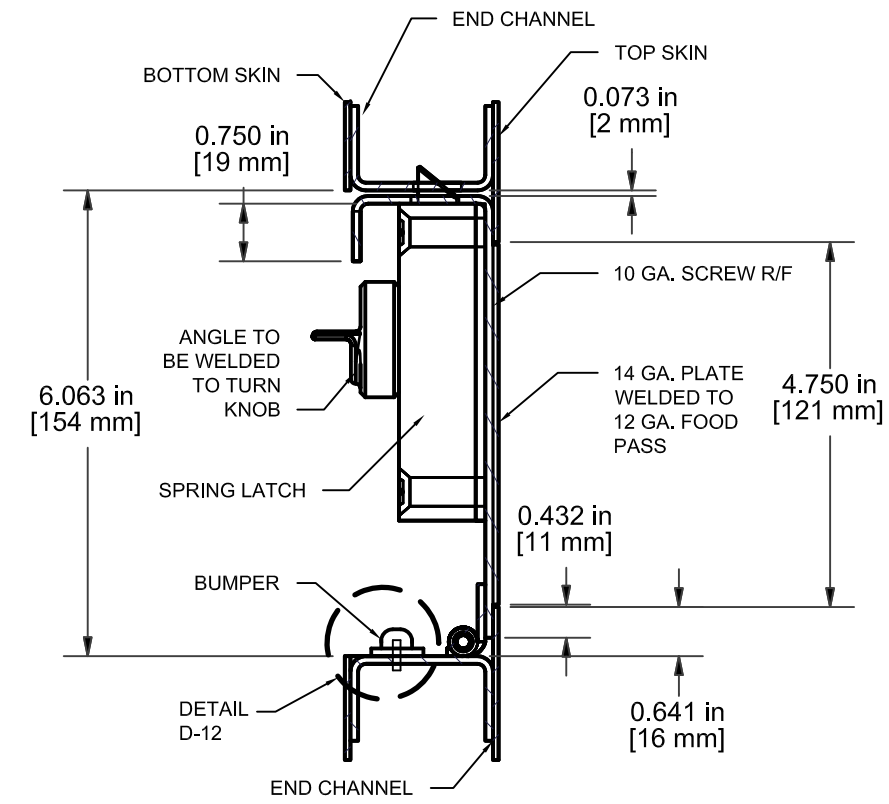
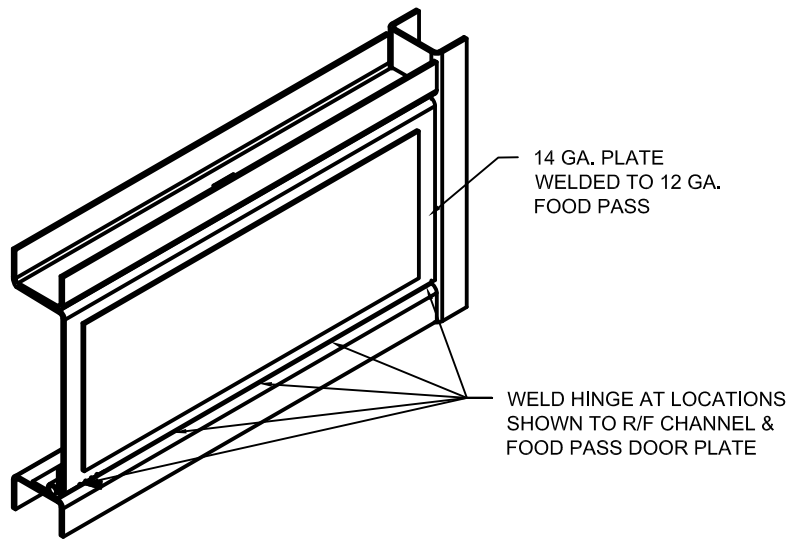


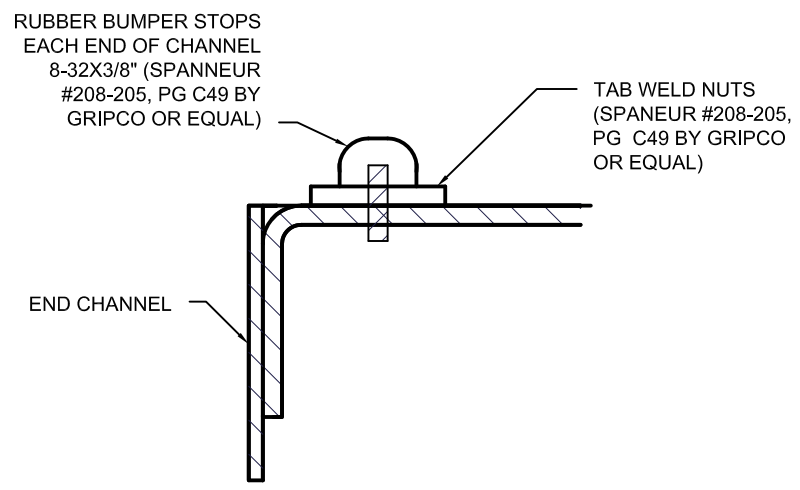
A-9 FOOD PASS THROUGH DETAIL



B-9 SECTION



C-9 FOOD PASS THROUGH DETAIL



D-12 BUMPER DETAIL

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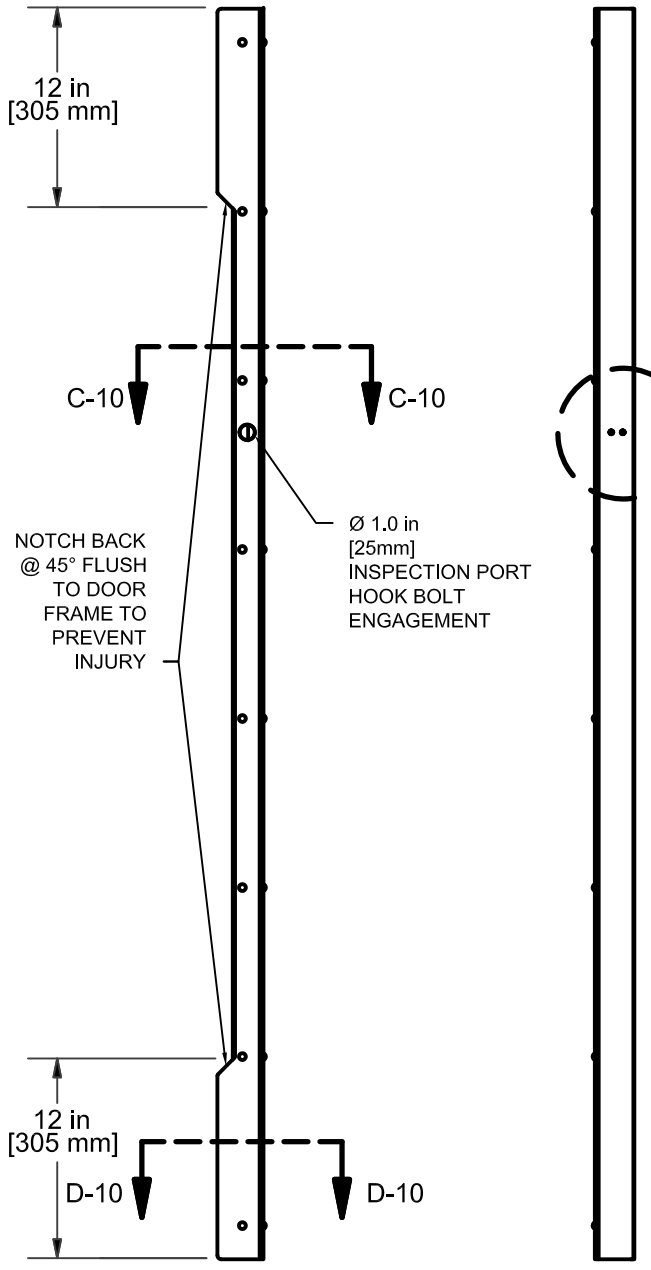
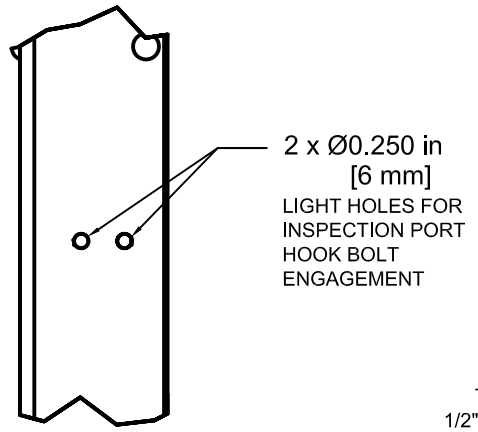
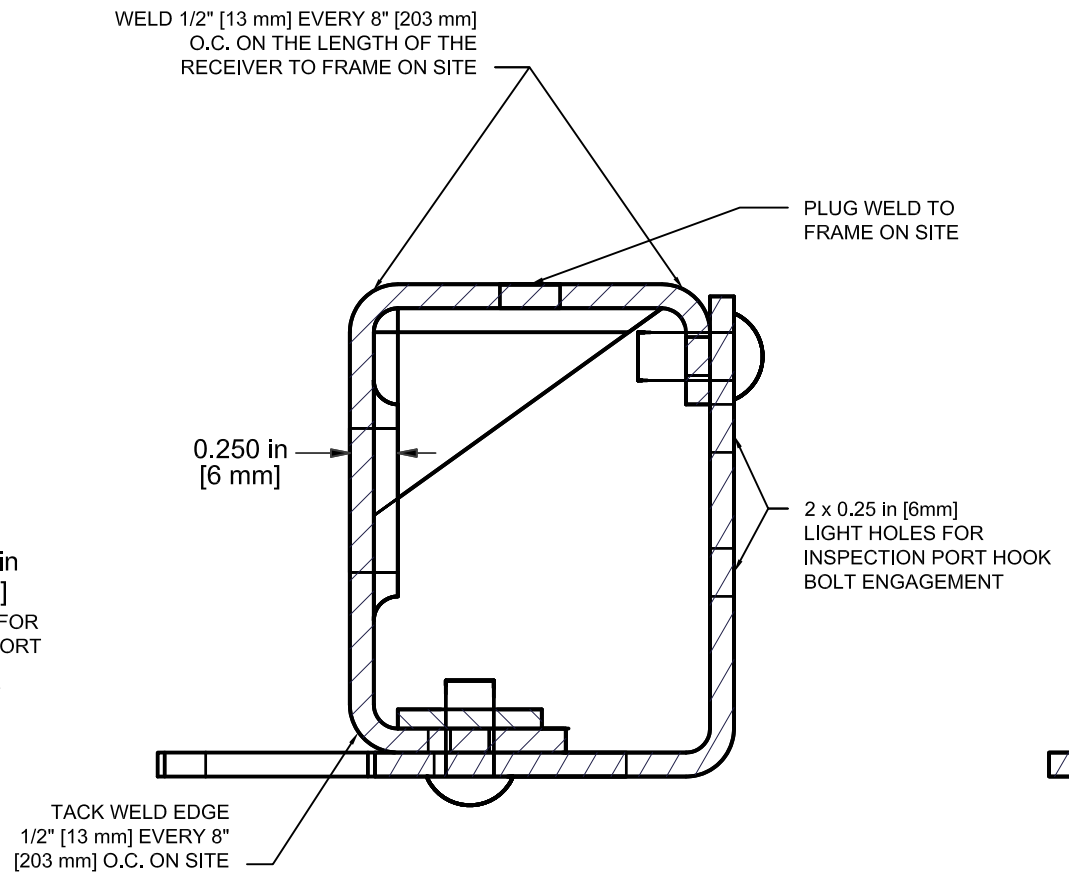


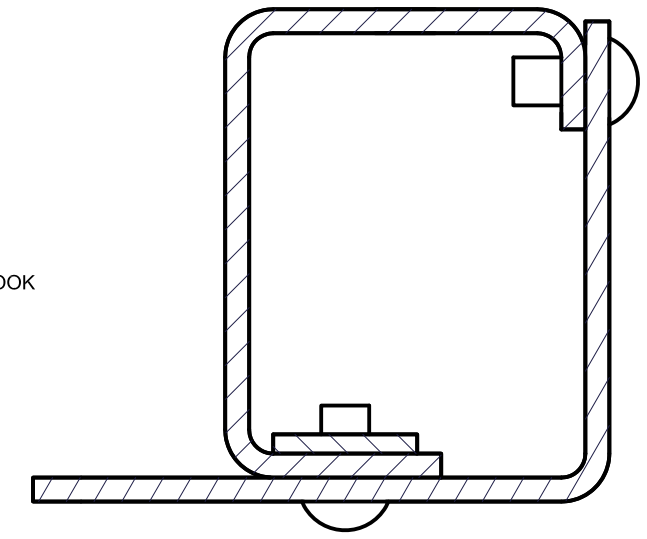
A-10 DOOR RECEIVER



B-10 DETAIL



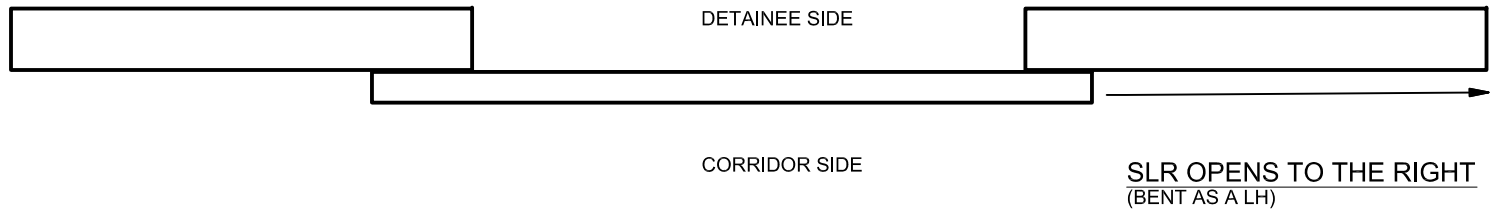
C-10 SECTION THROUGH DOOR RECEIVER



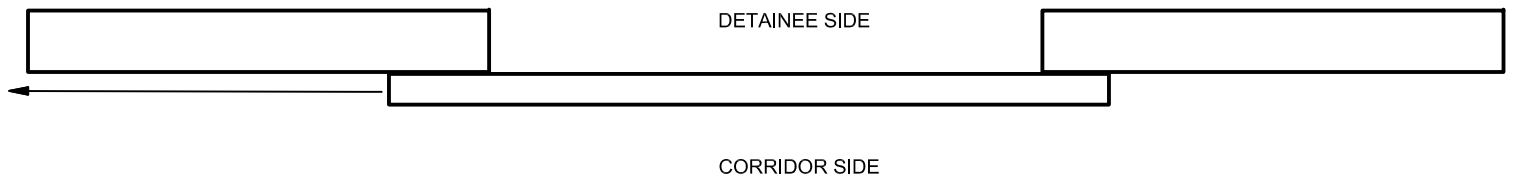
D-10 SECTION THROUGH DOOR RECEIVER

REVISIONS:	NOTES:		JOB:	
REVISION AS PER THE MEETING ON JULY 20, 2006	REMOVE ALL BURRS AND SHARP EDGES AFTER WELDING	FINAL	CONTRACTOR:	
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007
			W.O.#:	FILE NUMBER: PG.#: 10

A-11 SLIDING HANDING SHEET



SLR OPENS TO THE RIGHT
(BENT AS A LH)



SLL OPENS TO THE LEFT
(BENT AS A RH)

REVISIONS:	NOTES:		JOB:	
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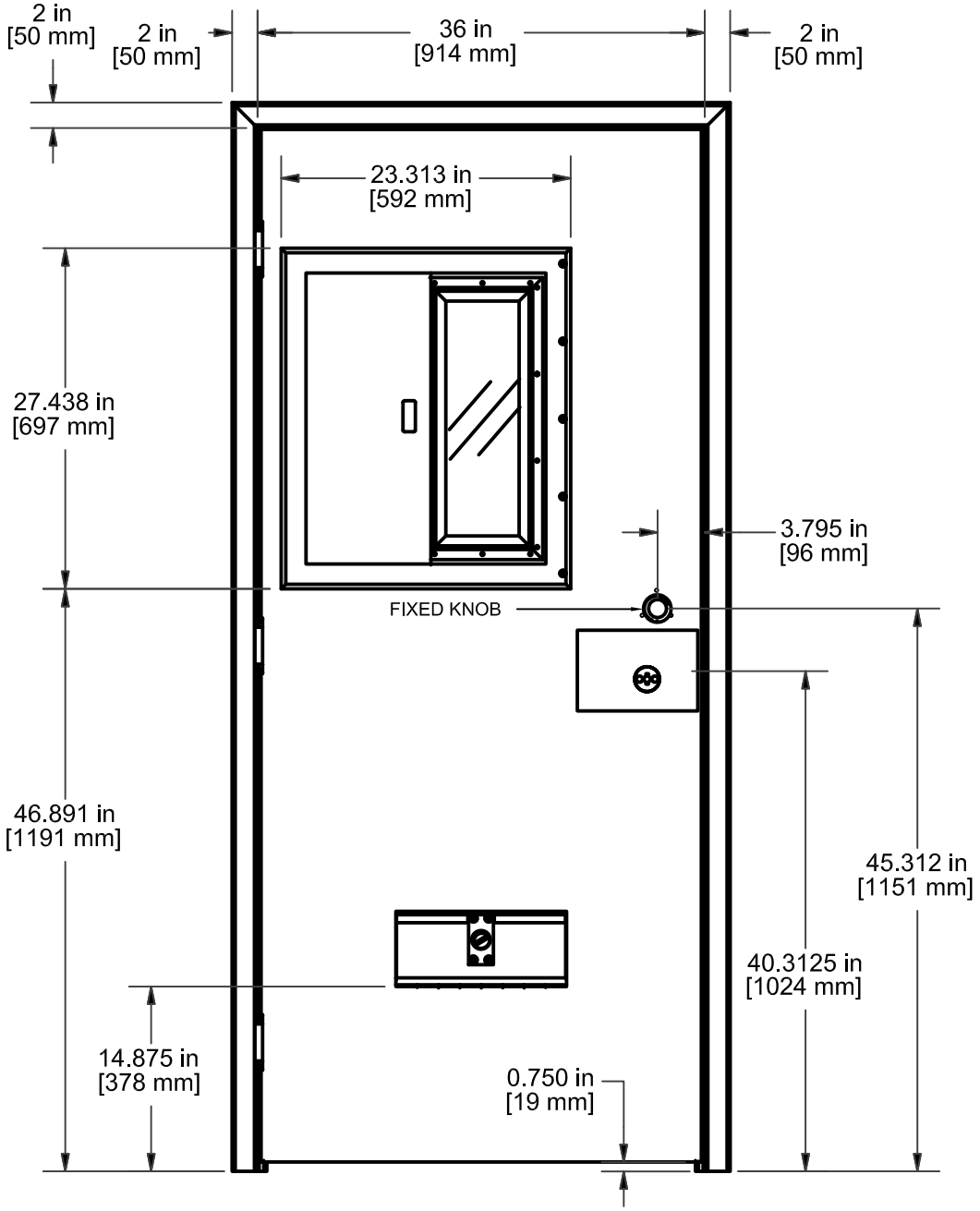
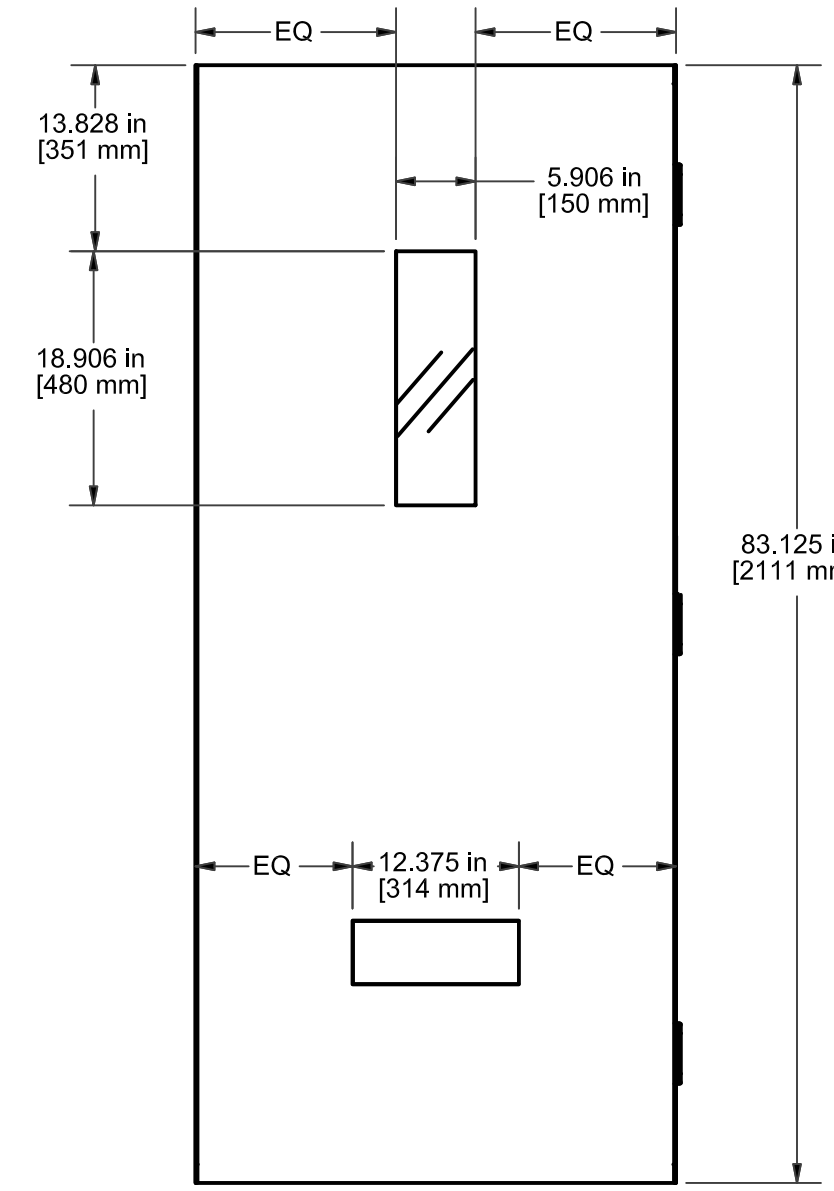
			W.O.#:	FILE NUMBER: PG.#: 11

TYPE B CELL DOOR (SWINGING)

(MAY ALSO BE INSTALLED IN TYPE A CELLS)
12GA. FRAME & 14GA. STEEL STIFFENED DETENTION DOOR
LEVEL 3 NAAMM 863-98 AND ASTM - F1450-97 PERFORMANCE CRITERIA
FOR STATIC LOAD, RACK, IMPACT, & EDGE CRUSH TESTS
3'-0" x 7'-0" x 2" [914 x 2134 x 51 mm]

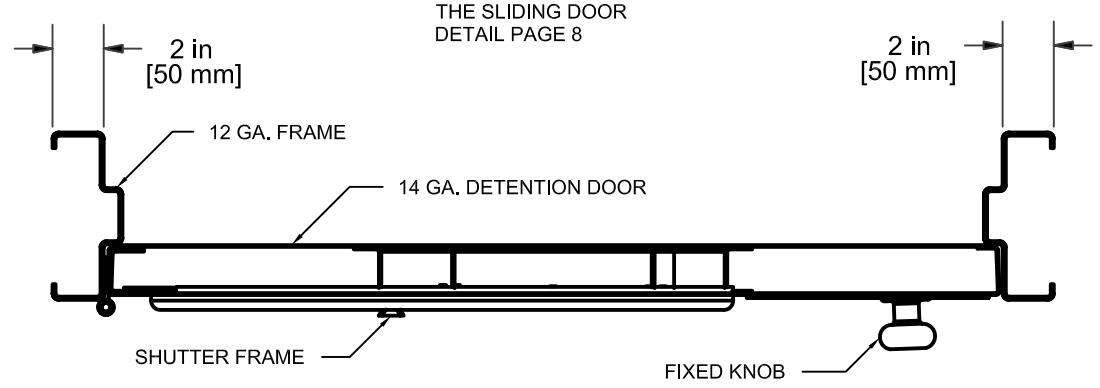


A-12 VIEW FROM CORRIDOR SIDE

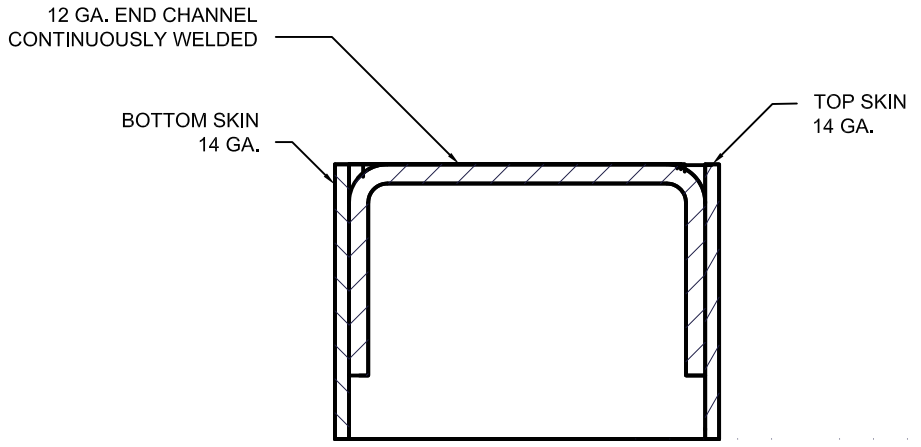


B-12 VIEW FROM DETAINEE SIDE

NOTE: LITE KIT IS THE SAME AS THE SLIDING DOOR DETAIL PAGE 8

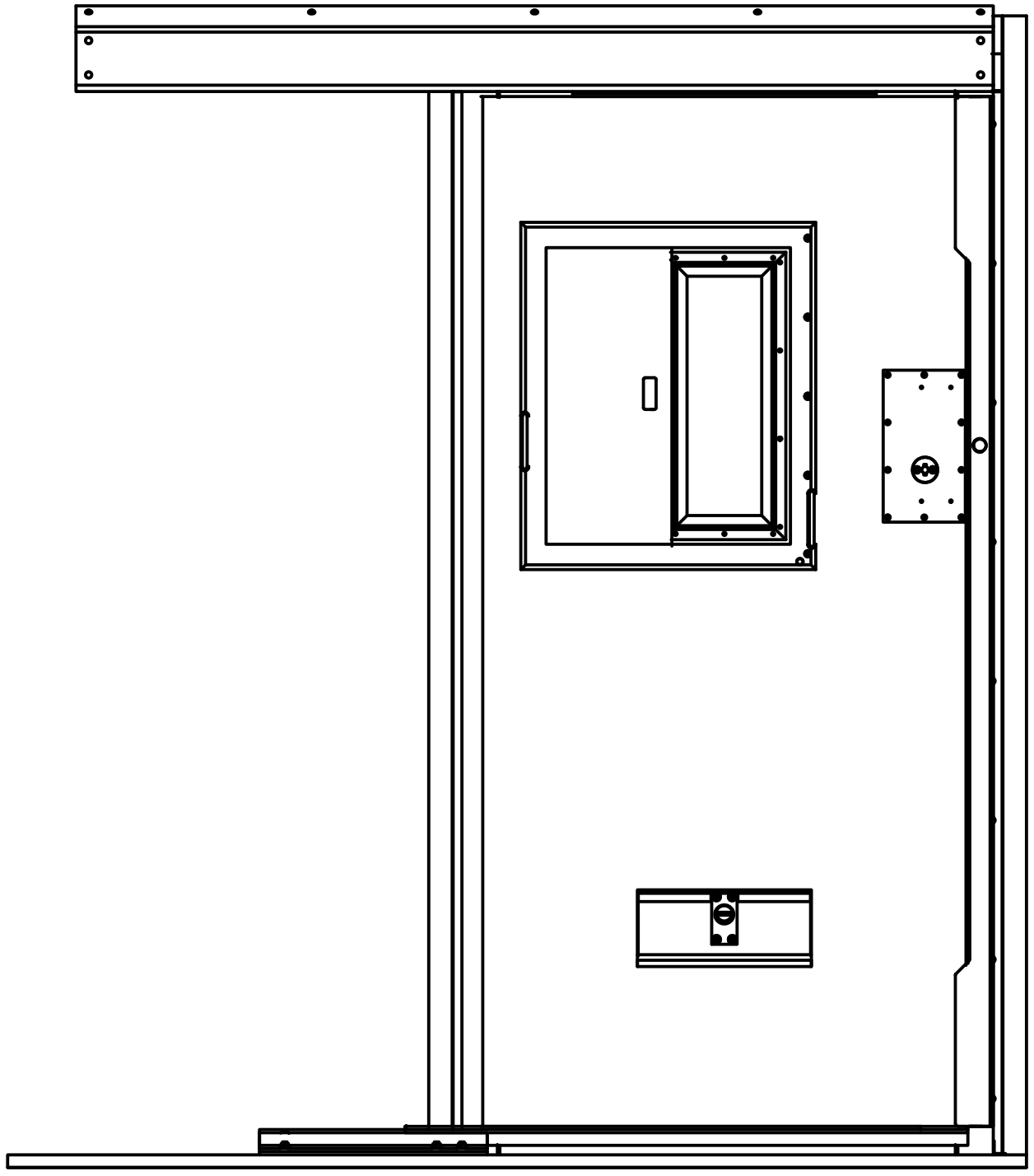


C-12 CROSS SECTION THROUGH DOOR & FRAME

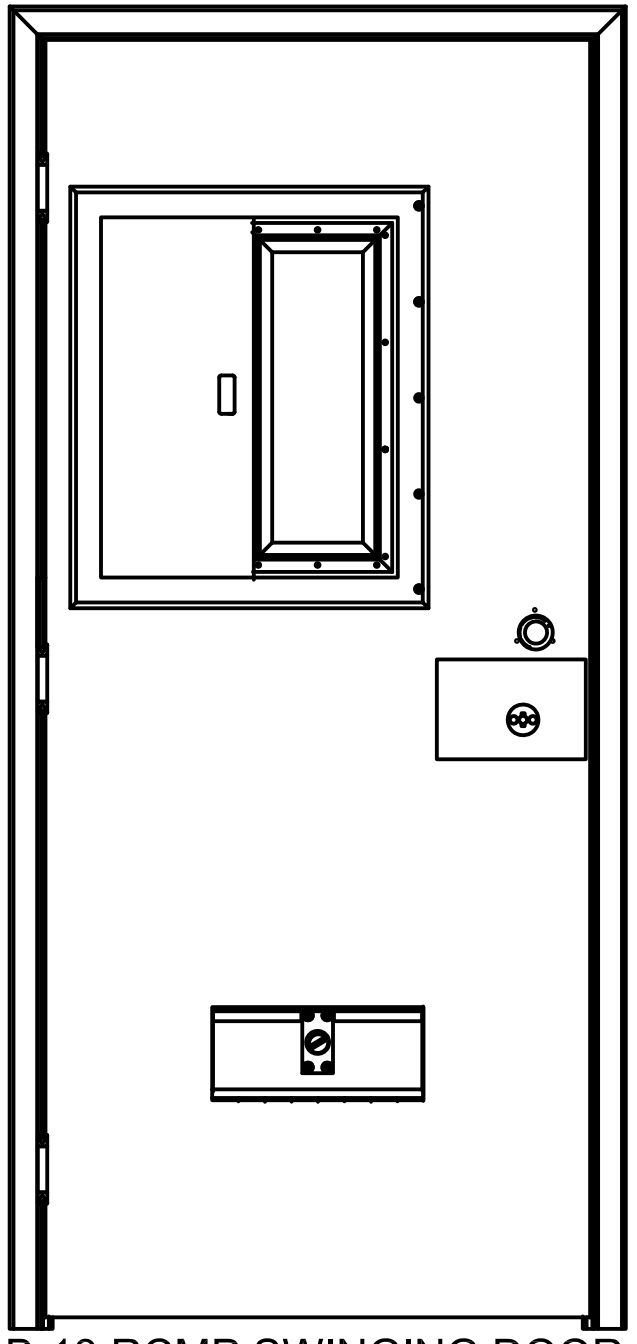


D-12 DETAIL TOP & BOTTOM END CHANNEL

REVISIONS:	NOTES:		JOB:	
REVISION AS PER THE MEETING ON JULY 20, 2006	THIS DRAWING IS THE EXCLUSIVE PROPERTY OF THE RCMP. NO USE WHATSOEVER OF THE INFORMATION CONTAINED HEREON, NOR REPRODUCTION IN WHOLE OR IN PART MAY BE MADE WITHOUT EXPRESSED WRITTEN PERMISSION. THIS DRAWING REMAINS THE PROPERTY OF THE RCMP AND MUST BE RETURNED ON DEMAND.	FINAL	CONTRACTOR:	
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007
			W.O.#:	FILE NUMBER: / PG.#: 12



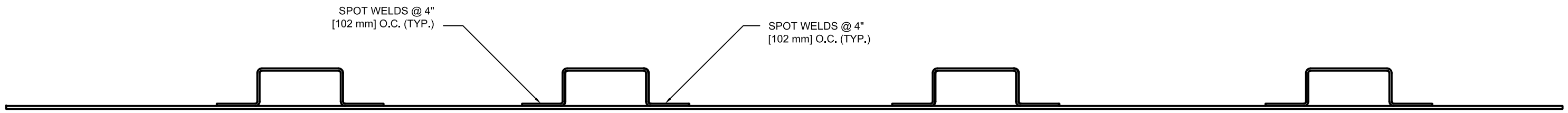
A-13 RCMP SLIDING DOOR



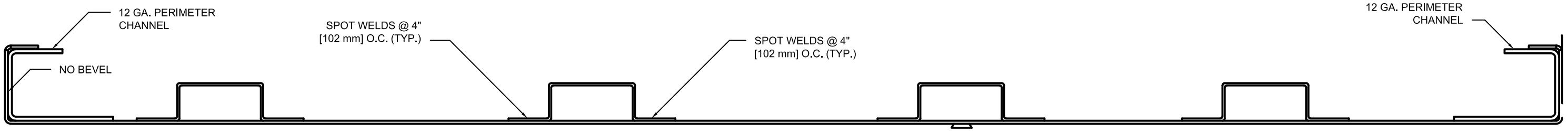
B-13 RCMP SWINGING DOOR

REVISIONS:	NOTES:		JOB:	
REVISION AS PER THE MEETING ON JULY 20, 2006	THIS DRAWING IS THE EXCLUSIVE PROPERTY OF THE RCMP. NO USE WHATSOEVER OF THE INFORMATION CONTAINED HEREON, NOR REPRODUCTION IN WHOLE OR IN PART MAY BE MADE WITHOUT EXPRESSED WRITTEN PERMISSION. THIS DRAWING REMAINS THE PROPERTY OF THE RCMP AND MUST BE RETURNED ON DEMAND.	FINAL	CONTRACTOR:	
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007
			W.O.#:	FILE NUMBER: PG.#: 13

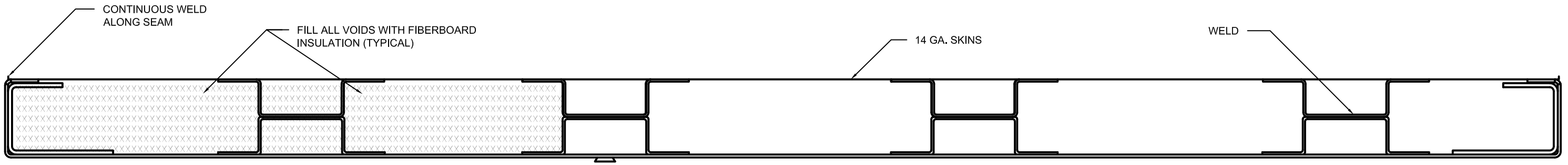
TYPE A CELL DO0R (SLIDING)



A-14 TOP SKIN PROFILE



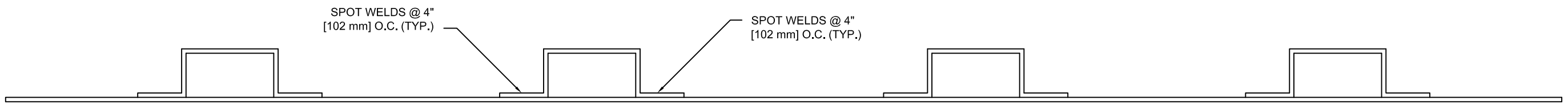
B-14 BOTTOM SKIN PROFILE



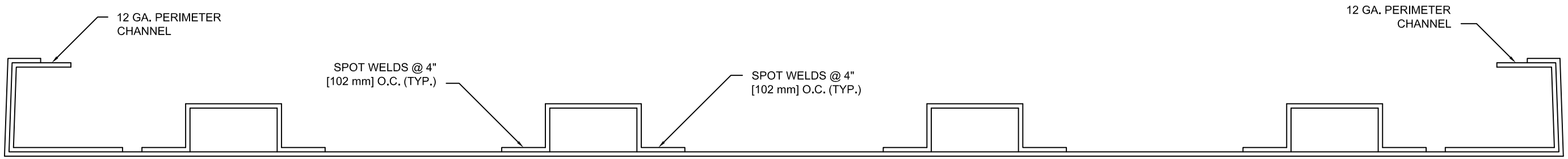
C-14 TOP & BOTTOM SKIN ASSEMBLY PROFILE

REVISIONS:	NOTES:		JOB:		
REVISION AS PER THE MEETING ON JULY 20, 2006	THIS DOOR IS A SQUARE EDGE AS IT IS SLIDING	FINAL	CONTRACTOR:		
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007	
			W.O.#:	FILE NUMBER:	PG.#: 14

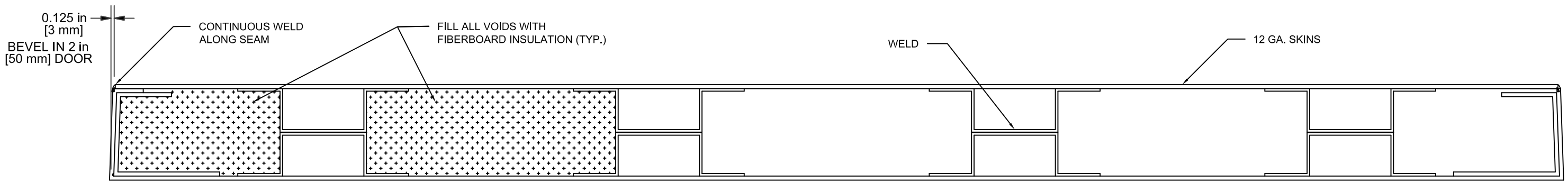
TYPE B CELL DOOR (SWINGING)



A-15 TOP SKIN PROFILE



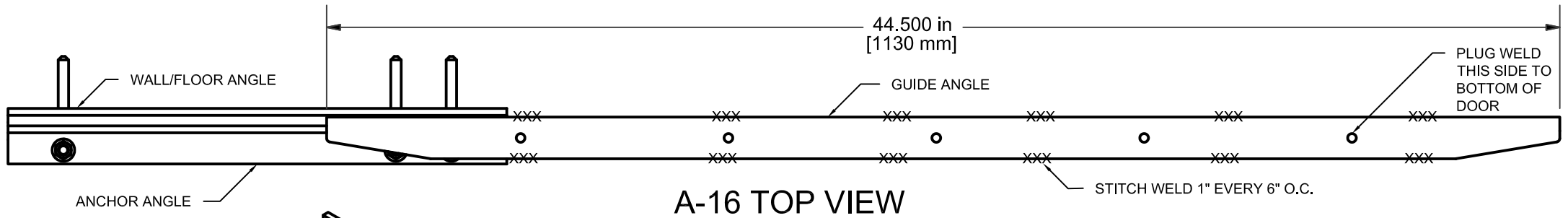
B-15 BOTTOM SKIN PROFILE



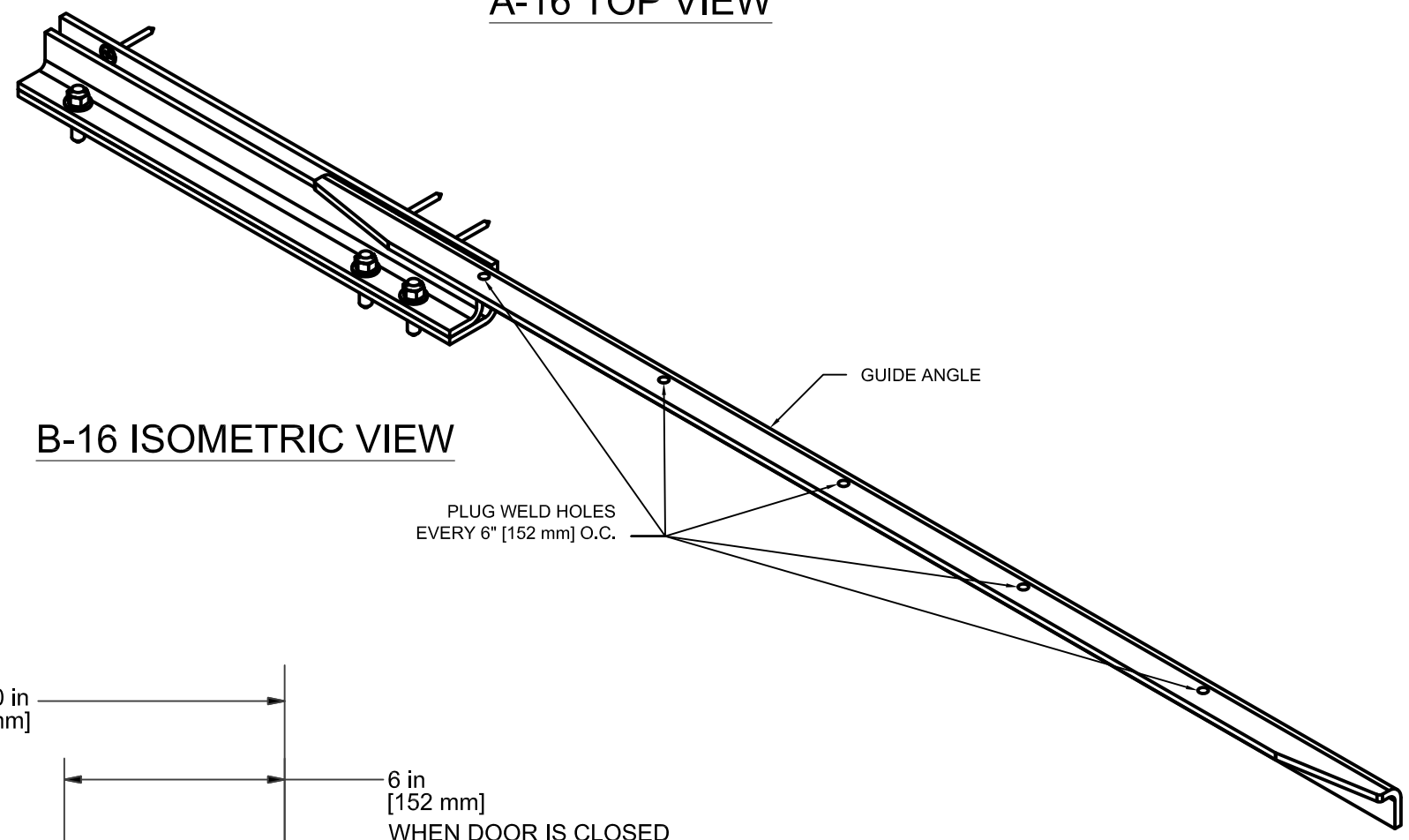
C-15 TOP & BOTTOM SKIN ASSEMBLY PROFILE

REVISIONS:	NOTES:		JOB:	
REVISION AS PER THE MEETING ON JULY 20, 2006	THIS DRAWING IS THE EXCLUSIVE PROPERTY OF THE RCMP. NO USE WHATSOEVER OF THE INFORMATION CONTAINED HEREON, NOR REPRODUCTION IN WHOLE OR IN PART MAY BE MADE WITHOUT EXPRESSED WRITTEN PERMISSION. THIS DRAWING REMAINS THE PROPERTY OF THE RCMP AND MUST BE RETURNED ON DEMAND.	FINAL	CONTRACTOR:	
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007
			W.O.#:	FILE NUMBER: / PG.#: 15

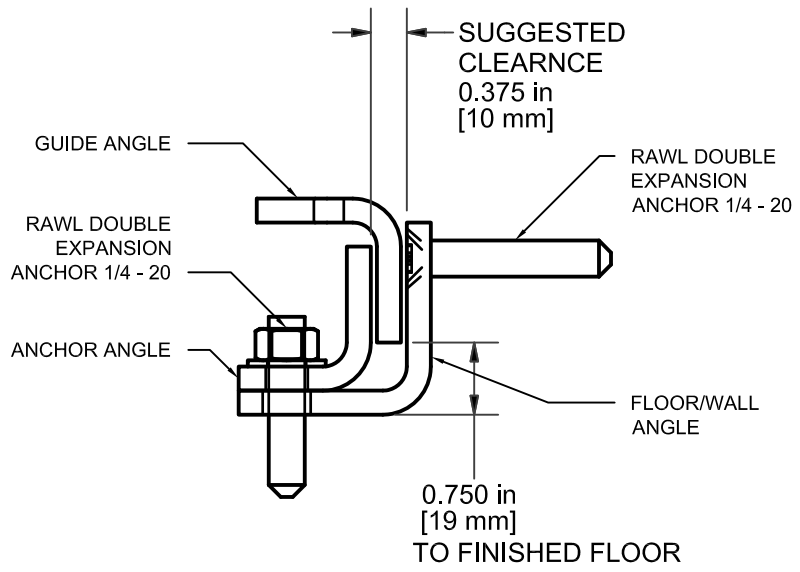
INSTALLATION OF WALL/FLOOR & ANCHOR ANGLE & GUIDE ANGLE



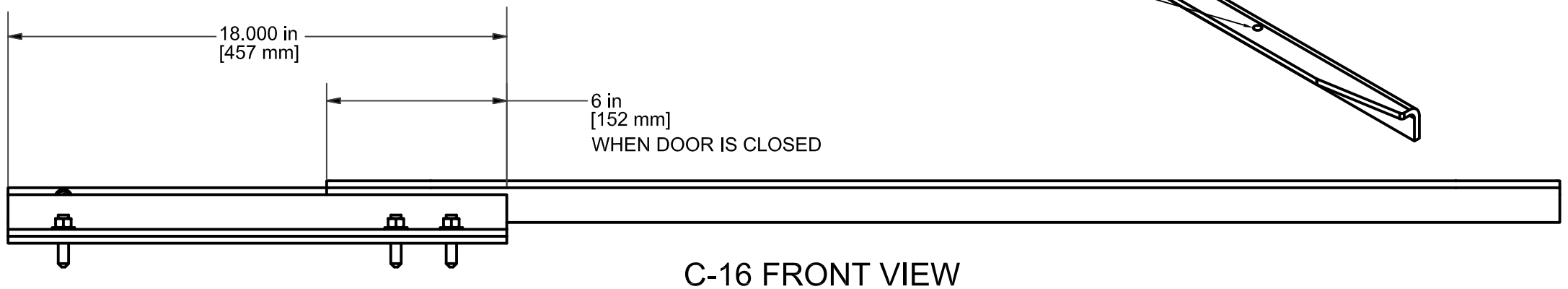
A-16 TOP VIEW



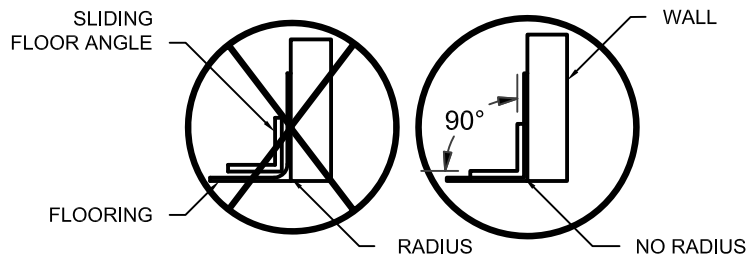
B-16 ISOMETRIC VIEW



D-16 DETAIL



C-16 FRONT VIEW



NOTE: FLOORING IS NOT TO HAVE A RADIUS WHERE IT MEETS THE WALL, FOR SLIDING UNITS.

E-16 FLOORING DETAIL

REVISIONS:	NOTES:		JOB:		
REVISION AS PER THE MEETING ON JULY 20, 2006		FINAL	CONTRACTOR:		
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007	
			W.O.#:	FILE NUMBER:	PG.#: 16

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for acoustic steel door and frame assemblies.

1.2 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 08 14 16 – Flush Wood Doors

.3 Section 08 71 00 - Door Hardware.

.4 Section 08 80 50 – Glazing.

.5 Section 08 90 10 – Door, Frame and Hardware Schedule.

.6 Section 09 91 23 - Interior Painting.

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM A653/A653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM E90-09 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .3 ASTM E413-11 – Classification for Rating Sound Insulation

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA International)

- .1 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door Manufacturers' Association (CSDMA)

- .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.
- .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 2009.

.5 National Fire Protection Association (NFPA)

- .1 NFPA 80-2013, Standard for Fire Doors and Fire Windows.
- .2 NFPA 252-2013, Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC S104-10, Standard Method for Fire Tests of Door Assemblies.

1.4 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Acoustic Performance: Minimum Sound Transmission Class (STC) 46 tested to ASTM E90. Label indicating sound transmission class shall be applied to the door and door frame.

.2 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC S104 for ratings specified or indicated.

.3 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC S104, ASTM E152 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

1.5 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.

.3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan, Canada.

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, louvred, arrangement of hardware and fire rating and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing, fire rating, and finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

.5 Test Data:

.1 Submit test data indicating compliance with the Sound Transmission Class (STC) requirements. Include laboratory name, test report number, and date of test.

.2 Submit certification from test laboratory qualified under the National Voluntary Accreditation Program (NVLAP) of the U.S. Bureau of Standards.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

1.7 WARRANTY

.1 Manufacturer’s Limited Warranty: Five (5) years from date of supply, covering material and workmanship.

Part 2 Products

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

2.2 ACCESSORIES

.1 Hinges: Heavy weight butt type as recommended by the manufacturer.

.2 Primer: Rust inhibitive zinc chromate.

.3 Threshold: Smooth and flush, to provide a seal for door on closed position.

.4 Perimeter acoustic seals: Primary and secondary perimeter acoustic seals to provide a seal for door in closed position to meet specified STC rating.

.5 Head seal: Acoustic neoprene at header.

.6 Bottom acoustic seals: Acoustic mortised drop door bottom to provide a seal for door in closed position to meet specified STC rating.

2.3 STEEL DOORS

.1 Sheet steel faces, thickness, design, and core suitable to achieve specified STC performance.

.2 Acoustic core construction, longitudinal edges, mechanically interlocked with visible edge seams.

.3 Reinforce doors where hardware is required.

.4 Drill and tap for mortised, templated hardware.

.5 Top and Bottom Channels: Inverted, recessed, welded steel channels.

2.4 STEEL FRAMES

.1 Sheet steel, metal thickness appropriate to maintain door STC ratings, mitred corners, fully welded seams.

.2 Factory assemble and weld frames.

.3 Affix permanent metal nameplates to frame indicating manufacture’s name, door tag, and STC rating where is shall be clearly visible.

2.5 PRIMER

.1 Touch-up prime CAN/CGSB-1.181.

.1 Maximum VOC limit 50 g/L.

2.6 PAINT

.1 Factory paint steel doors and frames in accordance with Sections 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

2.7 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION GENERAL

.1 Install doors and frames to CSDMA Installation Guide.

.2 Install components to manufacturer’s written instructions.

.3 Utilize welders certified by Canadian Welding Bureau (CWB).

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Coordinate with masonry and gypsum board wall construction for anchor placement.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continuity of air barrier and vapour retarder.

3.4 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds to allow easy operation and proper function of seals.

.3 Adjust operable parts for correct function.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.6 FIELD QUALITY CONTROL

.1 Provide qualified manufacturer’s representative to instruct installers on the proper installation and adjustment of door assemblies.

.2 Provide manufacturer’s representative to inspect door installation, and test minimum ten (10) cycles of operation. Correct any deficient doors.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 05 50 00 - Metal Fabrications

.3 Section 08 90 10 – Door, Frame and Hardware Schedule

.4 Division 26 - Electrical

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM A1008/A1008M-[06a], Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

.2 ASTM A653/A653M-[06a], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian Standards Association (CSA International).

.1 CSA G164-M92 (R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 SYSTEM DESCRIPTION

.1 Design Requirements.

.1 Design exterior door assembly to withstand windload of 1 kPa with a maximum horizontal deflection of 1/240 of opening width.

.2 Design door panel assemblies with minimum thermal insulation factor 3.0 RSI (R17).

.3 Design door assembly to withstand minimum 75,000 cycles.

.4 Design door lift in Room 132 and 165 to suit low headroom.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.1 Indicate sizes, service rating, types, materials, operating mechanisms, hardware and accessories and required clearances.

.2 Indicate electrical requirements including motor size, voltage, amperage. and electrical connections Include low voltage wiring diagram.

.3 Provide written verification that door is designed to withstand designated minimum required cycles.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for overhead door hardware for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 WARRANTY

.1 Provide five-year manufacturer’s warranty for doors and all components and ten year for delamination.

Part 2 Products

2.1 MATERIALS

.1 Galvanized steel sheet: commercial quality to ASTM A653/A653M with Z275 zinc coating.

.2 Steel sheet: commercial quality to ASTM A1008/A1008M,.

.1 Exterior face sheet thickness 1.6 mm (16 gauge).

.2 Interior face sheet thickness 1.2 mm (18 gauge).

.3 Prefinished steel with factory applied, two coat baked on polyester, primer and finish coat.

.1 Coating thickness: recommended by manufacturer.

.2 Resistance to accelerated weathering for chalk rating of 8, colour fade 5units or less and erosion rate less than 20 % to ASTM D822 as follows:

.1 Outdoor exposure period 2500 hours.

.2 Humidity resistance exposure period 5000hours.

.4 Insulation: Non-CFC foamed in place, polyurethane to meet design requirements.

2.2 DOORS

.1 Door Movement:

.1 Doors are low headroom lift.

.2 Fabricate 50 mm thick insulated, textured panel doors of interlocking, roll formed steel sections, with thermal break between skins.

.3 Extend doors 100 mm minimum past both sides of door opening.

.4 Assemble components by means of spot or arc welding or coated rivet system or adhesive and self tapping screws to manufacturer's recommendations.

.5 Finish shall be factory applied, two-coat baked on polyester. Colour:

.1 Interior: White.

.2 Exterior at Police Building and Out Building 165: Red. Color selected by consultant to match red colour pre-formed metal siding at police building.

.6 Acceptable Manufacturer: Sentinel Thermostop by ASSA ABLOY or approved equivalent.

2.3 HEAVY DUTY INDUSTRIAL HARDWARE

.1 Track: standard hardware with 75 mm size 2.75 mm core thickness galvanized steel track. Track to suit specified door movements.

.2 Track Supports: 3.1 mm core thickness continuous galvanized steel angle track supports.

.3 Spring counter balance: heavy duty oil tempered torsion spring with manufacturers standard brackets.

.4 Top roller carrier: galvanized Steel 3.04mm thick adjustable.

.5 Rollers: full floating grease packed hardened steel, ball bearing 75mm diameter solid steel tire.

.6 Roller brackets: adjustable, minimum 3.1mm galvanized steel.

.7 Hinges: heavy duty, galvanized as recommended by manufacturer.

.8 Cable: 6 mm diameter galvanized steel aircraft cable.

2.4 ACCESSORIES

.1 Overhead horizontal track and operator supports: galvanized steel, type and size to suit installation.

.2 Track guards: 5 mm thick formed sheet 1500 mm high track guards.

.3 Pusher springs.

.4 Door Handles.

.1 No exterior handles.

.2 Handle interior side only on Outbuilding 157. No interior handle on room 151.

.3 Interior handle: flat bar door latch with hole in flat bar at overhead door track for installation of padlock for manual locking of door.

.5 Weather stripping.

.1 Sills: bulb type full width extruded neoprene weatherstrip.

.2 Jambs and head: extruded aluminum and arctic grade vinyl weatherstrip to manufacturer's standard.

.3 Two dual finned seals between sections.

.6 Finish ferrous hardware items with minimum zinc coating of 300 g/m^2 to CSA G164.

2.5 ELECTRICAL OPERATOR

.1 Electrical jack shaft operator to suit door size.

.2 Electrical motors, controller units, remote pushbutton stations, relays and other electrical components: to CSA approval.

.3 Electric Motor: 120/208 V

.1 Size motor to suit type and weight of door. Electrical division will provide 120/208 wiring to motor locations.

.1 Electrical division to provide final connection to motor and local disconnect.

.2 Door provider to provide any additional wiring and connections required for operation of door. All wiring to be installed in suitable sized steel conduit.

.4 Controller units with integral motor reversing starter, solenoid operated brake, heater elements for overload protection, including pushbuttons and control relays as applicable.

.5 Operation:

.1 Door 132B:

.1 Refer to Section 28 22 00 Building Security Access Control

.2 "OPEN-STOP-CLOSE" designations on pushbuttons in English.

.3 Interior wall mounted station:

.4 Provide key operated lockout capability on interior wall mounted station.

.1 Key wall mounted station to match building cylinders and keying.

.5 Exterior door controller station (exterior pedestal):

.1 Provide 1 wired, card operated, exterior door operator, Overhead door operation is locked out until activated by electronic card reader unless otherwise noted.

.2 Door 165B:

.1 "OPEN-STOP-CLOSE" designations on pushbuttons in English.

.2 Interior wall mounted station:

.1 Provide key operated lockout capability on interior wall mounted station.

.2 Key wall mounted station to match building cylinders and keying.

.6 Location:

.1 Interior and exterior pushbutton stations to be located as noted in drawings. Refer to architectural and electrical drawings.

.7 Wiring and Conduit

.1 Section Metal Door section is responsible to provide all low voltage wiring and connections for operation of doors.

.2 Provide conduit and wiring for each door control location. All wiring will be installed in conduit.

.3 Door provider is responsible for connection of each wall station.

.4 Door provider is responsible for final connection of safety equipment to low voltage wiring.

.5 Provide underground conduit for connection between overhead door operator pedestal and overhead door.

.8 Safety switch: combination roll rubber with limit switches for full length of bottom rail of bottom section of door, to reverse door to open position when coming in contact with object on closing cycle.

.1 Sensing edge cord to be self retracting.

.9 Emergency Release

.1 Attach operator to door with quick release device to disconnect door from operator in event of power failure. Provide chain for manual operation.

.2 Provide steel bracket on wall to allow chain to be bolted to the wall.

.10 Mounting brackets: galvanized steel, size and gauge to suit conditions.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Install doors and hardware in accordance with manufacturer's instructions.

.2 Rigidly support rail and operator and secure to supporting structure.

.3 Touch-up steel doors with primer where galvanized finish damaged during fabrication.

.4 Install operator including electrical motors, controller units, pushbutton stations, relays and other electrical equipment required for door operation.

.5 Lubricate and adjust door operating components to ensure smooth opening and closing of doors.

.6 Adjust weatherstripping to form a weather tight seal.

.7 Adjust doors for smooth operation.

.8 Install metal conduit as required for installation of low voltage wiring.

.9 Coordinate installation of conduit to be buried and cast in concrete for exterior pedestal with General Contractor.

.10 Install and make final connections of low voltage wiring.

3.3 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking; clean doors and frames.

.3 Clean glass and glazing materials with approved non-abrasive cleaner.

.4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Underwriters Laboratories

.1 UL325 - Door, Drapery, Gate, Louver, and Window Operators and Systems

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.40-97, Anticorrosive Structural Steel Alkyd Primer.

.2 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings.

.3 CAN/CGSB-79.1-M91, Insect Screens.

.3 Canadian Standards Association (CSA) International

.1 CSA A440-11, NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights.

.2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CSA-C22.2 NO. 0-10 - General requirements - Canadian electrical code, part II.

1.2 PERFORMANCE REQUIREMENTS

.1 Design and size components to withstand dead and live loads caused by pressure and suction of wind, acting normal to plane of system as calculated in accordance with NBC to a design pressure windload per 30 year occurrence.

.2 Limit mullion deflection to L/175; with full recovery of glazing materials.

.3 Size glass units and glass dimensions to limits established in CAN/CGSB-12.20.

.4 Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.

.5 Maintain continuous air barrier and vapour retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.

.6 Overall Thermal Resistance of:

.1 Total system maximum U-value: 1.60 W/m²K.

1.3 SUBMITTALS

.1 Shop drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate materials and details in full size scale for head, jamb and sill, profiles of components, interior and exterior trim junction between combination units elevations of unit, anchorage details, location of isolation coating, description of related components and exposed finishes fasteners, and caulking. Indicate location of manufacturer's nameplates.

.2 Samples:

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit samples from manufacture’s standard range of colours.

.3 Submit one representative cross-section of each type window frame (operable and fixed).

.4 Include frame, sash, sill, glazing and weatherproofing method, insect screens, surface finish and hardware. Show location of manufacturer's nameplates.

1.4 QUALITY ASSURANCE

.1 Mock-ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Construct mock-up to including window frame, glass glazing, and perimeter air barrier and vapour retarder.

.3 Mock-up will be used:

.1 To judge workmanship, substrate preparation, operation of equipment and material application.

.2 For testing to determine compliance with performance requirements (testing will be at the discretion of the Departmental Representative).

.4 Locate where directed.

.5 Allow 48 hours for inspection of mock-up before proceeding with work.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

.2 Pre-installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for windows for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 MANUFACTURER'S WARRANTY

.1 Provide manufacturer's written warranty that frame will not warp, shrink, dent, twist, bow or rot under normal conditions and use for a period of 25 years and against aging and maintenance of window finish for a period of 10 years from date of acceptance of installation.

.2 Sealed glazing units shall be warranted against failure of the air seal due to defects in material or workmanship for a period of 20 years from date of acceptance of installation.

Part 2 Products

2.1 MATERIALS

.1 Materials: to CSA A440 supplemented as follows:

.2 All windows by same manufacturer.

.3 Fibreglass frame and sash shall be made from 60 to 85% glass fibres and 15 to 35% resin.

.1 Main frame: pultruded fiberglass thermally broken and insulated with expanded polystyrene (Type 1) insulation. To sizes indicated on drawings. Finish shall be non-chalking and non-yellowing, U/V resistant.

.1 Colour: “Black”. Provide samples for selection.

.2 Sash: pultruded fiberglass thermally broken and insulated with expanded polystyrene (Type 1) insulation. To sizes indicated on drawings. Finish shall be non-chalking and non-yellowing, U/V resistant. Colour to match window frame.

.4 Glazing: Refer to Section 08 80 50 Glazing.

.5 Screens: to CAN/CGSB-79.1.

.1 Insect screening mesh: count 18 x 16, glassfibre mesh. (black)

.2 Fasteners: tamper proof.

.3 Screen frames: aluminum colour to match window frames.

.4 Mount screen frames for interior replacement.

.6 Interior jambs/sills: provide jamb/sill extension on interior as indicated and to suit conditions. Colour to match window frames.

.7 Interior trim: Refer to Section 06 40 00 Architectural Woodwork for window sills.

.8 Brickmould and brickmould extensions: by window manufacturer, profile and sizes as indicated. Minimum 50mm depth and minimum 1 mm wall thickness.

.1 Colour to match window frame.

.9 Isolation coating: alkali resistant bituminous paint.

.10 Fasteners: all fasteners are to be stainless steel and are to be concealed.

2.2 WINDOW TYPE AND CLASSIFICATION

.1 Types:

.1 Type 1: Location: Police Building. See drawings for locations:

.1 Opening sash: bottom projected (awning) with triple glazing insulating glass.

.1 Manual crank operation.

.2 Integral limiter to prevent sash from opening beyond 100mm beyond sill.

.2 Fixed sash: with triple glazing insulating glass.

.3 Screens: on ventilating portion of windows.

.2 Classification rating: to CSA A440.

.1 Air tightness: A3.
.2 Water tightness: B6.
.3 Wind load resistance: C3.
.4 Condensation resistance: Temperature Index, I 55.
.5 Forced Entry: F1
.6 Insect Screens: S1 (Heavy Duty)

2.3 FABRICATION

.1 Fabricate in accordance with CSA A440 supplemented as follows:

.2 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.

.3 Face dimensions detailed are maximum permissible sizes.

.4 Brace frames to maintain squareness and rigidity during shipment and installation.

.5 Finish steel clips and reinforcement with shop coat primer to CAN/CGSB-1.40; 380 g/m^2 zinc coating to CAN/CSA G164.

2.4 ISOLATION COATING

.1 Isolate aluminum from following components, by means of isolation coating:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
.2 Concrete, mortar and masonry.
.3 Wood.

2.5 GLAZING

.1 Refer to Section 08 80 50 - Glazing

2.6 HARDWARE

.1 Hardware: stainless steel or bronze sash locks and aluminum handles to provide security and permit easy operation of units. Colour to match window frames.

.2 Locks: provide operating sash with spring loading locking device, to provide automatic locking in closed position.

.3 Provide special keyed opening device for windows normally locked.

.4 Equip projected units with roto operators with locking handle.

2.7 AIR BARRIER AND VAPOUR RETARDER

.1 Equip window frames with factory installed air barrier and vapour retarder material for sealing to building air barrier and vapour retarder as follows:

.1 Material width: adequate to provide required air tightness and vapour diffusion control to building air barrier and vapour retarder from interior.

.2 Ensure continuity of air barrier and vapour retarder with adjacent construction.

.3 Refer to drawings for arrangement of air barrier.

2.8 LOW EXPANSION FOAM

.1 Low pressure polyurethane expanding foam, closed cell structure.

.2 Foam remains flexible after curing.

.3 Insulation value: R-5 per inch of cured foam.

Part 3 Execution

3.1 WINDOW INSTALLATION

.1 Install in accordance with CSA A440.

.2 Attach to structure to permit sufficient adjustment to accommodate existing building conditions and other irregularities.

.3 Install products specified square, plumb and level. Center window unit in opening and secure window unit as indicated in manufacturer's written instructions. Provide alignment attachments and shims to permanently fasten system to building structure.

.4 Arrange components to prevent abrupt variation in colour.

.5 All fasteners are to be stainless steel and are to be concealed. Exposed heads will not be permitted.

.6 Verify proper operation of all opening windows.

.7 Allow for deflection of structure at head of window so structure will not impact window.

3.2 SILL INSTALLATION

.1 Provide profile of sill as indicated on drawings for each condition.

.2 Fabricate sills to suit opening sizes.

.3 Secure sills in place with concealed anchoring clips located at ends and mid-point; space no more than 600 mm on centre in between.

3.3 CAULKING

.1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Provide backer rod in gap and

install sealant to thickness recommended by manufacturer for proper performing joint. Generally 1:3 thickness to width.

.2 Seal perimeter joints of window to adjoining finish material.

.3 Seal ends of sills at finish material.

3.4 LOW EXPANSION FOAM

.1 Ensure compatibility between foam and adjacent materials.

.2 Fill gap between window frame and adjacent rough opening with low expansion foam.

.3 Do not overfill cavity.

3.5 ADJUSTING

.1 Adjust units for smooth operation without binding or racking.

.2 Adjust operating hardware and screens for correct operation.

3.6 CLEANING

1. Clean interior and exterior surfaces free of labels, mortar, plaster, paint, joint sealers and other foreign mater to prevent damage to weatherstripping and to prevent interference with operation or hardware.

2. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

3.7 PROTECTION

.1 Protect window unit from damage. Protect ventilators and operating parts from dirt and damage caused by subsequent construction activities. Repair or replace damages units.

.2 Protect finished Work from damage.

3.8 SCHEDULE

1. Refer to drawings for window locations and sizes.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).

.1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-69.18-M90/ANSI/BHMA A156.1-1981, Butts and Hinges.

.2 CAN/CGSB-69.19-93/ANSI/BHMA A156.3-1989, Exit Devices.

.3 CAN/CGSB-69.20-M90/ANSI/BHMA A156.4-1986, Door Controls (Closers).

.4 CAN/CGSB-69.21-M90/ANSI/BHMA A156.5-1984, Auxiliary Locks and Associated Products.

.5 CAN/CGSB-69.22-M90/ANSI/BHMA A156.6-1986, Architectural Door Trim.

.6 CAN/CGSB-69.24-M90/ANSI/BHMA A156.8-1982, Door Controls - Overhead Holders.

.7 CAN/CGSB-69.26-96/ANSI/BHMA A156.10-1991, Power-operated Pedestrian Doors.

.8 CAN/CGSB-69.28-M90/ANSI/BHMA A156.12-1986, Interconnected Locks and Latches.

.9 CAN/CGSB-69.29-93/ANSI/BHMA A156.13-1987, Mortise Locks and Latches.

.10 CAN/CGSB-69.32-M90/ANSI/BHMA A156.16-1981, Auxiliary Hardware.

.11 CAN/CGSB-69.35-M89/ANSI/BHMA A156.19-1984, Power Assist and Low Energy Power Operated Doors.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Hardware List:

.1 Submit contract hardware list in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.4 Closeout Submittals

.1 Provide operation and maintenance data for door closers, locksets, door holders electrified hardware and fire exit hardware for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.2 Storage and Protection:

.1 Store finishing hardware in locked, clean and dry area.

1.5 WASTE DISPOSAL AND MANAGEMENT

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Dispose of corrugated cardboard, polystyrene, plastic, and packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.6 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Supply two sets of wrenches for door closers, locksets, and fire exit hardware.

Part 2 Products

2.1 HARDWARE ITEMS

.1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

.1 Locks and latches:

.1 Interconnected locks and latches: to CAN/CGSB-69.28, series 5000 interconnected lock, grade 1, designed for function and keyed as stated in Hardware Schedule.

.2 Mortise locks and latches: to CAN/CGSB-69.29, series 1000 mortise lock, grade 1, designed for function as stated in Hardware Schedule.

.3 Knobs: Corbin Russwin “Global” design.

.4 Lever handles: Corbin Russwin “Lustra” design.

.5 Escutcheons: Solid stainless steel

.6 Normal strikes: box type, lip projection not beyond jamb.

.7 Cylinders: Corbin-Russwin,0 bitted.

.8 Finish: BHMA 626 Satin Chrome.

.9 Acceptable manufacturer: Corbin Russwin.

.2 Padlocks

.1 Provided by Departmental Represetative.

.3 Evidence, Storage and Gun Lockers

.1 Refer to Section 10 51 13 – Metal Lockers

.4 Butts and hinges:

.1 Butts and hinges: to CAN/CGSB-69.18, listed in Hardware Schedule.

.2 Hinges on selected doors to be "NRP" Type (non-removable-pin) as scheduled.

.3 List of hinges:

a) FBB 168 114 x 114.

b) FBB 168 114 x 144 NRP.

.4 Acceptable manufacturers: Stanley, Hager, Monthard, McKimmey or approved alternate.

.5 Door Closers and Accessories: (heavy duty a) and normal b))

.1 Door controls (closers): to CAN/CGSB-69.20, size in accordance with CAN/CGSB-69.20, table A1, finished to 630.

.1 Grade 1, heavy duty, adjustable hydraulic back check, separate regulation of closing speed and latching speed, rack and pinion action.

.2 List of closers:

.1 LCN 4040 with delayed action function.

.2 LCN 4040H with integral hold-open function

.3 Acceptable manufacturers: LCN, Sargent, Norton, Rixson or approved alternate.

.6 Auxiliary locks and associated products: to CAN/CGSB-69.21, as listed in Hardware Schedule, finished to 26D.

.7 Architectural door trim: to CAN/CGSB-69.22, as listed in Hardware Schedule, finish as noted

.1 Door protection plates: kick plate type, 1.27 mm thick stainless steel, bevelled edges, 300 mm high by 25 mm less than door width, 32D finish.

.2 Push plates: 1.27 mm thick stainless steel, bevelled edges, 125 mm wide by 400 mm high, finished to 32D.

.3 Pulls: 19 mm diameter “D” style, projecting 35 mm from door, height 300 mm, without rose.

.8 Latch guard: Heavy gauge formed steel plate cover to protect lock strike area, 300 mm high, through bolt mounting formed to suit mortised locksets with standard strikes.

.9 Auxiliary hardware: to CAN/CGSB-69.32, as listed in Hardware Schedule and as listed below.

.1 Door check chain: heavy duty compression springs, heavy duty welded steel chain, vinyl cover. 650 mm long, 26D finish.

.2 Wall stop: concave wall stop with concealed mounting, 62 mm diameter, 30 mm projection, cast brass with rubber bumper, 26D finish.

.1 Acceptable products: Hager 234 or Richelieu 2205.

.3 Floor stop: to ANSI A156.16, low dome stop, 45 mm diameter, 3.2 mm thick base, cast brass, 26D finish.

.1 Acceptable products: Hager 241, or Richelieu 218.

.10 Thresholds:

.1 127 mm wide x full width of door opening, 12.7mm height, 3.8 mm wall. stainless steel mill finish, plain surface.

.2 127 mm wide x full width of door opening, extruded aluminum mill finish, serrated surface, with lip and vinyl door seal insert. Pemko 2005_T or approved alternate.

.3 127 mm wide x full width of door opening, 12.7 mm height, extruded stainless steel, mill finish, serrated surface, with thermal break of rigid PVC.

.11 Weatherstripping:

.1 Head and jamb seal:

.1 Extruded aluminum frame and solid closed cell neoprene insert, clear anodized finish.

.2 Door bottom seal:

.1 Heavy duty, extruded aluminum frame and closed cell neoprene weather seal, surface mounted, closed ends, adjustable, clear anodized finish.

.3 Door 139 EPDM neoprene bottom seal:

.1 Heavy duty, extruded aluminum frame and neoprene weather seal, recess mounted to door bottom, closed ends, clear anodized finish.

.2 Accpetable manufacturer:

.1 CT-54N by KNC Crower Mfg. Inc.

.2 Approved equivalent.

.12 Barrier Free Door Operator and Actuators:

.1 To ANSI/BHMA A165.19.

.2 Operator supplier shall include transformer for power for actuators. Include two push plate operators, mounted on push and pull side of doors. Tie operation of

door operator to release electric strike where electric strike is provided with hardware on door. Operator shall be able to be adjusted to reduce force required to open manually from 66 N to 40 N.

.3 Control boxes: complete with electric strike relay and ability to be connected to the building security system.

.4 Power operator door switches with 150 x 150 mm #4 satin finish stainless steel face plate and push button with engraved "barrier free" symbol and mounted in tamper resistant assembly installed by Factory Certified Personnel.

.5 Wall mounted switches: recess mounted switch and box, hard wired to operator housing. Mount operators on push and pull sides of doors as indicated.

.6 Provide one push button on each side of each power operated door

.7 Operation: to

.1 In conjunction with ANSI F13 lockset.

.2 Public hours: Push button operates electric strike in door frame to release electric strike and activate power operator to open door.

.3 Secure hours: Push button is deactivated, electric strike is locked.

.4 Provide switch in operator housing to deactivate door operators when doors are locked by deadbolt.

.8 Provide switched line voltage to control box. Locate switch adjacent to box.

.9 Operator supplier shall be responsible for wiring of all low voltage wiring for controlling door. Electrical Division will provide 120V.

.10 Mount control box in location as directed by Departmental Representative.

.11 Acceptable manufacturers: Gyrotech 500, Horton, Stanley, or approved alternate.

.13 Sound Seals:

.1 Head and jamb seal:

.1 Self-adhesive silicone perimeter gasketing.

.2 Acceptable Manufacturer: Pemko S773, DraftSeal DS340CS or approved alternate.

.14 Electric strike: SDC Model 55 electric strike complete with deadbolt keepers. No substitutions. Refer to Article 3.7 this section.

.1 Strike edge plate to match ANSI function of electric strike.

.15 Card reader: provided by Owner.

.16 Door Viewer

.1 Mount 1.57m above floor level.

.2 Pre-cut holes by door manufacturer to maintain listing of fire rated doors.

.3 Acceptable manufacturer:

.2 ASD Doorscope DS238.

2.3 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.5 Use fasteners compatible with material through which they pass.

2.4 KEYING

.1 Construction keying:

.1 Provide construction cores. Contractor to install construction cores and perform operation verification for all locks. Construction cylinders to be “0” bitted Corbin-Russwin L4 cylinders. Perimeter doors may have random bitting.

.2 Permanent keying:

.1 Provide 000000 bitted for keying by Owner.

.2 Provide two blank keys, in duplicate, for every lock in this Contract.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Furnish manufacturers' instructions for proper installation of each hardware component.

3.2 INSTALLATION

.1 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association and as specified.

.2 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.3 Use only manufacturer's supplied fasteners. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.4 Coordinate door and frame preparation with Section 08 11 00 Metal Doors and Frames to ensure the proper installation and operation of hardware.

.5 Door manufacturer to precut holes for door viewers to maintain listing of fire rated doors.

.6 Remove construction cores and locks when directed by Departmental Representative; install permanent cores and check operation of locks.

3.3 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to provide tight fit at contact points with frames.

3.4 TESTING

.1 All locks must be tested by the Contractor with the installed permanent cores for proper installation. All doors and locks not installed and operating correctly will be rejected.

3.5 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.

.3 Remove protective material from hardware items where present.

.4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.6 DEMONSTRATION

.1 Maintenance Staff Briefing:

.1 Brief maintenance staff regarding:

.1 Proper care, cleaning, and general maintenance of projects complete hardware.

.2 Description, use, handling, and storage of keys.

.3 Use, application and storage of wrenches for door closers, locksets, and fire exit hardware.

.2 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.7 SCHEDULE

Door 000	**Door 001**
1 lockset: • Full Mortise • Model:ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts (non-removable pins) 1 closer	1 lockset: • Full Mortise • Model: ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts (non-removable pins) 1 weatherstripping 1 closer 1 door viewer (interior to exterior)
Door 002	**Door 003**
1 lockset: • Full Mortise • Model:ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts (non-removable pins) 1 closer	1 lockset: • Full Mortise • Model:ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts (non-removable pins) 1 closer
Door 004	**Door 100A**
1 lockset: • Full Mortise • Model:ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts (non-removable pins) 1 closer	1 lockset: • Full Mortise • Model: ML2065-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F13 3 butts (non-removable pins) 1 weatherstripping 1 door sweep 1 closer 1 auto operator 1 electric strike (w/ deadbolt retainer) 1 floor stop 1 door viewer (interior to exterior) 1 threshold Comment: Handicap Assist Door. See Note 2 below.

Door 100B	**Door 102**
1 lockset: • Full Mortise • Model: ML2065-LWR-626 • “0” Bitted L4 Cylinder • ANSI No.: F13 3 butts 1 closer 1 auto operator 1 electric strike (w/ deadbolt retainer) 1 wall stop Comment: Handicap Assist Door. See Note 2 below.	1 lockset: • Full Mortise • Model: ML2057-LWR-626 • ANSI No.: F07 3 butts 1 closer 1 wall stop 1 kickplate
Door 103A	**Door 103B**
1 lockset: • Full Mortise • Model: ML2057-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F07 3 butts 1 closer 1 electric strike 1 weatherstripping 1 drop seal (coordinate w/ Section 08 34 74) 1 wall stop 1 kickplate Comment: Electronic Accessed Controlled Door. See Note 1 below.	1 lockset: • Full Mortise • Model: ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts 1 closer 1 electric strike 1 weatherstripping 1 drop seal (coordinate w/ Section 08 34 74) 1 wall stop 1 kickplate Comment:. Electronic Accessed Controlled Door. See Note 1 below.
Door 104	**Door 105**
1 lockset: • Full Mortise • Model: ML2051-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F04 3 butts 1 closer 1 weatherstripping 1 drop seal (coordinate w/ Section 08 34 74) 1 floor stop 1 kickplate	1 lockset: • Full Mortise • ML2029-LWR-626 • “0” Bitted L4 Cylinder • ANSI No.: F15 3 butts (non-removable pins) 1 closer 1 electric strike 1 kickplate 1 door viewer (view into reception area) Comment: Electronic Accessed Controlled Door. See Note 1 below.

Door 108	**Door 109A**
1 lockset: • Full Mortise • Model: ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts (non-removable pins) 1 closer 1 wall stop 1 kickplate	1 lockset: • Full Mortise • Model: ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts (non-removable pins) 1 weatherstripping 1 door sweep 1 closer 1 electric strike 1 latch guard 1 door viewer (view to exterior) 1 threshold Comment: Electronic Accessed Controlled Door. See Note 1 below.
Door 109B	**Door 110**
1 lockset: • Full Mortise • Model: ML2010-LWR-626 • ANSI No.: F01 3 butts (non-removable pins) 1 closer 1 wall stop 1 kickplate	1 lockset: • Full Mortise • Model: ML2060-LWR-626 • ANSI No.: F22 3 butts 1 wall stop 1 kickplate
Door 111	**Door 113**
1 lockset: • Full Mortise • Model: ML2051-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F04 3 butts 1 wall stop 1 weatherstripping 1 drop seal (coordinate w/ Section 08 34 74) 1 kickplate	1 lockset: • Full Mortise • Model: ML2057-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F07 3 butts 1 closer 1 kickplate 1 wall stop

Door 114	**Door 116**
1 lockset: • Full Mortise • Model: ML2057-LWR-626 • “0” Bitted L4 Cylinder • ANSI No.: F07 3 butts 1 closer 1 floor stop 1 kickplate	1 lockset: • Full Mortise • Model: ML2065-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F13 3 butts 1 closer 1 kickplate
Door 117	**Door 119**
1 lockset: • Full Mortise • Model: ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts 1 closer 1 floor stop 1 electric strike 1 kickplate Comment: Electronic Accessed Controlled Door. See Note 1 below.	1 lockset: • Full Mortise • Model: ML2060-LWR-626 • ANSI No.: F22 3 butts 1 wall stop
Door 120	**Door 120.1**
1 push plate 1 pull plate 3 butts 1 closer 1 wall stop 1 kickplate	1 lockset: • Full Mortise • Model: ML2010-LWR-626 • ANSI No.: F01 3 butts 1 closer 1 kickplate
Door 121	**Door 121.1**
1 push plate 1 pull plate 3 butts 1 closer 1 wall stop 1 kickplate	1 lockset: • Full Mortise • Model: ML2010-LWR-626 • ANSI No.: F01 3 butts 1 closer 1 wall stop 1 kickplate

Door 122	**Door 125**
1 lockset: • Full Mortise • Model: ML2060-LWR-626 • ANSI No.: F22 3 butts 1 wall stop	1 lockset: • Full Mortise • Model: ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts (non-removable pins) 1 closer 1 electric strike 1 kickplate Comment: Electronic Accessed Controlled Door. See Note 1 below.
Door 126	**Door 128A**
1 lockset: • Full Mortise • Model: ML2010-LWR-626 • ANSI No.: F01 3 butts 1 wall stop 1 kickplate	1 lockset: • Full Mortise • Model: ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts (non-removable pins) 1 weatherstripping 1 door sweep 1 closer 1 electric strike 1 kickplate 1 door viewer (view to exterior from interior) 1 threshold Comment: Electronic Accessed Controlled Door. See Note 1 below.
Door 128B	**Door 129A**
1 lockset: • Full Mortise • Model: ML2010-LWR-626 • ANSI No.: F01 3 butts 1 closer 1 wall stop 1 kickplate	1 lockset: • Full Mortise • Model: ML2092-GSR-626 • "0" Bitted L4 Cylinder 3 butts (non-removable pins) 1 closer 1 floor stop 1 electric strike 1 kickplate 1 weatherstripping 1 door sweep Comment: Knob trim (frozen both sides) – no indicator. Electronic Access Control Door. See Note 1 below.

Door 129B	**Door 130**
1 lockset : • Full Mortise • Model: ML2057-GSR-626 • "0" Bitted L4 Cylinder • ANSI No.: F07(K) 3 butts 1 closer 1 electric strike 1 kickplate Comment: Knob trim. Electronic Access Control Door. See Note 1 below.	1 lockset: • Full Mortise • Model: ML2022-GSR-626 • "0" Bitted L4 Cylinder • ANSI No.: F14(K) 3 butts (non-removable pins) 1 closer 1 electric strike 1 weatherstripping 1 door sweep 1 latch guard 1 door viewer (view to exterior from interior) 1 threshold Comment: Knob trim. Electronic Accessed Controlled Door. See Note 1 below.
Door 130.1	**Door 130.2**
1 lockset (no trim on the inside): • Full Mortise • Model: ML2011-626 • "0" Bitted L4 Cylinder • ANSI No.: F18 3 butts Comment: Provide cylinder pull.	1 lockset (no trim on the inside): • Full Mortise • Model: ML2011-626 • "0" Bitted L4 Cylinder • ANSI No.: F18 3 butts Comment: Provide cylinder pull.
Door 130.3	**Door 130.4**
1 lockset (no trim on the inside): • Full Mortise • Model: ML2011-626 • "0" Bitted L4 Cylinder • ANSI No.: F18 3 butts Comment: Provide cylinder pull.	1 lockset (no trim on the inside): • Full Mortise • Model: ML2011-626 • "0" Bitted L4 Cylinder • ANSI No.: F18 3 butts Comment: Provide cylinder pull.

Door 131	**Door 132A**
1 lockset: • Full Mortise • Model: ML2057-GSR-626 • "0" Bitted L4 Cylinder • ANSI No.: F07(K) 3 butts 1 kickplate 1 closer Comment: Knob trim	1 lockset: • Full Mortise • Model: ML2022-GSR-626 • "0" Bitted L4 Cylinders • ANSI No.: F14(K) 3 butts (non-removable pins) 1 weatherstripping 1 door sweep 1 closer 1 latch guard 1 kickplate 1 electric strike 1 door viewer (to view exterior from interior) 1 threshold Comment: Knob trim. Electronic Access Controlled Door. See Note 1 below.
Door 132B	**Door 132C**
1 lockset: • Key Switch • Model: Camden CI-1KFS • "0" Bitted Cylinder Comment: SEE SECTIONAL METAL DOORS 08 36 13 – coordinate with electrical.	1 lockset: • Full Mortise • Model: ML2022-GSR-626 • "0" Bitted L4 Cylinder • ANSI No.: F14(K) 3 butts (non-removable pins) 1 closer 1 wall stop 1 electric strike 1 kickplate 1 door sweep 1 weatherstripping 2 door viewers (to view both sides) Comment: Knob trim. Electronic Access Controlled Door. See Note 1 below.
Door 133	**Door 134**
SEE DETENTION DOOR AND FRAMES 08 34 63	SEE DETENTION DOOR AND FRAMES 08 34 63

Door 135	**Door 136**
1 lockset: • Full Mortise • Model: ML2022-GSR-626 • "0" Bitted L4 Cylinder • ANSI No.: F14(K) 3 butts (non-removable pins) 1 closer 1 wall stop 1 electric strike 1 kickplate 2 door viewers (to view both sides) 1 weatherstripping 1 door sweep Comment: Knob trim. Electronic Accessed Controlled Door. See Note 1 below.	1 lockset: • Full Mortise • Model: ML2010-LWR-626 • ANSI No.: F01 3 butts 1 closer 1 wall stop 1 kickplate Comment: Knob trim.
Door 137	**Door 138**
1 lockset: • Full Mortise • Model: ML2022-GSR-626 • "0" Bitted L4 Cylinder • ANSI No.: F14(K) 3 butts 1 closer 1 weatherstripping 1 drop seal (coordinate w/ Section 08 34 74) 1 kickplate Comment: Knob trim.	SEE DETENTION DOOR AND FRAMES 08 34 63
Door 139	**Door 140**
1 lockset (no trim on the inside): • Full Mortise • Model: ML2011-626 • "0" Bitted L4 Cylinder • ANSI No.: F18 3 butts 1 kickplate 1 weatherstripping 1 neoprene bottom seal (see weatherstripping) Comment: Provide cylinder pull.	1 lockset: • Full Mortise • Model: ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts (non removable pins) 1 closer 1 floor stop 1 kickplate 1 electric strike Comment: Electronic Access Controlled Door. See Note 1 below.

Door 141	**Door 142**
1 lockset: • Full Mortise • Model: ML2057-GSR-626 • "0" Bitted L4 Cylinder • ANSI No.: F07(K) 3 butts 1 closer 1 kickplate 1 electric strike Comment: Knob trim. Electronic Access Controlled Door. See Note 3 below.	1 lockset: • Full Mortise • Model: ML2057-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F07 3 butts (non-removable pins) 1 closer 1 wall stop 1 electric strike 1 kickplate Comment: Electronic Accessed Controlled Door. See Note 3 below.
Door 143	**Door 144**
1 lockset: • Full Mortise • Model: ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts (non-removable pins) 1 closer 1 kickplate	SEE DETENTION DOOR AND FRAMES 08 34 63
Door 145	**Door 146**
1 lockset: • Full Mortise • Model: ML2057-GSR-626 • "0" Bitted L4 Cylinders • ANSI No.: F07(K) 3 butts 1 kickplate 1 closer 1 weatherstripping 1 electric strike 1 door sweep Comment: Knob trim. Electronic Accessed Controlled Door. See Note 3 below.	SEE DETENTION DOOR AND FRAMES 08 34 63

Door 147	**Door 148**
1 lockset: • Full Mortise • Model: ML2057-GSR-626 • "0" Bitted L4 Cylinder • ANSI No.: F07(K) 3 butts 1 kickplate 1 closer 1 electric strike Comment: Knob trim. Electronic Access Controlled Door. See Note 3 below.	1 lockset: • Full Mortise • Model: ML2057-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F07 3 butts 1 closer 1 floor stop 1 kickplate 1 electric strike 1 weatherstripping 1 door sweep Comment: Electronic Access Controlled Door. See Note 3 below.
Door 149	**Door 150**
1 lockset (no trim on the inside): • Full Mortise • Model: ML2011-626 • "0" Bitted L4 Cylinder • ANSI No.: F18 3 butts 1 weatherstripping 1 drop seal (coordinate w/ Section 08 34 74) 1 kickplate Comment: Provide cylinder pull.	SEE DETENTION DOOR AND FRAMES 08 34 63
Door 151	**Door 152**
SEE DETENTION DOOR AND FRAMES 08 34 63	1 lockset: • Full Mortise • Model: ML2057-LWR-626 • “0” Bitted L4 Cylinder • ANSI No.: F07 3 butts (non-removable pins) 1 closer 1 floor stop 1 kickplate 1 weatherstripping 1 door sweep

Door 153	**Door 154**
1 lockset: • Full Mortise • Model: ML2057-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F07 3 butts 1 closer 1 wall stop 1 electric strike 1 kickplate Comment: Electronic Accessed Controlled Door. See Note 3 below.	1 lockset: • Full Mortise • Model:ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts (non-removable pins) 1 closer 1 wall stop 1 kickplate
Door 155	**Door 156**
1 lockset: • Full Mortise • Model: ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts (non-removable pins) 1 closer 1 kickplate 1 weatherstripping 1 door sweep	SEE DETENTION DOOR AND FRAMES 08 34 63
Door 157	**Door 158A**
1 lockset: • Full Mortise • Model: ML2057-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F07 3 butts (non-removable pins) 1 closer 1 kickplate 1 weatherstripping 1 door sweep	1 lockset: • Full Mortise • Model: ML2029-LWR-626 • "0" Bitted L4 Cylinders • ANSI No.: F15 3 butts (non-removable pins) 1 weatherstripping 1 door sweep 1 closer 1 latch guard 1 kickplate 1 electric strike 1 door viewer (view to exterior) 1 threshold Comment: Electronic Accessed Controlled Door. See Note 1 below.

Door 158B	**Door 159**
1 lockset: • Full Mortise • Model: ML2010-LWR-626 • ANSI No.: F01 3 butts 1 closer 1 wall stop 1 kickplate	1 lockset: • Full Mortise • Model: ML2051-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F04 3 butts 1 weather stripping 1 drop seal (coordinate with Section 08 34 74) 1 wall stop 1 kickplate
Door 160	**Door 161**
1 lockset: • Full Mortise • Model: ML2051-LWR-626 • “0” Bitted L4 Cylinder • ANSI No.: F04 3 butts 1 closer 1 weatherstripping 1 door sweep 1 wall stop 1 kickplate	1 lockset: • Full Mortise • Model: ML2065-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F13 3 butts 1 weather stripping 1 drop seal (coordinate w/ Section 08 34 74) 1 wall stop 1 kickplate
Door 162	**Door 163.1**
1 lockset: • Full Mortise • Model: ML2051-LWR-626 • ANSI No.: F04 3 butts 1 closer 1 weatherstripping 1 drop seal (coordinate w/ Section 08 34 74) 1 kickplate	1 passage set: • Full Mortise • Model: ML2050-LWR-626 • Half Dummy Trim 3 butts Spring-loaded roller latch closure 1 kickplate

Door 164A	**Door 164B**
1 lockset: • Full Mortise • Model: ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts 1 closer 1 weatherstripping 1 drop seal (coordinate w/ Section 08 34 74) 1 wall stop 1 kickplate 1 electric strike Comment: Electronic Accessed Controlled Door. See Note 1 below.	1 lockset: • Full Mortise • Model: ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts 1 closer w/ integral hold open 1 weatherstripping 1 drop seal (coordinate w/ Section 08 34 74) 1 wall stop 1 kickplate 1 electric strike Comment: Electronic Accessed Controlled Door. See Note 1 below.
Door 165A	**Door 165B**
1 lockset: • Full Mortise • Model: ML2029-LWR-626 • "0" Bitted L4 Cylinder • ANSI No.: F15 3 butts (non-removable pins) 1 weatherstripping 1 door sweep 1 threshold 1 closer	Two (2) sliding latch bolts from interior by overhead door manufacturer. SEE SECTIONAL METAL DOORS 08 36 13

Note 1: Prepare frame for installation of SDC Model 55 DU-630 electric strike (24Vdc). Ensure Deadbolt keepers are installed and aligned in door frame where there are lock sets with deadbolts.

Note 2: Prep door with SDC 55 series electric strike specified for handicap assist door latch release.

Note 3: Prepare frame for installation of SDC Model 55 ABCU-630 electric strike (24Vdc). Ensure Deadbolt keepers are installed and aligned in door frame where there are lock sets with deadbolts.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 07 92 00 – Joint Sealing

.2 Section 08 11 00 - Metal Doors and Frames.

.3 Section 08 11 16 – Aluminum Frames.

.4 Section 08 14 16 - Flush Wood Doors.

.5 Section 08 54 13 – Fibreglass Windows.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
.2 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
.3 CAN/CGSB-12.4-M91 Heat Absorbing Glass
.4 CAN/CGSB-12.11-M90, Wired Safety Glass.

.2 Flat Glass Manufacturers Association (FGMA).

.1 FGMA Glazing Manual - 1997.

.3 International Window Film Association (IWFA)

.1 IWFA Visual Quality Standard for Applied Window Film 1999.

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:

.1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit test data substantiating triple glazed sealed units meets specified maximum centre-of-glazing U-factor.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.3 Samples:

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Sealed Units: Submit duplicate 300 x 300 mm size samples of sealed units.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

.5 Closeout Submittals:

.1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 WARRANTY

.1 Contractor's Warranty –Contractor shall warrant the work in accordance with the General Conditions.

.2 Product Warranty – Provide a TEN (10) year manufacturer's warranty for sealed glazing units. Include coverage for sealed glass units from seal failure, interpane dusting or misting and replacement of same.

PART 2 Products

2.1 MATERIALS: FLAT GLASS

.1 Float glass: to CAN/CGSB-12.3, Glazing quality.

.2 Safety (tempered) glass: to CAN/CGSB-12.1, transparent.

.1 Type 2-tempered.

.2 Class B-float.

.3 Heat absorbing glass: to CAN/CGSB-12.4.

.1 Type: Insulating glass unit.

.2 Class: Heat strengthened.

.4 Silvered mirror glass: thickness to suit mirror dimensions.

.1 Type 3A-tempered.

2.2 MATERIALS: EXTERIOR SEALED INSULATING TRIPLE UNITS

.1 Refer to Section 08 54 13 Fiberglass Windows and drawings.

.2 Refer to Section 08 90 10 Door, Frame and Hardware Schedule and drawings.

.3 Performance: Maximum centre-of-glazing U-factor:

.1 0.79 W/m²K (0.14 Btu/hour ft²F)

.4 Insulating glass units: to CAN/CGSB 12.8, triple glazed unit; 44 mm overall thickness.

.1 Glass: to CAN/CGSB 12.1 and 12.3.

.2 Glass thickness: sized to in CAN/CGSB-12.20 and National Building Code to 1 in 50 hourly wind pressure level of 0.75 kPa – Open Terrain.

.1 Minimum lite thickness 6mm

.3 Exterior lite:

.1 Heat strengthened.

.2 Colour clear.

.4 Inter cavity space thickness: 12.5 mm

.5 Interior Lites:

.1 Heat strengthened.

.2 Low-E Glass coating: PPG “Solar Ban 60” soft coat low ‘e’

.3 Colour: clear.

.4 Coating surface #2 and surface #5.

.6 Inert gas fill: argon.

.7 Spacer: warm edge spacer PPG “Intercept” Black colour.

.8 U-value of sealed unit 0.18

.9 Solar Heat Gain Coefficient: 0.24

.10 Visible Transmittance: 0.41

2.3 LAMINATED GLASS UNIT

.1 Laminated glass: to ASTM C-1172

.1 Type: Full surface layer of 0.762 mm (or 0.030 inches) polyvinyl butyral (PVB) interlayer compressed between two panes of 6 mm tempered glass unless noted otherwise.

2.4 SAFETY (TEMPERED) GLASS:

.1 Safety glass: to CAN/CGSB-12.1, transparent, thickness as indicated.

.1 Type 2-tempered.

.2 Class B-float.

.3 Category 1 and 2 as applicable.

.4 Square edge.

2.5 POLYCARBONATE (Window frames only)

.1 Single 12.7 mm overall thickness polycarbonate sheet, clear colour.

.2 Ballistic performance: to ASTM F1233.

.3 Flexural strength: to ASTM D790.

.4 Surface burning characteristics for flame and smoke spread: to ASTM E84.

.5 Self ignition characteristics: to ASTM D1929.

.6 Acceptable product:

.1 Lexan

.2 Approved equivalent.

2.6 SPEAKER PORT

.1 Through glass mounted type, consisting of two circular 152 mm outside diameter perforated 14 gauge stainless steel discs, through bolted.

.2 Perforations: 3 mm dia. holes spaced 10 mm apart each way. Holes in back plate offset 4.8 mm from front plate.

.3 Fasteners: No 8 tamper resistant Torx flat head screws on secure side of room.

.4 Finish: exposed surfaces to ANSI No. 4, satin finish.

.5 Acceptable Product:

.1 Model 45-115-01-SD1 available from Securingcosmos.com.

.2 Metal Fab Services Ltd #820-SD.

2.7 WALL MIRROR

.1 Frame: stainless steel.

.2 Fasteners: vandal resistant clips, size and number to suit mirror dimensions.

2.8 ACCESSORIES

.1 Sealant – refer to Section 07 92 00 – Joint Sealing

.2 Setting blocks: Neoprene, 80-90 Shore durometer hardness to ASTM D2240, to suit glazing method, glass light, weight and area.

.3 Spacer shims: Neoprene, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.

.4 Glazing tape: Preformed butyl compound, 10-15 Shore durometer hardness to ASTM D2240; coiled on release paper; black colour.

.5 Mirror attachment accessories:

.1 Vandal-resistant stainless steel clips.

PART 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

.1 Verify that openings for glazing are correctly sized and within tolerance.

.2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.3 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.4 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

.1 Perform work in accordance with FGMA Glazing Manual for glazing installation methods.

.2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.

.3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.

.4 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.

.5 Place glazing tape on free perimeter of glazing in same manner described.

.6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

.7 Knife trim protruding tape.

3.5 INSTALLATION: EXTERIOR SEALED UNITS

.1 Install to window and steel frame manufacturer’s instructions.

3.6 INSTALLATION: LAMINATED/ TEMPERED GLAZED UNITS

.1 Refer to drawings for glazing configuration and installation.

.2 Install laminated glazing on exterior lite of sealed units.

.3 Perform work in accordance with FGMA Glazing Manual for glazing installation methods.

3.7 INSTALLATION: SAFETY (TEMPERED) GLASS:

.1 Refer to Section 08 90 10 Door Frame and Hardware Schedule and as noted in drawings.

.2 Perform work in accordance with FGMA Glazing Manual for glazing installation methods.

3.8 INSTALLATION: POLYCARBONATE (WINDOW FRAMES ONLY)

.1 Refer to drawings for configuration and installation.

3.9 INSTALLATION: MIRRORS

.1 Set mirrors with clips. Anchor rigidly to wall construction.

.2 Place plumb and level.

.3 Refer to drawings for locations.

3.10 SPEAKER PORT

.1 Cut opening in glass for speaker port.

.2 Install speaker port according to manufacturer’s written instructions.

3.11 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking.

.3 Remove glazing materials from finish surfaces.

.4 Remove labels after work is complete.

.5 Clean glass using approved non-abrasive cleaner in accordance with manufacture's instructions.

3.12 PROTECTION OF FINISHED WORK

.1 After installation, mark light with an "X" by using removable plastic tape or paste.

3.13 SCHEDULE

.1 Refer to Specifications and Drawings.

.2 Wall Mirrors

.1 Room 126

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 92 00 – Joint Sealing.

.3 Section 08 11 14 - Metal Doors and Frames.

.4 Section 08 80 50 – Glazing

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.

.2 Flat Glass Manufacturers Association (FGMA).

.1 FGMA Glazing Manual - 1997.

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:

.1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit test data substantiating triple glazed sealed units meets specified maximum centre-of-glazing U-factor.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.3 Samples:

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Sealed Units: Submit duplicate 300 x 300 mm size samples of sealed units.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

.5 Closeout Submittals:

.1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 WARRANTY

.1 Contractor's Warranty –Contractor shall warrant the work in accordance with the General Conditions.

.2 Product Warranty – Provide a five (5) year manufacturer's warranty for sealed glazing units. Include coverage for sealed glass units from seal failure, interpane dusting or misting and replacement of same.

PART 2 Products

2.1 STANDARD OF ACCEPTANCE

.1 Sound transmission class for complete unit: minimum STC 46.

.2 Acceptable Product

.1 Vision Control by Unicel Architectural.

2.2 MATERIALS: LAMINATED GLASS UNIT

.1 Laminated glass: to ASTM C-1172

.1 Type: Full surface layer of 0.762 mm polyvinyl butyral (PVB) interlayer compressed between two panes of 6 mm tempered glass for each pane of glazing.

2.3 MATERIALS: LOUVERS, FRAMES AND OPERATORS

.1 Louvers: Hollow extruded aluminum, interlocking profile, 6mm thick x 35mm deep; Duracron K-1285 Gloss White finish.

.2 Manual Operators: Aluminum knob type. Locate knob on Room 130 side.

.3 Glass Frame (Trim Kit): Welded metal frame sized to accept 63mm thick glass.

2.4 ACCESSORIES

.1 Sealant – refer to Section 07 92 00 – Joint Sealing

.2 Setting blocks: Neoprene, 80-90 Shore durometer hardness to ASTM D2240, to suit glazing method, glass light, weight and area.

.3 Spacer shims: Neoprene, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.

.4 Glazing tape: Preformed butyl compound, 10-15 Shore durometer hardness to ASTM D2240; coiled on release paper; black colour.

2.5 FABRICATION

.1 Sealed Insulated Glass Units:

.1 Comply with ASTM E2190,

.2 Fabricate spacer bar frame of tubular aluminum filled with desiccant.

.3 Bond spacer bar frame to glass panes.

.4 Fill space outside frame to glass edge with elastomeric sealant.

PART 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

.1 Verify that openings for glazing are correctly sized and within tolerance.

.2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.3 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.4 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

.1 Perform work in accordance with FGMA Glazing Manual for glazing installation methods.

.2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.

.3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.

.4 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.

.5 Place glazing tape on free perimeter of glazing in same manner described.

.6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

.7 Knife trim protruding tape.

3.5 CAULKING

.1 Seal full perimeter of both sides of observation control window frame with approved caulking, prior to installation of polycarbonate glazing screen.

3.6 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking.

.3 Remove glazing materials from finish surfaces.

.4 Remove labels after work is complete.

.5 Clean glass using approved non-abrasive cleaner in accordance with manufacture's instructions.

3.7 PROTECTION OF FINISHED WORK

.1 After installation, mark light with an "X" by using removable plastic tape or paste.

3.8 SCHEDULE

.1 Refer to Specifications and Drawings.

END OF SECTION

General notes:
.1 This schedule is to be read in conjunction with the Drawings and applicable Specification Sections**.**
.2 Refer to Section 08 71 10, Door Hardware for hardware groups.
.3 Refer to Drawings for door and frame types
.4 Refer to Electrical for Card reader rough-ins, door contacts, power operators and associated power. Hardware manufacturer/installer shall be responsible for making all low voltage connections.
.5 Verify all door and frame sizes prior to ordering.

Door No.	Door				Frame			Rating (Min.)	Glass	Additional Requirements
	Size	Type	Mat'l	Fin.	Type	Mat'l	Fin.			
Crawlspace – Refer to Drawing A2.1										
000	900x900	H	HM	PT4	F13	PS	PT4	-.	-	Non-rated fire separation.
001	900x900	H	IMD	PT4	F12	PS	PT4	-	-	Door viewer.
002	900x900	H	HM	PT4	F13	PS	PT4	-	-	Non-rated fire separation.
003	900x900	H	HM	PT4	F13	PS	PT4	45 MIN.	-	
004	900x900	H	HM	PT4	F13	PS	PT4	-	-	Non-rated fire separation.
Main Floor and Outbuilding – Refer to Drawing A2.2										
100A	1000 X 2150	A	IMD	PT4[1]	F4*	PS	PT4[1]	-	-	Auto Operator. Electric strike. Door viewer. [1] PT2 at interior face of door and frame.
100B	1000 X 2150	D	HM	PT2	F1*	PS	PT2	-	TG	Auto Operator. Electric strike.
102	900 X 2150	A	HM	PT2	F1	PS	PT2	-	-	
103A	900 X 2150	A	ASD	PT2	F2*	PS	PT2	-	-	Electronic access controlled door. Electric strike. Keyed on Room 101 side.
103B	900 X 2150	A	ASD	PT2	F2*	PS	PT2	-	-	Electronic access controlled door. Electric strike. Keyed on Room 103 side.
104	900 X 2150	A	ASD	PT2	F2	PS	PT2	-	-	
105	1000 X 2150	A	HM	PT2	F1*	PS	PT2	-	-	Electronic access controlled door. Electric strike. Door viewer.
108	900 X 2150	A	HM	PT2	F1	PS	PT2	-	-	Keyed on Corridor 108 side.
109A	1000 X 2150	A	IMD	PT4[2]	F4*	PS	PT4[2]	-	-	Electronic access controlled door. Electric Strike. Door viewer. [2] PT2 interior face of door and frame.
109B	1000 X 2150	D	HM	PT2	F1	PS	PT2	-	TG	
110	900 X 2150	A	WFD	S/V	F1	PS	PT2	-	-	
111	900 X 2150	A	ASD	PT2	F2	PS	PT2	-	-	

Door No.	Door				Frame			Rating (Min.)	Glass	Additional Requirements
	Size	Type	Mat'l	Fin.	Type	Mat'l	Fin.			
113	900 X 2150	A	WFD	S/V	F1	PS	PT2	-	-	Non-rated fire separation.
114	1070 X 2150	A	HM	PT2	F1	PS	PT2	45 MIN.	-	
116	1070 X 2150	A	WFD	S/V	F1	PS	PT2	-	-	
117	900 X 2150	A	HM	PT2	F1*	PS	PT2	45 MIN.	-	Electronic access control door. Electric strike.
119	900 X 1500	J	WFD	S/V	F1	PS	PT2	-	-	Door bottom is 300 AFF in regular frame for ventilation above and below.
120	900 X 2150	A	WFD	S/V	F1	PS	PT2	-	-	
120.1	600 x 2150	A	HM	PT2	F1	PS	PT2	45 MIN.	-	
121	900 X 2150	A	WFD	S/V	F1	PS	PT2	-	-	
121.1	600 x 2150	A	HM	PT2	F1	PS	PT2	45 MIN.	-	
122	900 X 1500	J	WFD	S/V	F1	PS	PT2	-	-	Door bottom is 300 AFF in regular frame for ventilation above and below.
125	900 X 2150	A	HM	PT2	F1*	PS	PT2	45 MIN.	-	Electronic access control door. Electric strike.
126	900 X 2150	D	WFD	S/V	F1	PS	PT2	-	TG	Coordinate undercut with transition strip required between flooring of different heights between Rooms 112 and 126.
128A	1000 X 2150	A	IMD	PT4[3]	F4*	PS	PT4[3]	-	-	Electronic access door. Electric strike. Door viewer. [3] PT2 interior face of door and frame.
128B	1000 X 2150	D	HM	PT2	F1	PS	PT2	-	TG	
129A	900 X 2150	F	HM	EL/ PT2[7]	F1*	PS	EL PT2[7]	45 MIN.	-	Electronic access control door. Electric strike. [7] PT2 on door and frame in Room 112. EL in Room 129.
129B	900 X 2150	F	HM	EL	F1*	PS	EL	-	LX	Electronic access control door. Electric strike.
130	900 X 2150	A	IMD	PT4/ EL[4]	F4*	PS	PT4/ EL[4]	-	-	Electronic access control door. Electric strike. Door viewer. [4]PT4 on exterior door and frame. EL interior door and frame.
130.1	600 X 2150	A	HM	EL	F1	PS	EL	-	-	
130.2	600 X 2150	A	HM	EL	F1	PS	EL	-	-	
130.3	600 X 2150	A	HM	EL	F1	PS	EL	-	-	
130.4	600 X 2150	A	HM	EL	F1	PS	EL	-	-	
131	900 X 2150	A	HM	EL	F1	PS	EL	-	-	Non-rated fire separation.
132A	1000 X 2150	A	IMD	PT4/ EL[9]	F4*	PS	PT4/ EL[9]	-	-	Electronic access control door. Electric strike. Door viewer. [9]PT4 on exterior door and frame. EL interior door and frame.
132B	3660W X 2440H	G	-	PRE	F11*	-	PT5/ EL[10]	-	-	Sectional Metal Door. [10]PT5 on exterior frame. EL interior frame. Key switch. Coordinate with electrical.
132C	900 X 2150	A	HM	EL	F1*	PS	EL	45 MIN.	-	Electronic access control door. Electric strike. Door viewers both sides.
133	1000 X 2150	E	STL	EL	F9	-	EL	-	LX	Hardware as specified

Door No.	Door				Frame			Rating (Min.)	Glass	Additional Requirements
	Size	Type	Mat'l	Fin.	Type	Mat'l	Fin.			
134	1000 X 2150	E	STL	EL	F9	-	EL	-	LX	Hardware as specified
135	900 X 2150	A	HM	EL/ PT2[5]	F1*	PS	EL PT2[5]	45 MIN.	-	Electronic access control door. Electric strike. Door viewer both sides. [5] PT2 on door and frame in Room 112. EL in Room 135.
136	900 X 2150	A	HM	EL	F1	PS	EL	-	-	
137	900 X 2150	A	ASD	EL	F2	PS	EL	-	-	
138	1000 X 2150	E	STL	EL	F9	-	EL	-	LX	Hardware as specified
139	900 X 2150	F	HM	EL	F1	PS	EL	-	LX	Coordinate final door size with shower base and water seal hardware.
140	900 X 2150	A	HM	PT2	F2*	PS	PT2	45 MIN.	-	Electronic access controlled door. Electric strike.
141	900 X 2150	A	HM	EL	F1*	PS	EL	-	-	Non-rated fire separation. Electronic access control door. Electric strike.
142	900 X 2150	A	HM	PT2	F1*	PS	PT2	45 MIN.	-	Electronic access control door. Electric strike.
143	900 X 2150	A	HM	PT2	F1	PS	PT2	45 MIN.	-	
144	1000 X 2150	E	STL	EL	F9	-	EL	-	LX	Hardware as specified
145	900 X 2150	A	HM	EL	F1	PS	EL	-		Non-rated fire separation.
146	1000 X 2150	E	STL	EL	F9	-	EL	-	LX	Hardware as specified
147	900 X 2150	A	HM	EL	F1	PS	EL	-	-	Non-rated fire separation.
148	900 X 2150	A	HM	PT2	F2*	PS	PT2	45 MIN.	-	Electronic access controlled door. Electric strike.
149	900 X 2150	A	ASD	EL	F2	PS	EL	-	-	
150	1000 X 2150	E	STL	EL	F9	-	EL	-	LX	Hardware as specified
151	1000 X 2150	E	STL	EL	F9	-	EL	-	LX	Hardware as specified
152	1070 X 2150	A	HM	PT2	F1	PS	PT2	45 MIN.	-	
153	900 X 2150	A	HM	PT2	F1*	PS	PT2	45 MIN.	-	Electronic access control door. Electric strike.
154	900 X 2150	A	HM	PT2	F1	PS	PT2	45 MIN.	-	
155	900 X 2150	A	HM	PT2	F1	PS	PT2	45 MIN.	-	
156	1000 X 2150	E	STL	EL	F9	-	EL	-	LX	Hardware as specified
157	900 X 2150	A	HM	PT2	F1	PS	PT2	45 MIN.	-	
158A	1000 X 2150	A	IMD	PT4[8]	F4*	PS	PT4[8]	-	-	Electronic access control door. Electric strike. Door viewer. [8]PT2 interior face of door and frame.
158B	1000 X 2150	D	HM	PT2	F1	PS	PT2	-	TG	
159	900 X 2150	A	WFD	S/V	F1	PS	PT2	-	-	
160	900 X 2150	A	WFD	S/V	F1	PS	PT2	-	-	

Door No.	Door				Frame			Rating (Min.)	Glass	Additional Requirements
	Size	Type	Mat'l	Fin.	Type	Mat'l	Fin.			
161	900 X 2150	A	ASD	PT2	F2	PS	PT2	-	-	
162	900 X 2150	A	ASD	PT2	F2	PS	PT2	-	-	
163.1	900 x 2150	A	WFD	S/V	F1	PS	PT2	-	-	
164A	900 X 2150	A	ASD	PT2	F2	PS	PT2	-	-	Keyed on Room 164 side.
164B	900 X 2150	A	ASD	PT2	F2	PS	PT2	-	-	
165A	900 X 2150	A	IMD	PT4	F1	PS	PT4	-	-	
165B	4877W X 2730H	G	-	PRE	F11	-	PT5[11]	-	-	Sectional Metal Door. [11]PT5 on exterior/interior frame.

Abbreviations:

EL – Elastomeric Coating (09 96 53)
HM – Hollow Metal Door (08 11 00)
ASD – Acoustic Steel Door (08 34 74)
IMD – Insulated Metal Door (08 11 00)
LX – Lexan (08 34 63)
PT# – Paint (# Denotes Colour) (09 91 13 & 09 91 23)
PS – Pressed Steel Frame (welded) (08 11 00 & 08 34 74)
LG – Laminated Glass (08 80 50)
WFD – Wood Flush Door (08 14 16)
TG – Tempered Glass (08 80 50)
STL – Steel (08 34 63)
S1 – Clear Varnish (09 91 23)
FI –Fibreglass Insulated Door (08 16 13)
HCW –Hollow Core Molded Panel Interior Doors (08 14 18)
SCW –Solid Core Molded Panel Interior Doors (08 14 18)
PRE – Prefinished
WD - Wood

Notes:

F# * denotes a frame with special security requirements, refer to electrical drawings and specifications.

This schedule is to be read in conjunction with the Drawings and Specification Sections.

Room No.	Floor	Base	Walls				Ceiling	Notes:
			N	S	E	W		
100	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
101	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
102	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
103	RFF	RB	PT1	PT1	PT1	PT1	ATC	
104	RFF	RB	PT1	PT1	PT1	PT1	ATC	
105	RSSF	COV	PT1	PT1	PT1	PT1	ATC	
106	RSSF	COV	PT1	PT1	PT1	PT1	ATC	
107	RSSF	COV	PT1	PT1	PT1	PT1	ATC	
108	RSSF	COV	PT1	PT1	PT1	PT1	ATC	
109	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
110	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
111	RFF	RB	PT1	PT1	PT1	PT1	ATC	
112	RSSF	COV	PT1	PT1	PT1	PT1	ATC	
113	RSSF	COV	RWC	RWC	RWC	RWC	PT6	
114	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
115	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
116	RSSF	COV	PT1	PT1	PT1	PT1	ATC	
117	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
118	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
119	RHF	COV	RWC	RWC	RWC	RWC	RWC	
120	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
120.1	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
121	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
121.1	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
122	RHF	COV	RWC	RWC	RWC	RWC	RWC	
123	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
124	RSSF	COV	PT1	PT1	PT1	PT1	ATC	
125	RSSF	COV	PT1	PT1	PT1	PT1	ATC	
126	RSF	RB	PT1	PT1	PT1	PT1	ATC	
127	RSSF	COV	PT1	PT1	PT1	PT1	ATC	

Room No.	Floor	Base	Walls				Ceiling	Notes:
			N	S	E	W		
128	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
129	RSSF	COV	EL	EL	EL	EL	EL	
130	RSSF	COV	EL	EL	EL	EL	EL	
130.1	RSSF	COV	EL	EL	EL	EL	EL	
130.2	RSSF	COV	EL	EL	EL	EL	EL	
130.3	RSSF	COV	EL	EL	EL	EL	EL	
130.4	RSSF	COV	EL	EL	EL	EL	EL	
131	RSSF	COV	EL	EL	EL	EL	EL	
132	CONC S&H	-	EL	EL	EL	EL	EL	Pigmented concrete with clean fines embedded within sealer.
133	RSSF	EL	EL	EL	EL	EL	EL	
134	RSSF	EL	EL	EL	EL	EL	EL	
135	RSSF	COV	EL	EL	EL	EL	EL	
136	RSSF	COV	EL	EL	EL	EL	EL	
137	RSSF	COV	APT	APT	APT	APT	APT	Window frame PT2.
138	RSSF	EL	EL	EL	EL	EL	EL	
139	SS	SS	SS	SS	SS	SS	SS	
140	RSSF	COV	PT1	PT1	PT1	PT1	ATC	
141	RSSF	COV	EL	EL	EL	EL	EL	
142	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
143	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
144	RSSF	EL	EL	EL	EL	EL	EL	
145	RSSF	COV	EL	EL	EL	EL	EL	
146	RSSF	EL	EL	EL	EL	EL	EL	
147	RSSF	COV	EL	EL	EL	EL	EL	
148	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
149	RSSF	COV	EL	EL	EL	EL	EL	Window frame PT2.
150	RSSF	EL	EL	EL	EL	EL	EL	
151	RSSF	EL	EL	EL	EL	EL	EL	
152	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
153	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
154	RSSF	COV	PT1	PT1	PT1	PT1	PT6	

Room No.	Floor	Base	Walls				Ceiling	Notes:
			N	S	E	W		
155	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
156	RSSF	EL	EL	EL	EL	EL	EL	
157	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
158	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
159	RFF	RB	PT1	PT1	PT1	PT1	ATC	
160	RFF	RB	PT1	PT1	PT1	PT1	ATC	
161	RSSF	COV	PT1	PT1	PT1	PT1	ATC	
162	RFF	RB	PT1	PT1	PT1	PT1	ATC	
163	RSSF	COV	PT1	PT1	PT1	PT1	ATC	
163.1	RSSF	COV	PT1	PT1	PT1	PT1	PT6	
164	RFF	RB	PT1	PT1	PT1	PT1	ATC	
165	CONC S&H	-	PT1	PT1	PT1	PT1	PT1	

List of Abbreviations:

APT	ACOUSTIC PANEL TYPE 1 (09 84 00)
ATC	ACOUSTIC TILE CEILING (09 51 13 & 09 53 01)
CONC S&H	CONCRETE WITH HARDENER AND SEALER (03 35 00/09 91 23)
COV	COVED FLOORING BASE (09 67 00)
RFF	RUBBER FLOCKED FLOORING (09 65 18)
EL	ELASTOMERIC COATING (09 96 53)
EXP	EXPOSED – No finish
GB	GYPSUM BOARD – PAINTED (09 91 23)
H1	HARDWOOD 1 (06 40 00)
PT#	PAINT (# DENOTES COLOUR – SEE 09 91 23)
RB	RUBBER BASE (09 68 00)

RSSF	RESILIENT SHEET SAFETY FLOORING (09 65 16)
RHF	RESILIENT HYDRO FLOORING (09 65 16)
RWC	RESILIENT WALL CLADDING (10 26 00)
RSF	RUBBER SPORT FLOORING (09 65 20)
SS	STAINLESS STEEL (05 50 00)

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 07 27 00 – Air and Vapour Barriers.

.3 Section 09 06 01 – Room Finish Schedule.

.4 Section 09 51 13 – Acoustical Panel Ceilings.

.5 Section 09 84 00 – Acoustic Treatment

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

- .1 ASTM C36/C36M-03e1, Specification for Gypsum Wallboard.
- .2 ASTM C475-12, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- .3 ASTM C840-11, Specification for Application and Finishing of Gypsum Board.
- .4 ASTM C841-03(2008), Standard Specification for Installation of Interior Lathing and Furring.
- .5 ASTM C1002-07, Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- .6 ASTM C1047-10a, Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- .7 ASTM C1178/C1178M-11, Specification for Glass Mat Water-Resistant Gypsum Backing Board.
- .8 ASTM C1396/C1396M-11, Standard Specification for Gypsum Board.
- .9 ASTM C1629/C1629M-06(2011), Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels

.2 Association of the Wall and Ceilings Industries International (AWEI)

.3 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.4 Underwriters' Laboratories of Canada (ULC)

- .1 CAN/ULC-S102-2007, Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

.1 Samples:

.1 Submit duplicate 300 x 300 mm samples of textured ceiling finishes for Housing Unit ceilings, in selected colour, to consultant for approval prior to installation.

1.4 MOCK-UP

.1 Provide mock-up in accordance with Section 01 45 00 – Quality Control.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in original packages, containers or bundles bearing manufacturers brand name and identification.

.2 Store materials inside, level, under cover. Keep dry. Protect from weather, other elements and damage from construction operations and other causes.

.3 Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.

.4 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 SITE ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature minimum 10 degrees C, maximum 21 degrees C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

Part 2 Products

2.1 MATERIALS

.1 Standard board: to ASTM C36/C36M, Type X, 16 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges bevelled.

.2 Mold and mildew resistant gypsum board: to ASTM C1396/C1396M, Type X, thickness as indicated in drawings, 1200 mm wide x maximum practical length.

.3 Water-resistant gypsum board (Water-Resistant Fiber-Reinforced Gypsum Backing Panels): to ASTM 1278 regular thickness as indicated in drawings, 1200 mm wide x maximum practical length, Type X.

.4 Metal Access doors: frameless, welded construction, push latching door, removable door, accepts 12.7 mm or 15.9 mm gypsum board, exposed frames paintable.

.5 Metal furring runners, hangers, tie wires, inserts, and anchors required for installation to ASTM C841.

.6 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.

.7 Resilient drywall furring: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.

.8 Metal channel stiffener: 19 x 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.

.9 Steel drill screws: to ASTM C1002.

.10 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, metal, zinc-coated by electrolytic process, 0.5 mm base thickness, perforated flanges, one piece length per location.

.11 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.12 Acoustic sealant: in accordance with Section 07 92 00 - Joint Sealants.

.13 Polyethylene: to CAN/CGSB-51.34, Type 2.

.14 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self-sticking permanent adhesive on one face, lengths as required.

.15 Joint compound: to ASTM C475, asbestos-free.

.16 Texturing plaster: mill mixed finishing plaster prepared for texture ceiling application. Colour: See Section 09 06 01.

Part 3 Execution

3.1 ERECTION

.1 Do application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.

.2 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C840 except where specified otherwise.

.3 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.4 Install work level to tolerance of 1:1200.

.5 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, and grilles.

.6 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.7 Install gypsum board fire and sound stops and to form plenum areas to underside of wood roof deck above suspended ceilings as indicated.

.8 Install wall furring for gypsum board wall finishes in accordance with ASTM C840, except where specified otherwise.

.9 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.10 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

.11 Erect drywall resilient furring transversely across studs, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 25 mm drywall screw.

3.2 APPLICATION

.1 Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical work are approved.

.2 Apply single and double layer gypsum board (as indicated on drawings) to metal furring or framing using screw. Maximum spacing of screws, 300 mm on centre.

.1 Single-Layer Application:

.1 Apply gypsum board on ceilings prior to application of walls in accordance with ASTM C840.

.2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.

.2 Double-Layer Application:

.1 Install gypsum board for base layer and exposed gypsum board for face layer.

.2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.

.3 Apply base layers at right angles to supports unless otherwise indicated.

.4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.

.3 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.4 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

.5 Install gypsum board with face side out.

.6 Do not install damaged or damp boards.

.7 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

.8 Apply water resistant, fiber-reinforced gypsum board panels in Rooms 000, 001, 002, 003, 119, 122, and 139. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. Thickness and fire resistance rating to match gypsum board specified in Wall Type.

.9 Apply mold and mildew resistant panels to interior side of walls in Rooms 120, 121, and in locations where gypsum board is to be painted. Thickness and fire resistance rating to match gypsum board specified in Wall Type.

3.3 INSTALLATION

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated.

.4 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.

.5 Provide continuous polyethylene dust barrier behind and across control joints.

.6 Apply 12 mm diameter bead of acoustic sealant continuously around perimeter of first layer of multiple layers of gypsum board to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, and penetrations, in partitions where perimeter sealed with acoustic sealant.

.7 Install access doors to electrical and mechanical fixtures specified in respective sections.

.1 Rigidly secure frames to furring or framing systems.

.8 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.9 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with Association of the Wall and Ceiling Industries (AWCI) International Recommended Specification on Levels of Gypsum Board Finish:

.1 Levels of finish:

.1 Level 0: No tapping, finishing or accessories required.

.2 Level 1: Embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.

.3 Level 2: Embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener

heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.

.4 Level 3: Embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.5 Level 4: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.6 Level 5: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.

.10 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.11 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.12 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.13 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.14 Mix joint compound slightly thinner than for joint taping.

.15 Apply thin coat to entire surface using trowel or drywall broadknife to fill surface texture differences, variations or tool marks.

.16 Allow skim coat to dry completely.

.17 Remove ridges by light sanding or wiping with damp cloth.

.18 Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.

3.4 CONTROL JOINTS

.1 Provide control joints at not greater than 9 m spacing on continuous gypsum board walls in a single plane and at not greater than 9 m spacing on ceilings and bulkheads except where indicated otherwise in the drawings.

.1 Confirm location of control joints with the Consultant prior to installation of gypsum board

.2 Provide control joints of preformed units set in gypsum board facing and supported independently on both sides of joint. Interrupt top and bottom tracks at location of control joint.

.3 Install control joints straight and true. Finish control joints as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

3.5 ACCESS PANELS

.1 Coordinate installation with Mechanical.

.2 Secure frames rigidly in place, plumb and level in opening, with plane of door and panel face aligned with adjacent finished surfaces.

.3 Set concealed frame type units flush with adjacent finished surfaces.

.4 Position unit to provide convenient access to concealed work requiring access.

3.6 FINISH SCHEDULES

.1 Levels of finish: Interior partitions;

- .1 Level 1:
  - .1 Plenums above suspended ceilings, inside of duct shafts and other gypsum board wall areas not exposed to view.
- .2 Level 4:
  - .1 Vertical surfaces (walls) exposed to view.
  - .2 Ceilings and underside of bulkheads exposed to view.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 09 06 01 – Room Finish Schedule.

.2 Section 09 53 01 - Acoustical Suspension: Suspension system

.3 Division 23 - Air diffusers within ceiling systems

.4 Division 26 - Lighting fixtures within ceiling system

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C635-00 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

.2 ASTM E 413-87(1999) Standard Classification for Rating Sound Insulation

.3 ASTM E1264-[98], Standard Classification for Acoustical Ceiling Products.

.4 ASTM E1477-[98a(2003)], Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.

.5 ASTM E 1414-00a Standard test method for Airborne Sound Attenuation Between Rooms sharing a Common Ceiling Plenum

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit duplicate full size samples of each type of acoustical tile ceiling lay in panels required for the project

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Permit wet work to dry before beginning to install.

.2 Maintain uniform minimum temperature of 15 degrees C and humidity of 20 to 40% before and during installation.

.3 Store materials in work area 48 hours prior to installation.

1.6 EXTRA MATERIALS

.1 Provide extra materials of acoustic units in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide acoustical units amounting to 2% of gross ceiling area for each pattern and type required for project.

.3 Ensure extra materials are from same production run as installed materials.

.4 Clearly identify each type of acoustic unit, including colour and texture.

.5 Deliver to Owner and obtain receipt, upon completion of the work of this section.

Part 2 Products

2.1 MATERIALS

.1 To CAN/CGSB-92.1 ASTM E1264.

.2 Flame spread rating in accordance with CAN/ULC-S102 and ASTM E 1264; Class A.

.3 Smoke developed in accordance with CAN/ULC-S102.

.4 Acoustic ceiling tiles for suspended ceiling.

.1 Textures: smooth.
.2 Noise Reduction Coefficient (NRC) designation of 0.70.
.3 Ceiling Attenuation Class (CAC) rating in accordance with ASTM C 1414
.4 Light Reflectance (LR) range of 0.90.
.5 Edge type: beveled tegular.
.6 Colour: White.
.7 Size: 610 x 610 x 19 mm thick.
.8 Shape: flat.
.9 Approved materials:

.1 Armstrong World Industries: Ultima

.2 CGC: Mars ClimaPlus

.3 Celotex: Symphony M

.4 Approved Alternate

Part 3 Execution

3.1 EXAMINATION

.1 Do not install acoustical panels and tiles until work above ceiling has been inspected by Consultant.

3.2 INSTALLATION

.1 Co-ordinate with Section 09 53 01 - Acoustical Suspension.

.2 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

.3 Install covers and escucheons to trim openings cut into ceiling tiles or panels.

3.3 ACOUSTIC CEILING TILES

.1 Install acoustical tiles in accordance with the manufacturer's instruction, and in compliance with ASTM C 636 and with the authority having jurisdiction.

.2 Install acoustic units to clean, dry and firm substrate.

.3 Install acoustical units parallel to building lines with edge unit not less than 50% of unit width with directional pattern running in same direction. Refer to reflected ceiling plan.

.4 Scribe acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning Procedures

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 09 06 01 – Room Finish Schedule.

.2 Section 09 21 16 – Gypsum Board Assemblies.

.3 Section 09 51 13 – Acoustical Panel Ceilings.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C635-04, Standard Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.

1.3 DESIGN REQUIREMENTS

.1 Maximum deflection: 1/360th of span to ASTM C635 deflection test.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit a sample, one 1200mm length of T-bar for each type specified.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

Part 2 Products

2.1 MATERIALS

.1 Heavy duty system to ASTM C635.

.2 Basic materials for suspension system: commercial quality cold rolled steel hot dipped galvanized steel.

.3 Exposed tee bar grid components: Components die cut. Main tee with double web, steel construction. Main beams and cross tees shall have rotary stitching.

.4 Suspension systems: non fire rated.

.5 Hanger wire: galvanized soft annealed steel wire: To ASTM A641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least three times design load, but not less than:

.1 3.6 mm diameter for access tile ceilings

.2 2.6 mm diameter for other ceilings

.6 Hanger inserts: purpose made.

.7 Carrying channels: thickness to suit, galvanized steel.

.8 Accessories: splices, clips, wire ties, retainers and wall moulding flush reveal, to complement suspension system components, as recommended by system manufacturer.

2.2 ACOUSTICAL SUSPENSION:

.1 Coordinate suspension components with suspended tile and panel requirements.

.2 Components: All main beams and cross tees shall be commercial quality hot-dipped galvanized (galvanized steel, aluminum, or stainless steel) as per ASTM A 653. Main beams and cross tees are double-web steel construction with 15/16 inch type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished galvanized steel (aluminum or stainless steel) in baked polyester paint. Main beams and cross tees shall have rotary stitching (exception: extruded aluminum or stainless steel).

.1 Structural Classification: ASTM C 635 HD.

.2 Colour: White and match the actual color of the selected ceiling tile, unless noted otherwise.

.3 Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct hung unless otherwise indicated.

.4 Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least time three design load, but not less than 12 gauge.

.5 Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Installation: in accordance with ASTM C636 except where specified otherwise.

.2 Do not erect ceiling suspension system until work above ceiling has been inspected by Consultant.

.3 Secure hangers to overhead structure using industry approved attachment methods.

.4 Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.

.5 Lay out centre line of ceiling both ways, to provide balanced borders at room perimeter unless otherwise indicated.

.6 Ensure suspension system is co-ordinated with location of related components.

.7 Install wall moulding to provide correct ceiling height.

.8 Completed suspension system to support super-imposed loads, such as plywood panels and battens, lighting fixtures diffusers grilles and speakers.

.9 Support at light fixtures, diffusers, plywood panels, with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.10 Interlock cross member to main runner to provide rigid assembly.

.11 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.

.12 Finished ceiling system to be square with adjoining walls and level within 1:1000.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning Procedures

.2 Touch up scratches, abrasions, voids and other defects in painted surfaces.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Resilient sheet flooring. See Section 09 65 18 for rubber base.

1.2 RELATED SECTIONS

.1 Section 01 00 05 – General Requirements

.2 Section 06 40 00 - Architectural Woodwork

.3 Section 09 65 18 – Rubber Flocked Flooring

.4 Section 09 65 20 – Rubber Sport Flooring

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM D2047-04 James Machine – Coefficient of Friction on Flooring Material

.2 ASTM E648 09a/NFPA 253 2000 – Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

.3 ASTM F1303-04 (2014) – Standard Specification for Sheet Vinyl Floor Covering with Backing

.2 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102.2, Surface Burning Characteristics of Building Materials and Assemblies.

1.4 SUBMITTALS

.1 Submit in accordance with 01 00 05 – General Requirements.

.2 Shop Drawings

.1 Submit shop drawing/seaming diagram in accordance with Section 01 00 05 – General Requirements.

.2 Shop drawing/seaming diagrams shall clearly indicate the location of all seams and directions of sheet materials.

1.5 SAMPLES

.1 Submit samples in accordance with 01 00 05 – General Requirements indicating the required colours for flooring, welding rods, and applicable accessories.

.2 Submit 2 samples, 300 x 600 mm of each of the following required for the project:

.1 PVC Sheet flooring. Adhere samples to 10 mm thick plywood with joints and seams to represent project installation.

1.6 INSPECTION AND TESTING

.1 Materials and workmanship subject to inspection on behalf of Owner.

.2 Submit product data including certified copies of test reports verifying flooring materials comply with requirements specified herein, including requirements of standards specified.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Deliver, store, handle and protect materials in accordance with Section 01 00 05 – General Requirements

.2 Deliver and store materials in a dry, protected area in original, undamaged, unopened containers with manufacturer's labels indicating brand names, colours and patterns, and quality designations.

.3 Do not open containers or remove markings until materials are inspected and accepted.

.4 Store rolls on end and protect accepted materials in accordance with manufacturer's directions and recommendations.

1.8 QUALITY ASSURANCE

.1 In the event of conflict between pertinent codes, standards and/or regulations, most stringent shall govern.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Provide sufficient heating and ventilation in areas where work of this section is being performed. Take all precautionary measures necessary to ensure that excessive temperature changes do not occur.

.2 Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture tests. The flooring contractor shall perform moisture content testing of structural substrates before placement of finish flooring. Moisture content testing shall be in accordance with ASTM F 1869 and ASTM D 4263. Installation of flooring materials shall not proceed until moisture transmission rate or vapour emission is at levels that comply with flooring manufacturer's written recommendation for flooring materials/systems.

.3 For installation of resilient flooring, maintain 18º C minimum, 38º C maximum for 48 hours before, during and 7 days after installation.

.4 Allow all resilient flooring materials and adhesives to condition to the room temperature a minimum of 48 hours before starting the installation.

.5 Provide adequate ventilation to remove fumes and moisture.

.6 Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring.

1.10 MAINTENANCE DATA

.1 Provide copies of maintenance instructions for incorporation into Operating and Maintenance Manuals in accordance with Section 01 00 05 – General Requirements

.2 Instructions are to include manufacturer's recommended materials and methods for cleaning, including precautions in the use of cleaning materials that may be detrimental to surface if improperly applied.

1.11 MAINTENANCE MATERIAL

.1 Deliver maintenance material for maintenance use:

.1 Deliver 4 m² of each colour and pattern of sheet flooring required for the project;

.2 Deliver 10 linear meters of each colour and pattern of rubber base required for the project;

.2 All maintenance material shall be from same dye lot as used in the project.

.3 Package neatly and mark plainly. Deliver to Owner and obtain a receipt.

Part 2 PRODUCTS

2.1 RESILIENT SHEET SAFETY FLOORING

.1 Homogenous cross-linked polyvinyl chloride (PVC) sheet flooring denoted “RSSF” in Room Finish Schedule and drawings:

.1 Safety sheet flooring: to ASTM F 1303, Type 2, Grade 1, moisture resistant backing Class A; carborundum free; static coefficient of slip resistance in excess of 0.6 when tested to ASTM D2047; Surface roughness Rz > 20um, RRL Pendulum test >36 (wet test – 4S Rubber/Slider 96); Sustainable wet slip resistance AS/NZS 4586 R10; reaction to fire to ASTM E648, meeting Class 1 rating; classified antistatic to EN 1815.

.2 Must be compatible to heat weld with resilient wall panels. See Room Finish Schedule.

.2 Thickness: Minimum 2.0 mm.

.1 Seams: Heat welded rod colour-matched to sheet flooring. Cut groove 3mm wide by 2/3 depth of the material, evenly along each joint.

.3 Width of roll: 2 metres.

.4 Seams: Heat welding rod as recommended by sheet flooring manufacturer, colour matched to sheet flooring.

.5 Base: Form continuous coved base from sheet flooring.

.3 Acceptable manufacturer and products:

.1 Polyflor Polysafe Verona

.2 Approved alternate.

.7 Colour: One colour selected by consultant from manufacturer’s standard range.

.4 Sealant: as recommended by flooring manufacturer. Colour to match flooring.

.5 Cove former: as recommended by flooring manufacturer, 19mm radius.

.6 Cove top edge (typical): water-tight cap strip suitable for installation at top edge of coved sheet material.

.7 Cove top edge (at resilient wall panels): heat weld flooring cove base to wall panel to create waterproof joint. See Room Finish Schedule.

2.2 RESILIENT SHEET HYDRO FLOORING

.1 Homogenous polyvinyl chloride (PVC) sheet flooring denoted "RHF" in Room Finish Schedule and drawings:

.1 Safety sheet flooring: to ASTM F 1303, Type 2, Grade 1, moisture resistant backing Class A; carborundum free; static coefficient of slip resistance in excess of 0.6 when tested to ASTM D2047; Surface roughness Rz > 20um, RRL Pendulum test >36 (wet test – 4S Rubber/Slider 96); Sustainable wet slip resistance AS/NZS Part C Class B; reaction to fire to ASTM E648, meeting Class 1 rating; classified antistatic to EN 1815; water tightness to EN 13553 suitable for installation in wet areas.

.2 Thickness: Minimum 2.0 mm with raised emboss.

.1 Seams: Heat welded rod colour-matched to sheet flooring. Cut groove 3mm wide by 2/3 depth of the material, evenly along each joint.

.3 Width of roll: 2 metres.

.4 Base: Form continuous coved base from sheet flooring.

.5 Acceptable manufacturer and products:

.1 Polyflor Polysafe Hydro Evolve

.2 Approved alternate.

.6 Sealant: as recommended by flooring manufacturer. Colour to match flooring.

.7 Cove former: as recommended by flooring manufacturer, 19mm radius.

.8 Cove top edge: heat weld to resilient wall panels to ensure watertight joint.

.9 Colour: One colour selected by consultant from manufacturer's standard range.

2.3 BASE MATERIALS

.1 At RSSF and RHF: Cove resilient sheet flooring material unless indicated otherwise in drawings. Utilize manufacturer's recommended cove former. 100 ht.

2.4 ACCESSORIES/ADHESIVES/SEALERS

.1 Sub-Floor Filler: Self levelling consistency:

.1 Ardex K-15.

.2 Mapei Ultraplan 1.

.3 Vetonite Plaano.

.2 Subfloor Leveller: Series LS Leveller System as manufactured by Johnsonite, Division of Duramax.

.3 Primers, Adhesives: Waterproof, of types recommended by resilient flooring manufacturer for specific material, application and climatic extremes and movement associated with transportation of building modules.

.4 Provide metal edge strips of width shown on the drawings and of required thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage, or overlap-type metal edge strips for exposed anchorage. Unless otherwise shown, provide strips made of extruded aluminum with a mill finish.

.5 Provide reducers/risers/transitions strips at all intersections with joint covers and dissimilar flooring materials.

.6 Sealers, Cleaners and Wax: Type recommended by resilient flooring material manufacturer for material type and location.

Part 3 EXECUTION

3.1 ACCEPTABLE INSTALLERS

.1 Installation of materials of this Section shall be by the manufacturer's approved installers, in strict accordance with manufacturer's installation instructions.

.2 The Work of this Section shall be performed by skilled workers with at least three (3) years successful installation experience with the type of materials specified herein.

.3 Submit evidence of experience and obtain Consultant's approval before proceeding with flooring installation.

3.2 EXAMINATION

.1 Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.

.2 Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mould, or mildew.

3.3 SITE AND SUBSTRATE CONDITIONS

.1 Surfaces of substrate must not be coated with any type of membrane or curing compound.

.2 Ensure concrete floors are dry maximum 7% moisture content and exhibit negative alkalinity, carbonization or dusting.

.3 Store flooring materials in area of application. Allow 3 days for material to reach equal temperature as area.

3.4 PREPARATION

.1 Ensure floors are level with maximum surface variation of 6 mm in 3 metres non-cumulative.

.2 Ensure concrete floors are free from scaling and chatter marks.

.3 Perform subfloor Calcium Chloride Tests (and Bond Tests) to determine if surfaces are dry; free of curing and hardening compounds, old adhesive and other coatings; and ready to receive flooring.

.4 Vacuum or broom-clean surfaces to be covered immediately before the application of flooring. Make subfloor free from dust, dirt, grease, and all foreign materials.

.5 Provide subfloor leveller at junction of resilient flooring with other flooring types to give a level transition. Bond to substrate with suitable substrate adhesive as recommended by leveller manufacturer.

.6 Ensure walls are prepared according to floor manufacturer’s instructions where safety flooring will form coved base.

3.5 LEVELLING

.1 Smooth surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with specified sub-floor filler.

.2 Clean floor and apply, trowel, and float filler to leave smooth, flat hard surface. Prohibit traffic until filler is cured.

.3 Clean floor with an industrial vacuum cleaner. Remove any substance deleterious to adhesive bond.

.4 Provide subfloor leveller at junction of resilient flooring with other flooring types to give a level transition. Bond to substrate with suitable substrate adhesive as recommended by leveller manufacturer.

3.6 INSTALLATION - FLOORING GENERAL

.1 Lay flooring to provide a minimum number of seams. Locate seams at doorways and in areas of least amount of traffic. Avoid cross seams, filler pieces, and strips. "T" seams are not acceptable. Match edges for colour shading and pattern at the seams in compliance with the manufacturer's recommendations.

.2 Locate seams 150 mm minimum from joints in sawcuts in concrete, subfloor or underlayment joints.

.3 Install sheet flooring to a minimum of 1/3 full material width, except as detailed otherwise, and with sheet parallel to width of room.

.4 Install sheet flooring using rolls in consecutive number to ensure match of colour and pattern.

.5 Install with a minimum tile width 1/2 full size at room or area perimeter, to square grid pattern with all joints aligned and pattern grain parallel for all units and parallel to width of room.

.6 Install flooring wall to wall after the installation of floor-set cabinets, and casework. Extend flooring into toe spaces, door recesses, closets, and similar openings. Cove base as scheduled up floor-set cabinets and casework.

.7 Install flooring wall to wall before the installation of furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings.

.8 Install flooring on pan-type floor access covers. Maintain continuity of colour and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.

.9 Scribe flooring to walls, columns, cabinets, floor outlets and other appurtenances to provide tight joints.

.10 Terminate resilient flooring at centre line of door openings where adjacent floor finish is dissimilar.

.11 Adhere flooring to the subfloor without cracks, voids, raising and puckering at the seams. Spread cement evenly in quantity recommended by manufacturer to ensure adhesion over entire area of installation. Spread only enough adhesive to permit installation of flooring before initial set. Roll with a 45 kilogram roller in the field areas. Hand-roll flooring at the perimeter and the seams to assure adhesion. Refer to specific rolling instructions of the flooring manufacturer.

.12 Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.

.13 Install feature strips and floor markings where indicated. Fit joints tightly.

.14 Install edge strips at unprotected or exposed edges where flooring terminates.

.15 Install transition strips, risers, reducers at dissimilar flooring heights.

.16 Carry flooring through beneath edges of metal thresholds.

.17 Use methods and sequence of work in conformance with written instructions of the flooring manufacturer. Finish all seams flush and free from voids, recesses, and raised areas.

.18 Apply sealer, polish or wax as recommended by manufacturer.

3.7 INSTALLATION – COVE

.1 Turn flooring material up wall and securely bond to cove former and wall substrate. Install cove base to 100mm above finished floor.

.2 Mitre cove at corners. Hot weld joints and mitred corners with matching welding rod.

.3 Trim back cove formers in proximity to openings or door frames on wall and neatly terminate at opening or frame.

.4 Install top cove edge strip.

3.8 MANUFACTURER'S FIELD SERVICES

.1 Manufacturer's technical representative, acceptable to the Consultant, shall provide adequate initial on-site direction to Subcontractor and Contractor, to ensure acceptable application of all resilient flooring materials.

.2 Provide additional periodic site representation to assist Subcontractor and Contractor in performance of the Work.

3.9 CLEANING

.1 Promptly, as the work proceeds, clean up excess materials, rubbish and overspray or splash.

.2 Remove excess adhesive from floor, base and wall surfaces without damage.

.3 Clean floors by following manufacturer’s written instruction.

3.10 PROTECTION

.1 Prohibit traffic from floor finish for 48 hours after installation.

.2 Protect resilient flooring until Substantial Performance of the Work.

.3 Make good all damage to satisfaction of the Departmental Representative at no cost.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Modular carpet and rubber base.

1.2 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 09 06 01 – Room Finish Schedule.

.3 Section 09 65 16 – Resilient Sheet Flooring.

1.3 REFERENCES

.1 American Association of Textile Chemists and Colorists (AATCC)

.1 AATCC 16-1998, Color Fastness to Light.

.2 AATCC 134-2001, Electrostatic Propensity of Carpet.

.2 American Society for Testing and Materials (ASTM International)

.1 ASTM E84-01, Test Method for Surface Burning Characteristics of Building Materials.

.2 ASTM F 1861-00, Standard Specification for Resilient Wall Base

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-4.129-93(R1997), Carpets for Commercial Use.

.4 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-2007, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S102.2-88(R2000), Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies.

1.4 SUBMITTALS

.1 Submit control submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit verification to demonstrate compliance with CAN/ULCS102 and CAN/ULCS102.2.

.3 Submit carpet schedule using same room designations indicated on drawings.

.4 Confirm carpet tile layout pattern to be used.

.5 Submit carpet manufacturer's installation instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit product data sheet for each carpet, , adhesive, carpet protection and subfloor patching compound.

.3 Submit data on specified products, describing physical and performance characteristics, sizes, patterns, colours, and methods of installation.

1.6 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit duplicate 610x610 mm pieces of each type carpet specified.

1.7 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Submit maintenance data: Include maintenance procedures, recommendations for maintenance materials and equipment, and suggested schedule for cleaning.

1.8 QUALIFICATIONS

.1 Installer Qualifications:

.1 Flooring contractor requirements.

.1 Specialty contractor normally engaged in this type of work, with prior experience in installation of these types of materials.

.2 Be responsible for proper product installation, including floor testing and preparation as specified and in accordance with carpet manufacturers written instructions.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Label packaged materials. For carpet tile products indicate nominal dimensions of tile and indicate installation direction.

.2 Store packaged materials in original containers or wrapping with manufacturer's seals and labels intact.

.3 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness.

.4 Store materials in area of installation for minimum period of 48 hours prior to installation.

.5 Modular carpet: store on pallet form as supplied by Manufacturer. Do not stack pallets.

1.10 ENVIRONMENTAL REQUIREMENTS

.1 Moisture: Ensure substrate is within moisture limits and alkalinity limits prescribed by manufacturer.

.2 Temperature: Maintain ambient temperature of not less than 18 ^{o}C from 48 hours before installation to at least 48 hours after completion of work.

.3 Relative humidity: Maintain relative humidity between 10 and 65% RH for 48 hours before, during and 48 hours after installation.

.4 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

1.11 EXTRA MATERIALS

.1 Provide extra materials of carpet, carpet base, and adhesives in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide 10 complete modular carpet pieces of each colour and pattern.

.3 Extra materials to be from same production run as installed materials.

.4 Identify each package of carpet and each container of adhesive.

.5 Store where directed by Consultant.

Part 2 Products

2.1 MODULAR CARPET

.1 To ASTM E648/NFPA 253 – Class 1; ASTM E 662/NFPA 258 – 450 or less; ASTM D 2859 – pass.

.2 Carpet: solid vinyl reinforced base, flocked nylon surface.

.3 Gauge: 5.3 mm.

.4 Backing: vinyl cushioned.

.5 Wear layer composition: nylon type 6.6

.6 Wear layer density: approx. 70,000,000 fibers/yd2.

.7 EN1307 (wear class): 4 (heavy duty).

.8 Carpet Tile Dimensions: 500 x 500 mm.

.9 Colourization: multiple colour tones.

.10 Adhesive: as recommended by carpet manufacturer

.11 Acceptable Manufacturer/Product:

.1 Forbo – series: Flotex “Penang”

.2 Approved equivalent.

.12 Colour:

.1 “382015 Beige” or as selected from manufacturer’s standard range.

2.2 ACCESSORIES

.1 Binder bars: Stainless steel.

.2 Adhesive:

.1 Recommended by carpet manufacturer for direct glue down installation of modular carpet or speciality backed carpets.

.3 Subfloor patching compound: Portland cement base filler, mix with latex and water to form a cementitious paste.

2.3 BASE MATERIALS

.1 Resilient base: Conforming to ASTM F 1861, rubber, Type TS vulcanized rubber or Type TP thermoplastic rubber, coved, 102 mm high x 3mm thick, including premoulded end stops and external corners, of same material, size and colour as base.

.2 Color: Selected from manufacturer’s standard range.

.3 Acceptable Manufacturers:

.1 Johnsonite

.2 Approved alternate.

Part 3 Execution

3.1 SUB-FLOOR TREATMENT

.1 Concrete substrates shall be free of paint, dirt, grease, oil, curing or parting agents, and other contaminates, including sealers, that may interfere with the bonding of the adhesive.

.2 Wherever a powdery or porous concrete surface is encountered, a primer compatible with the adhesive shall be used to provide a suitable surface for glue-down installation.

3.2 PREPARATION

.1 Prepare floor surfaces in accordance with CRI 104 Standard for Installation of Commercial Carpet.

.2 Pre-condition carpeting following manufacturer's printed instructions.

3.3 INSTALLATION

.1 Lay tile using a quarter turn pattern. Confirm with Department Representative prior to installation.

.2 Install carpeting using minimum of pieces.

.3 Apply acrylic adhesive and install modular carpet in accordance with manufacturer's written instructions.

.4 Lay modular carpet with butt seams.

.5 Finish installation to present smooth wearing surface free from conspicuous seams, burring and other faults.

.6 Use material from same dye lot. Ensure colour, pattern and texture match within any one visual area. Maintain constant pile direction.

.7 Fit neatly around architectural, mechanical, electrical and telephone outlets, and furniture fitments, around perimeter of rooms into recesses, and around projections.

.8 Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

.9 Install carpet smooth and free of bubbles, puckers, and other defects.

.10 Roll modular carpet with appropriate roller for complete contact of carpet with mill-applied adhesive to sub-floor.

3.4 SEAMS

.1 Seal edges of cut-outs with latex.

.2 Carpet visibility of seams and joints to acceptable industry standards.

3.5 CARPET TACKSTRIPS AND BINDER BARS

.1 Install binder bars at exposed carpet edges and centre under doors in door openings.

3.6 INSTALLATION - BASE

.1 Fit joints tight and vertical. Maintain minimum measurement of 450 mm between joints.

.2 Mitre internal corners. Provide scribed external corners.

.3 Install base on solid backing. Adhere tightly to wall and floor surfaces.

.4 Scribe and fit to door frames and other obstructions.

.5 Install straight and level to variation of plus or minus 3 mm over 3 m.

.6 Provide base to all architectural woodwork and architectural casework counters and cabinets.

3.7 PROTECTION OF FINISHED WORK

.1 Vacuum carpets clean immediately after completion of installation. Protect traffic areas.

.2 Prohibit traffic on carpet for a period of 24 hours until adhesive is cured.

.3 Install carpet protection to satisfaction of Consultant.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Rubber sport flooring in Room 126.

.2 See Section 09 65 18 for rubber base.

1.2 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 08 14 16 – Flush Wood Doors.

.3 Section 09 06 01 – Room Finish Schedule.

.4 Section 09 95 16 – Resilient Sheet Flooring

.5 Section 09 65 18 – Rubber Flocked Flooring.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM International)

.1 ASTM F 710 Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.

.2 ASTM F1344-[00], Specification for Rubber Tile..

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-25.20-95, Surface Sealer for Floors.

.2 CAN/CGSB-25.21-95, Detergent-Resistant Floor Polish.

1.4 SUBMITTALS

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit duplicate tile in size and colours specified.

.3 Submit technical data sheets of the flooring product and adhesive product.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for rubber sports flooring for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Maintain air temperature and structural base temperature at flooring installation area above 20°C for 48 hours before, during and for 48 hours after installation.

1.8 EXTRA MATERIALS

.1 Provide maintenance materials of resilient tile flooring, base and adhesive in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide 5 m^2 of each colour, pattern and type flooring material required for this project for maintenance use.

.3 Extra materials to be from same production run as installed materials.

.4 Clearly identify each container of floor tile and each container of adhesive.

.5 Deliver to Owner, upon completion of the work of this section.

.6 Store where directed by Owner.

1.9 WARRANTY

.1 Five year manufacturer warranty.

Part 2 Products

2.1 MATERIALS

.1 Rubber floor tile: prefabricated rubber sports surfacing, dual durometer vulcanized and calandered with special embossing, including adhesive. Prefabricated rubber surface to be sheet goods, calandered and vulcanized with a base of natural and synthetic rubber, stabilizing agents and pigmentation. To be manufactured in two layers, vulcanized together.

.1 Thickness: 16mm total thickness, with wear layer thickness of 3mm

.2 Tile size: 610 x 610 mm or 915 x 915 mm.

.3 Pattern: smooth textured pattern from manufacture's standard range , solid color field with speckle throughout entire thickness of wear layer

.4 Colour: 2 colours to be selected from standard range.

.5 The shore hardness of the lower layer shall be less than the upper layer within the limits of following table. Field laminated material is not acceptable.

Physical Properties	Standard	Specification
Hardness Shore A	ASTM D-2240	75 (+-5) top layer 55(+-) bottom layer
Tensile strength	ASTM D-412	565 psi (+-50)
Elongation at break	ASTM D-412	226 (+-50)

100% modulus	ASTM D-412	64 psi (+-25)
Taber abrasion H18 wheels 500gr/1000 cycles	STM C-501	0.0001gr
Critical radiant flux	ASTM E-648-94A	Class 1
Water absorption 24hr/23 degree C	ASTM D-570	0.49%
Coefficient of friction	ASTM D-2047	0.91 dry/ 0.94 wet
Static load limit	ASTM F-970	0.003 in
Flame spread	ASTM E-648-94A	0.46 watts/sq.cm, class 1

.2 Rubber base: Refer to Section 09 65 18 Rubber Flocked Flooring.

.3 Primers and adhesives: two part polyurethane adhesive suitable for adherence of flooring to concrete substrate. Adhesive to be supplied by or approved by the rubber flooring manufacturer.

.4 Sub-floor filler and leveller: as recommended by flooring manufacturer for use with their product.

.5 Edge transition strips and ramps between differing flooring heights: rubber; colour: black.

Part 3 Execution

3.1 INSPECTION

.1 Ensure concrete floors are dry, by using test methods recommended by tile manufacturer. Concrete must have cured for a minimum of 30 days. Vapour emission from the substrate must be less than 1.35 kg per 93 Sq.m in 24 hours as per ASTM 1869-98.

.2 Installer must have successfully completed installations of the same scale as this project, within the last three years and be recognized and approved by the sport surfacing manufacturer.

3.2 SUB-FLOOR TREATMENT

.1 Prepare to ASTM F 710 and as recommended by rubber sport floor manufacturer.

.2 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler. Floor must be level to not more than 3mm in 3 metre radius.

.3 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

.4 General Contractor and installer shall thoroughly inspect subfloor surface prior to proceeding with installation. Report any deficiencies to Consultant.

3.3 FLOORING APPLICATION

.1 Provide a high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours after installation. Vent directly to the outside. Do not let contaminated air re-circulate through a district or whole building air distribution system. Maintain extra ventilation for at least one month following installation.

.2 To minimize emissions from adhesives, use lowest V.O.C. emitting material that will meet requirements of this specification.

.3 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.4 Install sport flooring in accordance with manufacturer’s printed instructions.

.5 Lay flooring with joints parallel to building lines to produce tile pattern required. Border tiles minimum half tile width. Cut and adjust flooring prior to adhesion.

.6 As installation progresses, and after installation, ensure full adhesion of tiles in adhesive. Hold all seams in place in accordance with manufacturer’s recommendations.

.7 Cut tile and fit neatly around fixed objects.

.8 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar. Coordinate door undercut with door supplier.

.9 Install edge transition strips at unprotected or exposed edges where flooring terminates at openings or meets another type of flooring.

.10 Provide matching flooring transition strip/ramp where flooring meets flooring of different thickness.

3.4 BASE APPLICATION

.1 Refer to Section 09 65 18 – Rubber Flocked Flooring.

3.5 INITIAL CLEANING

.1 Remove excess adhesive from floor, base and wall surfaces without damage.

.2 Clean, floor and base surface to flooring manufacturer's instructions.

3.6 PROTECTION OF FINISHED WORK

.1 Protect new floors from time of final set of adhesive until final inspection.

.2 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 09 06 01 – Room Finish Schedule

.2 Section 09 21 16 – Gypsum Board Assemblies (coordinate installation of additional support in gypsum board walls as required for acoustic panels).

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International)

.1 ASTM C423-01, Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.2 ASTM E84 – Standard Test Methodfor Surface Burning Characteristics of Building Materials.

.2 Underwriter Laboratories of Canada (ULC)

.1 CAN/ULC-S702-97, Thermal Insulation, Mineral Fibre, for Buildings.

.2 CAN/ULC – S102 Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data

.1 Submit manufacturer's printed product literature, specifications and data sheets.

.2 Shop Drawings

.1 Submit shop drawings indicating panel sizes and configuration.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

Part 2 Products

2.1 MATERIALS

.1 Acoustical construction products must:

.1 Not require being labelled as poisonous, corrosive, flammable or explosive under the Consumer Chemical and Container Regulations of the Hazardous Products Act.

.2 Be accompanied by detailed instructions for proper handling and installation so as to minimize health concerns.

2.2 ACOUSTIC PANELS (APT) TYPE 1

.1 Acoustic core material: to CAN/CGSB-92.1.

- .1 NRC designation of 0.50 or greater.
- .2 Panel core: medium density fibreglass.
- .3 Thickness: min. 28mm with high impact underlay.
- .4 Edges: standard bevel edge with integral concealed edge reinforcing if required by panel sizes.
- .5 Panels and visible edges to be wrapped with fire retardant material.
  - .1 Flame spread class of 25 or less to CAN/ULC S102.
- .6 Fabric: Easy Clean Vinyl or Xorel Fabric meeting flame spread of 25 or less when tested to CAN/ULC S102.
  - .1 Colour selected from manufacturer's standard range of colours.
- .7 Dimensions: refer to drawings for sizes and locations.
- .8 Acceptable manufacturers:
  - .1 Armstrong "Soundsoak" Custom
  - .2 Approved equivalent.

Part 3 Execution

3.1 INSTALLATION

.1 Ensure substrate surface is straight to tolerance of plus or minus 3 mm over 3000 mm.

.2 Install according to manufacturer's written instructions.

.3 Install acoustic units to clean, dry and firm substrate using concealed clips.

.4 Fully adhere acoustic units to wall and ceiling substrate.

.5 Install acoustic units plumb and aligned. Arrange units as indicated.

.6 Cut panels to suit electrical and mechanical items mounted to walls and ceilings.

.7 Cut panels around openings in wall.

.8 Wrap fabric back to panels wherever panels are cut, cover exposed panel edges.

.9 Once installed, panels are not to be removable without use of proprietary tools.

3.2 CLEANING

.1 Keep acoustic installation and all components clean. Remove blemishes immediately.

3.3 PROTECTION

.1 Use polyethylene to protect finished acoustical treatment from damage.

.2 Remove prior to substantial completion.

3.4 SCHEDULES

.1 Indicated on drawings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 50 00 - Metal Fabrications.

.2 Section 06 10 00 – Rough Carpentry.

.3 Section 08 90 10 – Door, Frame and Hardware Schedule.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual – latest edition.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Conform to latest MPI requirements for exterior painting work including preparation and priming.

.2 Materials: in accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.

.3 paint materials such as linseed oil, shellac, and turpentine to be highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and to be compatible with other coating materials as required.

.4 Standard of Acceptance:

.1 Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Soffits: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

.3 Upon completion, submit records of products used. List products in relation to finish system and include the following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour numbers.

.4 MPI Environmentally Friendly classification system rating.

.5 Manufacturer's Material Safety Data Sheets (MSDS).

.4 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit duplicate 200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards.

1.5 MAINTENANCE

.1 Extra Materials:

.1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit one four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements, supplemented as follows:.

.1 Deliver and store materials in original containers, sealed, with labels intact.

.2 Labels: to indicate:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Provide and maintain dry, temperature controlled, secure storage.

.5 Observe manufacturer's recommendations for storage and handling.

.6 Store materials and supplies away from heat generating devices.

.7 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.

.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.9 Remove paint materials from storage only in quantities required for same day use.

.10 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.11 Fire Safety Requirements:

.1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

.2 Waste Management and Disposal:

.1 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.2 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground the following procedures shall be strictly adhered to:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.3 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.4 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

1.7 AMBIENT CONDITIONS

.1 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by specifying body, Paint Inspection Agency and, applied product manufacturer, perform no painting work when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate temperature is over 32 degrees C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.

.4 Relative humidity is above 85 % or when dew point is less than 3 degrees C variance between air/surface temperature.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.2 Perform no painting work when maximum moisture content of substrate exceeds:

.1 12% for concrete and masonry (clay and concrete brick/block).

.2 15% for wood.

.3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.2 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.

.5 Do not apply paint when:

.1 Temperature is expected to drop below 10 degrees C before paint has thoroughly cured.

.2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.

.3 Surface to be painted is wet, damp or frosted.

.6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.

.7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.

.8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

Part 2 Products

2.1 MATERIALS

.1 Paint materials listed in latest edition of MPI Approved Products List (APL) are acceptable for use on this project.

.2 Paint materials for paint systems: to be products of single manufacturer.

.3 Use only MPI listed L rated materials.

.4 Water-borne surface coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

.5 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

.6 Water-borne surface coatings and recycled water-borne surface coatings must have flash point of 61.0 degrees C or greater.

2.2 COLOURS

.1 PT4: to match Preformed Metal Siding Color 1

.2 PT5: to match Preformed Metal Siding Color 2

.3 Selection of colours will be from manufacturer’s full range of colours.

.4 Where specific products are available in restricted range of colours, selection will be based on limited range.

.5 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site.

.2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.

.3 Add thinner to paint manufacturer's recommendations. Do not use kerosene or organic solvents to thin water-based paints.

.4 Thin paint for spraying according in accordance with paint manufacturer's instructions.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss: defined as sheen rating of applied paint, in accordance with following values:

Gloss Level Category/	Units @ 60 Degrees/	Units @ 85 Degrees/
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	85	

.2 Gloss level ratings of painted surfaces as specified and asas noted on Finish Schedule.

2.5 EXTERIOR PAINTING SYSTEMS

.1 Structural Steel and Metal Fabrications: (only as noted)

.1 EXT 5.1M - Waterborne light industrial Gloss level 5 semi-gloss coating (over waterborne primer). Premium grade.

.2 Galvanized Metal: not chromate passivated (Exterior doors and for components noted to be painted)

.2 EXT 5.3L - Pigmented polyurethane over Epoxy Primer

.1 Grade: Premium; Gloss Level: G6

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PREPARATION

.1 Perform preparation and operations for exterior painting in accordance with MPI Maintenance Repainting Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

.3 Clean and prepare exterior surfaces to be painted in accordance with MPI requirements.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before priming and between applications of remaining coats. Touch-up, spot prime, and apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

3.3 EXISTING CONDITIONS

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Consultant damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

3.4 PROTECTION

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect passing pedestrians, and general public in and about building.

.5 Remove light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Store items and re-install after painting is completed.

.6 As painting operations progress, place "WET PAINT" signs in pedestrian and vehicle traffic areas.

3.5 APPLICATION

.1 Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray Application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.

.4 Brush out immediately runs and sags.

.5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access.

.5 Apply coats of paint as continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.

.9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, duct work, grilles and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.

.2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.3 Do not paint over nameplates.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.1 Remove paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

3.8 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 05 50 00 - Metal Fabrications.

.2 Section 06 10 00 – Rough Carpentry.

.3 Section 06 40 00 – Architectural Woodwork.

.4 Section 08 06 01 - Door, Frame and Hardware Schedule.

.5 Section 08 14 16 - Flush Wood Doors

.6 Section 09 06 01 – Room Finish Schedule.

.7 Section 09 21 16 – Gypsum Board Assemblies.

.8 Section 09 96 53 - Elastomeric Coatings.

.9 Section 12 50 00 - Detention Furnishings.

1.2 REFERENCES

.1 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33

.2 Environmental Protection Agency (EPA)

.1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 1995, (for Surface Coatings).

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual, 2004.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Contractor: minimum of five years proven satisfactory experience. Provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit product data and instructions for each paint and coating product to be used.

.2 Submit product data for the use and application of paint thinner.

.3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application and curing.

.3 Samples:

.1 Submit full range colour sample chips to indicate where colour availability is restricted.

.2 Submit three 200 x 300 mm sample panels of each paint, stain and clear coating with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards.

.3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.1 Submit manufacturer's installation application instructions.

.4 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour numbers.

1.5 MAINTENANCE

.1 Extra Materials:

.1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.

.2 Quantity: provide one four litre can of each type and colour of primer, stain and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Delivery, storage and protection: comply with Owner requirements for delivery and storage of extra materials.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Pack, ship, handle and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.

.2 Acceptance at Site:

.1 Identify products and materials with labels indicating:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Storage and Protection:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store materials and supplies away from heat generating devices.

.3 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.

.5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.

.7 Remove paint materials from storage only in quantities required for same day use.

.8 Fire Safety Requirements:

.1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

.9 Waste Management and Disposal:

.1 Handle and dispose of hazardous materials in accordance with Regional and Municipal, regulations.

.2 Ensure emptied containers are sealed and stored safely.

.3 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Dispose of according to Authorities with Jurisdiction.

.4 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.5 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

1.7 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces.

.2 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Provide continuous ventilation for seven days after completion of application of paint.

.4 Coordinate use of existing ventilation system with Consultant and ensure its operation during and after application of paint as required.

.5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.6 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Perform no painting when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is under 85% or when the dew point is more than 3 degrees C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.

.5 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.

.2 Perform painting work when maximum moisture content of the substrate is below:

.1 Allow new concrete and masonry to cure minimum of 28 days.

.2 15% for wood.

.3 12% for plaster and gypsum board.

.3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.

.3 Apply paint when previous coat of paint is dry or adequately cured.

Part 2 Products

2.1 MATERIALS

.1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Provide paint materials for paint systems from single manufacturer.

.3 Only qualified products with E2 or E3 "Environmentally Friendly" rating are acceptable for use on this project.

.4 Conform to latest MPI requirements for interior painting work including preparation and priming.

.5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

.6 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

.7 Provide paint products meeting MPI "Environmentally Friendly" minimumE2 ratings based on VOC (EPA Method 24) content levels.

.8 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

.9 Flash point: 61.0 degrees C or greater for water-borne surface coatings and recycled water-borne surface coatings.

.10 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E2 rating.

2.2 COLOURS

.1 PT1: to match General Paint CLW 1002W ‘Ottertail’

.2 PT2: to match General Paint CLC1257D ‘Strata”

.3 PT6: to match General Paint CLW 1037W ‘Stoney Plain’

.4 S1: no stain. Clear varnish.

.5 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. Obtain written approval from Departmental Representative DCC Representative Consultant for tinting of painting materials.

.2 Mix paste, powder or catalyzed paint mixes inaccordance with manufacturer's written instructions.

.3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

.4 Thin paint for spraying in accordance with paint manufacturer's instructions.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 2 - Velvet-Like Finish	Max.10	10 to 35
Gloss Level 3 - Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 - Satin-Like Finish	20 to 35	min. 35
Gloss Level 5 - Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 - Traditional Gloss	70 to 85	
Gloss Level 7 - High Gloss Finish	More than 85	

.2 Gloss level ratings of painted surfaces as indicated as noted on Finish Schedule.

2.5 INTERIOR PAINTING SYSTEMS

.1 Concrete horizontal surfaces: floors.

.1 INT 3.2F - Concrete floor sealer. Two coats. Broadcast clean non-skid aggregate into first coat of sealer while still wet.

.2 Structural steel and metal fabrications: (columns, beams, joists, steel furniture and as indicated on drawings):

.1 INT 5.1Q – Latex, Gloss Level 5 – Semi-Gloss finish (over alkyd primer). Premium grade, 1 coat primer, two top coats.

.3 Galvanized metal: (doors, frames, railings, misc. steel, pipes, overhead decking, ducts and as indicated on drawings).

.1 INT 5.3M - High performance architectural latex Gloss Level 5 – Semi-Gloss finish. Premium grade, 1 coat primer, two top coats.

.4 Dressed lumber: (including doors, door and window frames, window sills, casings, joint covers, mouldings and as indicated as S1 on drawings):

.1 INT 6.3Q - Waterborne clear acrylic Gloss Level 5 – Semi-Gloss finish.. Premium grade, two coats clear varnish.

.5 Wood paneling and casework: partitions, panels, shelving, millwork:

.1 INT 6.4S - High performance architectural latex Gloss Level 5 – Semi-Gloss finish. Premium grade, 1 coat primer, two top coats.

.2 See Section 09 96 53 Elastomeric Coatings where indicated.

.6 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:

.1 INT 9.2B - High performance architectural latex Gloss Level 3–egg shell finish. Premium grade, 1 coat primer, two top coats.

.7 Cell Identification Number: Refer to Section 09 96 53 Elastomeric Coatings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Correct damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Proceeding with work is acceptance of substrate.

.3 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.4 Maximum moisture content as follows:

.1 Stucco, plaster and gypsum board: 12%.

.2 Concrete: 12%.

.3 Clay and Concrete Block/Brick: 12%.

.4 Wood: 15%.

3.4 PREPARATION

.1 Protection:

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect passing pedestrians, building occupants and general public in and about the building.

.2 Surface Preparation:

.1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.

.2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.3 Place "WET PAINT" signs in occupied areas as painting operations progress.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.3 Tint filler to match stains for stained woodwork.

.6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.7 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted.

.8 Touch up of shop primers with primer as specified.

3.5 APPLICATION

.1 Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in uniform layer using brush and/or roller type suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.

.4 Brush out immediately all runs and sags.

.5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.

.5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.9 Finish inside of cupboards and cabinets as specified for outside surfaces.

.10 Finish closets and alcoves as specified for adjoining rooms.

.11 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.

.2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Keep sprinkler heads free of paint.

.7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.8 Paint fire protection piping red.

.9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.10 Paint natural gas piping yellow.

.11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.12 Do not paint interior transformers and substation equipment.

.13 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.7 FIELD QUALITY CONTROL

.1 Standard of Acceptance:

.1 Walls: no defects visible from a distance of 1000 mm at 90 degreesto surface.

.2 Ceilings: no defects visible from floor at 45 degrees degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.8 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition.

.5 Touch up scratches, abrasions, voids and other defects in painted surfaces.

3.9 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning Procedures

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 08 34 63 - Detention Doors and Frames.

.3 Section 09 06 01 – Room Finish Schedule.

.4 Section 09 91 23 – Interior Painting.

1.2 REFERENCES

.1 ASTM International

.1 ASTM E84-12, Standard Test Method for Surface Burning Characteristics of Building Materials.

.2 Underwriters' Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for elastomeric coating application and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Samples:

.1 Submit duplicate 200 x 200 mm samples of each colour and texture of wall coating applied to gypsum board, plywood, and porous concrete block.

.2 Prior to commencing application, prepare wall and apply sample of wall coating of each texture to full wall panels, for Departmental Representative's approval.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for elastomeric coatings for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect elastomeric coating materials.

.3 Replace defective or damaged materials with new.

.4 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.5 Fire Safety Requirements:

.1 Provide one 9 kg Type ABC fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

1.6 SITE CONDITIONS

.1 Environmental Requirements:

.1 Temperature: minimum temperature of substrate 10 degrees C. Minimum temperature of air during and for 48 hours before and after coating is applied 15 degrees C.

.2 Ventilation:

.1 Ventilate enclosed spaces in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

.2 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Provide continuous ventilation for seven days after completion of application of paint.

.4 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.

.5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

Part 2 Products

2.1 MATERIALS

.1 Coating: elastomeric, catalyst cured thermo-plastic without vinyl resins, semi-gloss surface finish, minimum dry film thickness 6 - 8 mils per coat, colour as selected by Departmental Representative from manufacture's standard range.

.1 Fire hazard classification: 25/35 to ASTM E84.

.2 Coatings: VOC limit 180 g/L maximum.

.3 Substrate filler: epoxy caulk.

.4 Substrate filler: to CAN/CGSB-1.188.

.5 Identify each coating material container with ULC listed markings stating fire hazard classification.

.6 Provide factory-mixed coatings.

.7 Do not thin, reduce, dilute, or add materials to coatings unless described in manufacturer's product literature.

.8 Acceptable material: Amerlock 400.

.2 Cell Number Identification Coating: engineered siloxane, high gloss epoxy coating, colour as selected by Departmental Representative from manufacture's standard range.

.1 Fire hazard classification: 25/35 to ASTM E84.

.2 Coatings: VOC limit 180 g/L maximum.

.3 Substrate filler: as per manufacturer’s written recommendations.

.4 Substrate filler: to CAN/CGSB-1.188.

.5 Identify each coating material container with ULC listed markings stating fire hazard classification.

.6 Provide factory-mixed coatings.

.7 Do not thin, reduce, dilute, or add materials to coatings unless described in manufacturer's product literature.

.8 Acceptable material: PPG PSX 700.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for elastomeric coating and engineered siloxane application in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Ensure that items penetrating coating are placed before application of coating.

.3 Ensure maximum moisture content of substrate: 12%.

.4 Ensure negative alkalinity of substrate before application of coating.

.5 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.6 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.1 Protect adjacent surfaces and equipment from damage by over spray, fall-out and dusting.

.2 Clean substrate of matter which would affect bond of applied coating.

.3 Plywood - remove dust, dirt, and other surface debris by vacuuming or wiping with dry or clean cloths.

.4 Steel - Remove all dirt, grease or other contaminants using standard cleaning practices.

.5 Gypsum board - tape and mud all joints, fill all screw holes and sand surface smooth. Remove all dust, and other surface debris by vacuuming or wiping with dry, clean cloths.

.6 Epoxy caulk all joints in new and existing surfaces and prepare entire wall and ceiling surfaces as recommended by manufacturer.

.7 Elastomeric Coating – prepare as per manufacturer's written recommendations for application of engineered siloxane. Mask area for cell number identification.

3.3 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written application recommendations.

.2 Apply substrate filler coat 0.75 mm minimum thickness over completely dry concrete, concrete masonry, and other coarse surfaces as required to achieve a 100% filled, smooth surface with no pin holes and voids.

.3 Apply substrate filler coat 0.5 mm minimum thickness over gypsum board and plywood surfaces as required to achieve a 100% filled, smooth surface.

.4 Apply primer coat 0.5 mm minimum thickness over metal doors and metal frames as required to achieve a 100% filled, smooth surface.

.5 Prime surfaces according to manufacturer's directions, allow to dry. Ensure primer is compatible with substrate and top coatings.

.6 Apply coating employing trained applicators, using equipment specifically designed for this purpose by brush and roller.

.7 Apply coating to a small test area and allow to set. Notify Departmental Representative to inspect mock-up.

.8 Apply coating in two individual, uniform applications, permitting first to cure at least four hours before applying second coat.

.9 Mask cell identification number, prepare substrate and apply cell number identification coating as per manufacturer's written instructions. Apply coating in two individual, uniform applications, permitting first to cure as per manufacturer's written instructions before applying second coat.

.10 Finished work: to match approved samples, be uniform in thickness, sheen, colour and texture and to be free from marks, dirt particles, runs, crawls, drips, sags, brush marks, curling, holes, air pockets and other defects.

3.4 FIELD QUALITY CONTROL

.1 Inspection of coating application will be carried out Departmental Representative.

3.5 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Finished areas: Unless noted otherwise, paint all exposed grilles, security cages, and other mechanical and electrical equipment with colour and finish as selected by Departmental Representative.

.2 Do not paint over nameplates.

.3 Keep sprinkler heads free of paint.

.4 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.7 PROTECTION

.1 Repair damage to adjacent materials caused by elastomeric coating application..

3.8 SCHEDULES

.1 Plywood:

.1 One coat epoxy primer.

.2 Two coats (minimum) Amerlock 400.

.2 Steel - not primed:

.1 One coat epoxy primer.

.2 Two coats (minimum) Amerlock 400.

.3 Steel - primed:

.1 Touch-up with epoxy primer.

.2 Two coats (minimum) Amerlock 400.

.4 Gypsum board:

.1 One coat epoxy primer.

.2 Two coats (minimum) Amerlock 400.

.5 Cell Identification Number Coating:

.1 Surface preparation as per manufacturer’s written instructions for Amerlock 400 substrate.

.2 Two coats (minimum).

.3 See drawings for locations.

.6 All colours to be selected by Departmental Representative.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 01 00 05 – General Requirements.

.2 Section 06 10 00 – Rough Carpentry.

1.2 REFERENCES

.1 Aluminum Association (AA).

.1 DAF 45-03, Designation System for Aluminum Finishes.

.2 Underwriters' Laboratories of Canada (ULC).

.1 CAN/ULC-S102-M88 (R2000), Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S706-02, Wood Fibre Thermal Insulation for Buildings.

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 00 05 – General Requirements, Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet.

.3 Shop Drawings:

.1 Indicate location, type, size, panel arrangement, backing, hardware, anchor or mounting details, frame or trim and accessories.

.4 Samples:

.1 Submit tackboard covering samples for colour selection.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Surface burning characteristics of materials: listed and labelled by an organization accredited by Standards Council of Canada.

.2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

PART 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 CP Distributors Ltd.

.2 Shanahan's Building Specialties Limited

.3 Approved equivalent.

2.2 MATERIALS / COMPONENTS

.1 Whiteboards (noted as WB on drawings)

.1 12.7mm total thickness.

.2 Finish: Porcelain-ceramic semi-gloss finish.

.3 Base sheet: 28 ga. steel to ASTM A526, pre-cleaned and treated to ensure maximum adhesion of an acid resistant type porcelain enamel.

.4 Core panel: 11 mm high-density wood fibreboard to CAN/ULC-S706.

.5 Backer sheet: tempered aluminum foil for fixed wall mounted panels.

.2 Tackboards (noted as TB on drawings)

.1 12.7mm total thickness.

.2 Facing: Fabric to CAN/ULC-S102-M88 manufacturer's standard tweed pattern or 15oz vinyl, exposed edges for trim installation, in colours as selected by Consultant.

.3 Fabric adhesive: manufacturer's standard type.

.4 Core panel: 11 mm high-density wood fibreboard to CAN/ULC-S706.

.5 Acceptable Products:

.1 CP Distributors Ltd.: Fabrictac 2EP, Versatrim 200 Series

.2 Shanahan's Building Specialties: Vin-tac Vinyl

.3 Approved equivalent.

.3 Trim -Tackboards and whiteboards

.1 Perimeter trim or frame of manufacturer's standard sections appropriate for installation conditions.

.2 Extruded aluminum: Aluminum Association alloy AA6063-T5, minimum 1.5 mm wall thickness, clear anodized finish.

.3 Whiteboard trim to be supplied with bottom rail with integral chalk trough complete with end closures.

.4 Maprails

.1 Maprail shall be supplied over tackboard and whiteboard panels as noted on drawings. Provide maprail complete with integral cork insert and nylon end stops. Provide 1 nylon maphook clip per 1 linear meter, minimum 2 hooks.

.1 Acceptable Products:

.1 CP Distributors Ltd.:

.1 JT204 2" Maprail or approved equivalent.

.2 #2HMC 2" Nylon Maphook/Clip or approved equivalent.

.5 Joint reinforcement: concealed mechanical jointing system to provide straight, rigid, continuously supported, tight butt, flush joints at surface.

.6 Anchor clips, brackets and fasteners: concealed type recommended by manufacturer for fixed mounting.

2.3 FABRICATION

.1 Fabricate tackboard and whiteboard panels to sizes indicated. Dimensions on drawings are nominal. Panels may be up to 25 mm larger than sizes noted to suit standard trim.

.2 Manufacture panels in largest sizes possible. Factory fit assemblies too large for shipment to site in one piece; disassemble for delivery and site assembly.

PART 3 Execution

3.1 INSTALLATION

.1 Provide in-wall blocking behind each installation.

.2 Install in accordance with manufacturer's instructions, parallel to floor with uniform vertical surface, plumb and level, to provide rigid, secure surface.

.3 Install trim around panels. Make mitres and joints to hair-line fit, free of rough edges. Use concealed brackets to reinforce and hold joints tight and flush. No exposed fasteners permitted. Overlap trim 6 mm onto panels.

.4 Mechanical attachment:

.1 To concrete or solid masonry use lag screw and expansion bolts or screws and fibre plugs as appropriate for stresses involved.

.2 To hollow masonry use toggle bolts or equivalent.

.3 To wood or sheet metal use screws. Secure into blocking in stud walls.

3.2 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

.3 Clean aluminum with damp rag and approved non-abrasive cleaner.

3.3 SCHEDULE

Room No.	Type	Size	Quantity	Notes
107	White Board	1220 ht x 1830 w	1	
127	White Board	1220 ht x 610 w	1	
161	White Board	1220 ht x 1830 w	1	North wall.
161	Tack Board	50 ht x 3400	1	Centre on east wall at 2200 AFF.
161	Tack Board	50 ht x 305 long	2	Mount flush with top edge of whiteboard on either side of whiteboard on north wall.
164	White Board	1220 ht x 1830 w	1	

END OF SECTION

HG1-13319

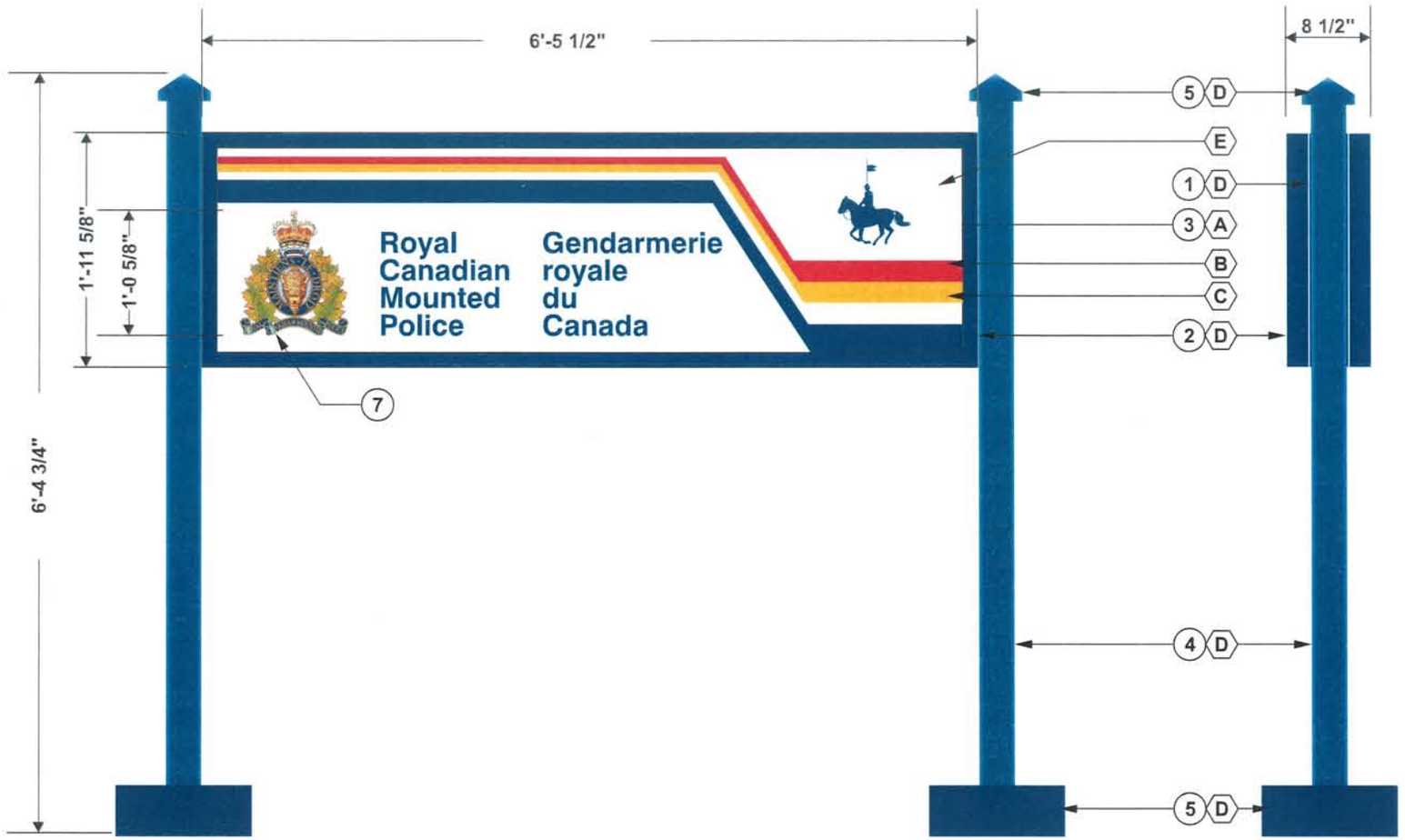
DOUBLE-SIDED ILLUMINATED PYLON SIGN

Installation:	Interior: ☐	Exterior: ☑

Electrical specifications:

Volts:	120	Amp.:	1.12	Circ.:	N/A

#	Descriptions:
1	ALUMINUM EXTRUSION CABINET IMN-83358
2	ALUMINUM EXTRUSION RETAINER IMN-85224
3	3/16"TK. CLEAR POLYCARBONATE FACE WITH VINYL APPLIED ON SECOND SURFACE
4	POST
5	BASE COVER
6	3/16" ABS MOLDED END CAP
7	COLOR CREST DECAL APPLIED SECOND SURFACE



FRONT VIEW

SIDE VIEW

Notes:

- SEE TECHNICAL DRAWING FOR MORE DETAIL

#		Colors:
A		BLUE TRANSLUCENT VINYL 3M #3630-167
B		RED TRANSLUCENT VINYL 3M #3630-33
C		YELLOW TRANSLUCENT VINYL 3M #3630-015
D		PAINT - TO MATCH BLUE VINYL #3630-167
E		WHITE TRANSLUCENT VINYL 3M #3630-20

Customer Approval:_____ Date:____/____/____

PRODUCTION INFORMATION : XX

XX

Descriptions:	Plate #:
XX	XX
XX	XX
XX	XX
XX	XX
XX	XX
XX	XX
XX	XX

This sign is intended to be installed in accordance with the requirements of Article 600 of the National Electrical Code and Section 24 of the Canadian Electrical Code and/or other applicable local codes. This includes proper grounding and bonding of the sign.

Pattison Sign Group illuminated signs contain Fluorescent, Neon and/or HID Lamps. These lamps contain Mercury (Hg). Dispose of these lamps according to Local, Provincial, State, or Federal Laws.

IF THIS AGREEMENT INCLUDES THE MANUFACTURING AND INSTALLATION OF A BASE(S) BY PATTISON SIGN GROUP FOR THE SIGNS ORDERED HEREIN, SUCH BASE(S) SHALL BE BUILT AND INSTALLED IN ACCORDANCE WITH APPLICABLE LAWS AND REGULATIONS. IF A BASE(S) IS TO BE BUILT OR PROVIDED BY THE CUSTOMER (OR HIS AGENT), AND NOT BY PATTISON SIGN GROUP, THE CUSTOMER SHALL ENSURE THAT THE BASE(S) ARE BUILT AND INSTALLED IN ACCORDANCE WITH APPLICABLE LAWS AND REGULATIONS AND SHALL HOLD PATTISON SIGN GROUP HARMLESS AND INDEMNIFY IT AGAINST ANY AND ALL CLAIMS, LIABILITIES, ACTIONS, PENALTIES, FINES, AND ANY LEGAL FEES INCURRED BY PATTISON SIGN GROUP ARISING FROM THE FAILURE OF THE CUSTOMER (AND/OR IT'S AGENT) IN DOING SO.

CUSTOMER APPROVAL

PRIOR TO SIGNING APPROVAL, PLEASE ENSURE THAT ALL MEASUREMENTS, DESIGN SPECIFICATIONS, SPELLING AND COLORS HAVE BEEN VERIFIED.

UPON SIGNING OF APPROVAL, THE CLIENT IS ENTIRELY RESPONSIBLE FOR COMPLETE PAYMENT OF GOODS.

CUSTOMER APPROVAL :

_____ DATE: _____

Pattison Sign Group

Tel: (506) 735-5506 | Fax: (877) 737-1734 | Toll Free: 1-800-561-9798

Client:	RCMP		
Site:	SHELLBROOK, SK		
Draftsman:	DANIEL DUROCHER	Date:	05.18.016
Checked By:	XX		
Page:	1/1	Scale:	1:3

PART 1 General

1.1 REFERENCES

.1 Aluminum Association, Inc. (AA)

.1 Designation System for Aluminum Finishes- 1997.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A653/A653M-[01a], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual – March 1998.

.4 Canadian Standards Association (CSA)

.1 CAN/CSA-B651-95 (R2001), Barrier-Free Design.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures

.2 Submit shop drawings, catalogue sheets and full size templates.

.3 Indicate materials, thicknesses, sizes, finishes, colours, construction details, removable and interchangeable components, mounting methods and schedule of signs.

.4 Submit drawn-to-scale details for individually fabricated lettering indicating word and letter spacing.

1.3 SAMPLES

.1 Submit samples in accordance with Sections 01 33 00 – Submittal Procedures

.2 Submit representative sample of each type sign, sign image and mounting method.

1.4 QUALITY ASSURANCE

.1 Welding Certification in accordance with Section 01 33 00 – Submittal Procedures

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction Waste Management and Disposal.

PART 2 Products

2.1 MATERIAL

.1 Multi-layered acrylic material with low-glare matte finish

.2 Size: 100 x 100 x 1.6mm thick

.3 Adhesives, paints, sealants and solvents: type recommended by material manufacturer for applicable condition.

2.2 SIGN GRAPHICS

.1 Sign graphics to be well defined, arranged for balanced appearance, and properly word and letter spaced.

.2 Apply by engraving at a depth of .30mm using a rotating carbide cutter.

2.3 DOOR SIGNS

.1 Engrave 25mm high, single line three or four digit numerals incised to expose contrasting coloured core. Numbers shall correspond to room numbers on plans.

.2 For interchangeable mounting: supply door signs with approved type, channel holders fabricated from 1.6mm aluminum, clear anodized finish.

.3 For fixed mounting: use self-stick foam tape.

2.4 WASHROOM SIGNS

.1 Each sign to be engraved with international symbol of man and/or woman.

.2 Signs to be complete with drill holes and tamperproof screws for anchoring. Mount at 1500mm height on door.

.3 Correspond signs according to plans.

2.5 HANDICAP SIGNS

.1 Each sign is to be engraved with international symbol of accessibility for the handicapped.

.2 Signs to be complete with drilled holes and tamperproof screws for anchoring. Mount at 1500mm height on door.

.3 Correspond signs according to plans.

2.6 FABRICATION

.1 Fabricate signs in accordance with details, specifications and shop drawings.

.2 Build units square, true, accurate to size, free from visual or performance defects.

.3 Accurately fit and securely join sections to obtain tight, closed joints.

.4 Allow for thermal movement without distortion of components.

.5 Exposed fasteners permitted only where indicated or approved by Engineer and to be inconspicuous and same finish and colour as base material, or as noted.

.6 Polish exposed edges to smooth, slightly convex profile.

.7 Manufacturer's nameplates on sign surface locations visible in completed work not acceptable.

2.7 FINISHES

.1 Low-glare mate acrylic; colours to be selected.

PART 3 Execution

3.1 INSTALLATION

.1 Erect and secure signs plumb and level at elevations indicated.

.2 Comply with sign manufacturer's installation instructions and approved shops drawings.

.3 Mechanical attachment:

.1 To steel use bolts with nut and lock washers, self-tapping screws.

.1 Do steel welding to CSA W59 and aluminum welding to CSA W59.2. Finish exposed welds flush and smooth.

.2 To wood use screws.

.3 Secure into framing members behind stud walls or above ceilings.

.4 Fabricate special fasteners as required for installation conditions.

.5 Mechanical fasteners and methods of attachment subject to Engineer's approval. Obtain Engineer's approval before fixing to structural steel.

3.2 CLEANING

.1 Leave signs clean.

.2 Touch up any damaged finishes.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 - Rough Carpentry.

.2 Section 10 28 10 – Toilet and Bath Accessories.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A653/A653M-[02a], Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian Standards Association (CSA)

.1 CAN/CSA-B651-95 (R2001), Barrier-Free Design.

1.3 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures

.2 Indicate fabrication details, plans, elevations, hardware, and installation details.

.3 Submit 2 colour charts for selection of colours.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 STORAGE AND PROTECTION

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Protect finished surfaces during shipment and installation. Do not remove until immediately prior to final inspection.

PART 2 Products

2.1 MATERIAL

.1 Toilet Partitions

.1 Doors and Panels

.1 Minimum base steel thickness: 0.8 mm.

.2 Constructed of 2 sheets Galvanneal steel, cemented to a honeycomb core. Honey comb to have a maximum 25mm cell size. Form and finish doors and panels with continuous self-locking edges with mitred, welded corners, and ground smooth. Height of doors and panels shall be 1460 mm.

.3 Finish: All steel surfaces to be undercoated with an iron phosphate treatment suitable for final finish. Paint finish shall be a high solid polyester baking enamel to approximately 50% gloss. Colour shall be selected from manufacturer's standard range of colours.

.2 Pilasters

.1 Minimum base steel thickness: 0.9 mm.

.2 Floor Braced.

.3 Manufactured from same material and fabrication methods as doors and panels. Pilaster height shall be 2083mm high. Provide stainless steel shoes.

.3 Headrail: Clear anodized alloy and temper 6063T5 with anti-grip design. Outer flanges shall fit over the facing of the pilaster and be supported at the wall.

.4 Components:

.1 Hinges, latch and connecting brackets: heavy-duty manufacturer's standard surface mount type, Type 304 stainless steel.

.2 Latches will have emergency access feature.

.3 Coat hook: combination hook and rubber door bumper, stainless steel.

.4 Door pull: Standard, stainless steel and barrier-free type suited for out-swing door.

PART 3 Execution

3.1 INSTALLATION

.1 Ensure supplementary anchorage, if required, is in place.

.2 Do work in accordance with CAN/CSA-B651.

3.2 ERECTION – TOILET PARTITIONS

.1 Install partitions and pilasters secure, plumb and square.

.2 Leave 12 mm space between wall and panel or end pilaster.

.3 Anchor mounting brackets to wood framing using screws and shields: to hollow walls using bolts and toggle type anchors, to steel supports with bolts in threaded holes.

.4 Attach panel and pilaster to brackets with through type sleeve bolt and nut.

.5 Equip each door with coat hook mounted on door.

.6 Attach pilasters to floor with pilaster supports and level, plumb, and tighten installation with levelling device. Secure pilaster shoes in position.

.7 Secure headrail to pilaster face with not less than two fasteners per face.

.8 Set tops of doors parallel with overhead brace when doors are in closed position.

.9 Install hardware. Adjust and align hardware for proper function.

3.3 SCHEDULE

.1 Provide toilet partitions in rooms:

.1 Women’s Room 120
.2 Men’s Room 121
.3 And as noted on drawings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 07 92 00 - Joint Sealants.

.2 Section 09 21 16 – Gypsum Board Assemblies.

.3 Section 09 65 16 – Resilient Sheet Flooring.

1.2 SECTION INCLUDES

.1 Vinyl wall and ceiling protection panels.

.2 Stainless steel corner guards.

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM E84, 10b Standard Test Method for Surface Burning Characteristics of Building Materials
- .2 ASTM D 256, 10 Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
- .3 ASTM E648 Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

.2 Underwriters Laboratories of Canada (ULC)

- .1 CAN/ULC-S102.2-10 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures

.2 Product Data: Submit manufacturer's printed product literature and specifications.

.3 Manufacturer's Instructions: Submit manufacturer's installation instructions.

.4 Provide seaming layout for review by consultant.

.5 Samples: For each finish product specified, including trim pieces, provide two samples, minimum size 300 by 300 mm, representing actual product, colour, and patterns.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials in original factory wrappings and containers, clearly labeled with manufacturer

1.6 PROJECT CONDITIONS

.1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

.1 Product Warranty: Standard manufacturer's product warranty against manufacturing defects.

Part 2 Products

2.1 RESILIENT WALL CLADDING

.1 Type RWC as denoted in Room Finish Schedule. Flexible, homogeous PVC wall and ceiling covering with polyurethane surface treatment meeting ASTM E648 Class 1 for flame spread and smoke developed characteristics. Meeting CAN/ULC-S102.2-10 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

.2 Thickness: 1.25 mm

.3 Roll width: 2.0 m

.4 Finish: smooth.

.5 Colour: one color selected by consultant from manufacturer's standard range.

.6 Pattern: marbelized.

.7 Joints: Heat welded to provide waterproof barrier. Weld compatible to resilient sheet safety floor and resilient sheet hydro floor. Refer to Section 09 65 16. Weld color: to match protection panel.

.8 Accessories

.1 Welds: As recommended by manufacturer.

.2 Corners: Cove former. 20mm radius.

.3 Adhesive and Primer: As recommended by manufacturer.

.9 Acceptable Products:

.1 Polyflor Polyclad Pro PU

.2 Approved alternate.

2.2 CORNER GUARDS:

.1 Stainless Steel, type 304, 90 x 90 x 1220 mm high, 1.2mm thick (18 gauge). Finish: #4 satin. Corners shall be rounded with no sharp edges. Field applied adhesive mounting.

Part 3 Execution

3.1 EXAMINATION

.1 Verify substrates are properly prepared.

.2 Wall surfaces to receive impact-resistant wall covering materials shall be dry and free from dirt, grease, loose paint, and scale.

3.2 INSTALLATION

.1 Avoid materials with chips, cracks, voids, stains, or other defects that might be visible in the finished work.

3.3 RESILIENT WALL CLADDING

.1 Adhesive trowel and application method to conform to manufacturer’s recommendations.

.2 Cut panels to fit around floor sinks and showers and door frames.

.3 Seal panels to edges to shower inserts, floor sinks and door frames. Refer to Section 07 92 00 - Joint Sealants.

.4 Utilize pre-fabricated cove formers from manufacturer at all wall-wall and wall-ceiling intersections.

.5 Seaming layout to minimize joints. Heat weld all joints between sheets and between wall panels and resilient flooring.

3.4 CORNER GUARDS

.1 Install aluminum retainers, mounting brackets, and other accessories in strict accordance with the manufacturer's instructions.

.2 Install corner guards with construction adhesive as recommend by manufacturer.

.3 Install corner guards as indicated in schedule.

3.5 CLEANING

.1 Remove excess adhesive in manner recommended by manufacturer.

.2 Clean plastic covers and accessories using a standard non-ammonia based household cleaning agent.

3.6 SCHEDULE

.1 Wall and Ceiling Protection

.1 See Room Finish Schedule.

.2 Corner Guards

.1 As indicated on drawings.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.

.2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.

.3 CGSB 31-GP-107Ma-90, Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.

.3 Canadian Standards Association (CSA)

.1 CAN/CSA-B651-07(2012), Barrier-Free Design.

.2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

1.3 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Samples to be returned for inclusion into work.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 EXTRA MATERIALS

.1 Provide special tools required for accessing, assembly/disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.

.2 Deliver special tools to Departmental Representative.

Part 2 Products

2.1 MATERIALS

.1 Sheet steel: to ASTM A653/A653M with ZF001 designation zinc coating.

.2 Stainless steel sheet metal: to ASTM A167, Type 302, with satin finish.

.3 Stainless steel tubing: Type 302, commercial grade, seamless welded, 1.2 mm wall thickness.

.4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 COMPONENTS

.1 All washroom components shall be supplied by the same manufacturer, from the same design series wherever possible.

.2 Police Building:

.1 Toilet tissue dispenser (TPD2): double roll type, surface mounted, heavy-duty cast aluminum with satin finish, capacity of two standard-core toilet tissue rolls up to 152mm diameter (2000 sheets). Theft-resistant spindles shall be molded high-impact ABS with retractable pins and concealed locking mechanism.

.1 Bobrick B-2740

.2 Approved alternate.

.2 Soap dispenser (HSD): liquid push-in valve spout, self-contained, 340 mL translucent polyethylene, tamper proof filler lock, surface mounted.

.3 Paper Towel Dispenser (TD): for roll paper towels, stainless steel cabinet, hinged front panel with full length piano hinge, lock and key, surface mounted, touch free pull dispensing mechanism dispenses one 305mm (12”) towel per pull (pull force 1.8 pounds (8.0N), minimum capacity 205mm (8”) wide x 205mm (8”) diameter non-perforated paper towel rolls.

.1 Acceptable material: Bobrick B-2860

.2 Approved alternate.

.4 Waste receptacle (TC): 320mm x 320 mm x 560 mm high, stainless steel, open top, no cover.

.1 Acceptable material: Bobrick B-2260 or approved alternate.

.5 Mirror (MI): Frame: heavy-gauge, one piece, roll-formed stainless steel with bright polished stainless steel finish. Channel shall be a minimum 13mm x13mm x 9.5mm with 90 degree mitred corners. Continuous integral stiffeners on all sides. Back of unit to be galvanized steel.

.1 Mirror: 6 mm tempered glass set on neoprene tubing in frame.

.2 Attachment clips: Vandal resistant stainless steel clips with concealed fasteners. Mirror support brackets sized to suit mirror size.

.3 Size: 450mm x 900mm, or equivalent, in configurations shown on drawings.

.4 Acceptable material: Bobrick B-165 Series or approved alternate.

.6 Grab bars (GB1 & GB2): 32 mm dia x 1.6 mm wall tubing of stainless steel, 76 mm diameter wall flanges, concealed screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories. Peened surface at area of hand grips. Grab bar material and anchorage to withstand downward pull of 2.2 kN.

.7 Clothes Hook (CH & BFCH)

.1 Type 304, 2.8mm stainless steel, all welded construction with no sharp corners. Satin finish.

.2 Acceptable material: Bobrick B-6827 or equivalent.

.8 Mop/Broom Holder (MBH):

.1 Stainless steel, spring-loaded rubber cams with anti-slip coating, plated steel retainers. Length 610mm with three holders.

.2 Acceptable material: Bobrick B-223 or approved alternate.

.9 Shower Rod and Curtain (SR)

.1 Heavy duty, 20 ga., stainless steel shower curtain rod complete with 1200 x 1830 heavy duty white vinyl shower curtain and hooks.

.10 Stainless Steel Shelf (SLF): Surface Mounted Shelf is 18-8 stainless steel, type 304. All exposed surfaces are N^{o}4 satin finish. Exposed finishes to be protected during shipment by PVC film which is easily removed after installation. Shelf and brackets to be welded construction.

.1 Shelf: 18 gauge. 13mm lip on all four (4) sides, with front lip hemmed under.

.2 Brackets: 16 gauge. Three (3) brackets used with 381mm spacing.

.3 Attachment: N^{o}10 (M5) self-tapping screws through holes provided in support brackets. Adequate blocking in wall required so as to meet intended load weight (times 3) and to support shelf.

.4 Size: Shelf is 305mm deep by 914mm long with 152mm high brackets.

.5 Acceptable material: ASi Model N^{o} 0692-1236 or approved equivalent.

2.3 FABRICATION

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CSA G164.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.

.9 Provide steel anchor plates and components for installation on studding and building framing.

2.4 FINISHES

.1 Chrome and nickel plating: to ASTM B456, satin finish.

.2 Manufacturer's or brand names on face of units not acceptable.

Part 3 Execution

3.1 INSTALLATION

.1 Install and secure accessories rigidly in place as follows:

.1 Stud walls: install steel back-plate to stud prior to plaster, drywall or plywood finish. Provide plate with threaded studs or plugs.

.2 Toilet/shower compartments: use male/female through bolts.

.2 Install grab bars on built-in anchors provided by bar manufacturer.

.3 Use tamper proof screws/bolts for fasteners.

.4 Fill units with necessary supplies shortly before final acceptance of building.

.5 Install mirrors in accordance with Section 08 80 50 - Glazing.

3.2 SCHEDULE

.1 Locate accessories where indicated. Exact locations determined by Departmental Representative.

.2 Room 102

.1 1 mirror at sink
.2 1 toilet tissue dispenser
.3 1 soap dispenser
.4 1 paper towel dispenser
.5 1 waste disposal
.6 1 clothes hook
.7 1 grab bar 610 long
.8 1 grab bar 915 long

.2 Room 163

.1 1 paper towel dispenser

.3 Room 110

.1 1 mirror at sink
.2 1 toilet tissue dispenser
.3 1 soap dispenser
.4 1 paper towel dispenser
.5 1 waste disposal
.6 1 clothes hook
.7 1 grab bar 610 long
.8 1 grab bar 915 long

.4 Rooms 113

.1 1 Mop/Broom Holder
.2 1 Stainless Steel Shelf

.5 Room 120

.1 1 mirror at each sink
.2 1 toilet tissue dispenser in each stall
.3 1 soap dispenser
.4 1 paper towel dispenser
.5 1 waste disposal

.6 Room 119

.1 4 clothes hooks
.2 1 shower rod with hooks and curtain

.7 Room 121

.1 1 mirror at each sink
.2 1 toilet tissue dispenser in each stall
.3 1 soap dispenser
.4 1 paper towel dispenser
.5 1 waste disposal

.8 Room 122

.1 4 clothes hooks
.2 1 shower rod with hooks and curtain

.9 Room 136

.1 1 mirror at sink
.2 1 toilet tissue dispenser
.3 1 soap dispenser
.4 1 paper towel dispenser
.5 1 waste disposal

.10 Room 147

.1 1 Mop/Broom Holder

.11 Rooms 141,142,154

.1 1 paper towel dispenser each room
.2 1 waste disposal each room

END OF SECTION

1 General

1.1 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).
.2 National Fire Protection Association (NFPA)
  .1 NFPA 10-2006, Standard for Portable Fire Extinguishers.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:
  .1 Submit manufacturer's printed product literature and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  .2 Submit two copies WHMIS MSDS - Material Safety Data Sheets in accordance with specifications.

.3 Provide shop drawings.

.4 Quality control submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

.5 Closeout Submittals:
  .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

2 Products

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

.1 Cartridge operated type with hose and shut-off nozzle, ULC labelled for A, B and C class protection.
  .1 Sizes: Refer to equipment schedule.

2.2 CARBON DIOXIDE

.1 Extinguishers Insulated handle, hose and horn discharge assembly, self-closing lever or squeeze-grip operation, fully charged, ULC labelled for B and C class protection.
  .1 Sizes: Refer to equipment schedule.

2.3 EXTINGUISHER BRACKETS

.1 Type recommended by extinguisher manufacturer.

2.4 CABINETS

.1 Semi-recessed, as indicated, constructed of 1.6 mm thick steel, 180 degrees opening door of 2.5 mm thick steel with latching device.

.2 Cabinet to maintain fire resistive rating of construction in which they occur.

.3 Cabinet door: with 5 mm full glass panel.

.4 Finish:
- .1 Tub: prime coated.
- .2 Door and frame: No.4 satin finish stainless steel.

2.5 IDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of ANSI/NFPA 10.

.2 Attach bilingual label to extinguishers, indicating month and year of installation. Provide space for service dates.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install or mount extinguishers in cabinets or on brackets as indicated on drawings and/or required by authority having jurisdiction.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Section includes clothing lockers, change room bench, evidence lockers and rifle storage lockers.

1.2 REFERENCES

.1 CAN/CGSB-44.40-2001, Steel Clothing Locker.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate type and class of locker, thicknesses of metal, fabricating and assembly methods, assembled banks of lockers, tops, hooks, shelves, bases, trim, numbering, filler panels, end/back panels, doors, handles, locking method, ventilation method, and finishes.

1.4 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit duplicate 50 x 50 mm samples of colour and finish on actual base metal.

Part 2 Products

2.1 SINGLE TIER CLOTHING LOCKERS (LK1)– ROOMS 118 AND 123

.1 Lockers: to CAN/CGSB-44.40.

.2 Steel: cold rolled to ASTM #A653.

.3 Basis of Design: Shanahan's – "Police and Crew Series, Double Door"

.4 Single tier locker.

.1 Size: 610 mm wide x 610 mm deep x 1829 mm high, minimum 1.5 mm steel thickness.

.2 Side and back panels: .56 mm (24 Ga) cold rolled steel.

.3 Vent holes: vent openings in top and bottom of doors plus additional vent holes in body top of locker. Vent holes in body top to be equal in area to vent holes in top of doors.

.4 Assembly: factory assembled welded construction.

.5 Doors:

.1 Double doors.

.2 Double pan construction. Outer panel shall be no less than .90mm (20 Ga) cold rolled steel to ASTM A366. Inner panel .56 mm (24 Ga) cold

rolled steel. Sandwich panel construction welded and complete with honeycomb core. Vent slots in top and bottom of door.

.3 Full length astragal welded to active door (right hand).

.4 Rubber bumpers.

.6 Door hinges: Frame to be equipped with 3 – 64mm long, 5 knuckle hinges, 2 mm (14 Ga).

.7 Door handle: recessed handle stainless steel box and pull.

.8 Shelves and centre divider

.1 Notched into frame, thickness .90mm (20 Ga).

.1 Top shelf, full width of locker; bottom shelf, half width of locker; vertical divider to underside of top shelf; and pull out drawer (full extension), half width of locker complete with keyed cylinder cam lock.

.9 Accessories

.1 Coat rod – 19 mm diameter.

.2 Coat hooks – 6 mm diameter zinc plated steel, 5 per locker.

.10 Locking system: padlocks provided by Owner.

.11 Options: to CAN/CGSB-44.40,

.1 Base: 100 high steel base, colour to match locker frames.

.2 Finished end panels: minimum 0.9 mm steel thickness, colour to match locker frames.

.3 Steel trim including corner angles and jamb trim: minimum 0.9 mm steel thickness, colour to match locker frames.

.4 Corner and Filler Panels: minimum 0.9 mm steel thickness, colour to match locker frames. See drawings for locations.

.5 Number plates: to manufacturer's recommendations.

.12 Finish

.1 Metal finish: Steel surfaces shall be thoroughly cleaned and undercoated with an iron phosphate treatment utilizing a wash and etching process. The paint finish shall be 2 coats of high quality alkyd baking enamel to 40% - 45% gloss, electro-statically applied to a minimum thickness of 1mm.

.2 Color to be selected from manufacturers standard color selector.

2.2 BENCH – ROOMS 118 AND 123

.1 Basis of Design: Shanahan's – "Moveable Pedestal Locker Room Benches"

.2 Movable Pedestal:

.1 Free standing, A-Frame leg design from stainless steel. Frame is 280 mm at base of legs sloping inward to seat. PVC cap fitted to bottom of legs.

.2 Height: 380 mm to 405 mm high.

.3 Tubing: 25 mm x 25 mm 16 gauge, type 304-4 stainless steel.

.3 Seat

.1 End grain hard Maple, 32 mm thick by 254 wide, edges rounded, all surfaces sanded.

.2 Quantity and Length:

.1 2 benches each 1220 mm (4') long

.3 Finish: one coat sealer and one top coat clear lacquer.

2.3 RIFLE LOCKERS – ROOMS 125 AND 143 (STG4 and STG10)

.1 Acceptable product:

.1 Dasco Storage Solutions, "Weapon Storage Components"

.2 Approved equivalent.

.2 Lockers: to CAN/CGSB-44.40, freestanding.

.1 Steel thickness: No. 16 ga

.2 Assembly: welded construction.

.3 Top: flat

.4 Doors: bi-fold. One-piece double-wall envelope construction, steel thickness 16 ga MSG, door swings as indicated in drawings.

.5 STG4: 42" side x 15" deep x 72" high. 16 rifle rack with 2 plain adjustable shelves per unit. Two adjustable removable stock saddles per unit.

.6 STG10: 42" side x 15" deep x 84" high. 32 rifle rack with 1 plain adjustable shelf. Two adjustable removable stock saddles per unit.

.7 Hinges: hinges concealed behind door when door is closed.

.8 Door handle: recessed handle steel with nickel-plated finish.

.9 Quantity: refer to drawings.

.3 Accessories

.1 Adjustable rifle stock saddles with rubber matting on shelf, barrel saddle.

.2 Extruded rubber edging on all saddles to prevent direct contact between weapon and metal.

.3 Adjustable shelving: steel construction, 16 ga. Adjustable in minimum 50mm increments.

.4 Mounting: provide holes in back of cabinet for mechanical fastening of cabinet to wall.

.4 Locking

.1 Locking system: cylinder lock keyed to building keying system.

.2 Key rifle lockers in Room 125 and 143 separately (2 keys per cabinet). Provide one master key required for all rifle lockers.

2.4 RECESSED HANDGUN LOCKERS – ROOMS 132 AND 112

.1 Acceptable product:

.1 Model Number EDHGF06 Flush. Wall mounted handgun lockers by Spacesaver Corporation, a division of KI, 1450 Janesville Ave., Fort Atkinson, WI 53538-2798. 1-800-492-3434. www.spacesaver.com. Distributed by HBI Office Plus Inc., Saskatoon, SK.

.2 Approved equivalent.

.2 Acceptable manufacturers:

.1 DSM Law Enforcement Products by Spacesaver Corporation

.2 Approved equivalent.

.3 Lockers: to CAN/CGSB-44.40, recessed.

.1 Door and hinge steel thickness: minimum 1.02 mm (18 ga)

.2 Cabinet steel thickness: minimum 1.29 mm (16ga)

.3 Assembly: welded construction.

.4 Finish: Textured powder coated paint.

.5 Color: Selected by consultant from manufacturer's standard range.

.6 Doors: Each 132 mm high x 264 mm wide (5-3/16" high x 10-3/8" wide). 6 doors/compartments.

.7 Shelves: 1/8" neoprene shelf lining.

.8 Cabinet Size: 25" wide x 6.5" deep x 20-1/8" high. 1-1/2" trim frame.

.9 Hinges: piano hinges concealed behind door when door is closed.

.10 Door handle: none.

.11 Number tags: located on each door.

.12 Quantity: refer to drawings.

.4 Accessories

.1 Mounting: holes in back of cabinet for mechanical fastening of cabinet to wall. Provide wood blocking in wall to suit.

.5 Keying and Locking

.1 Keying and Locking system: Master keyed and all locks keyed differently. Keys removable only in locked position.

2.5 SURFACE MOUNTED HANDGUN LOCKER – ROOM 125

.1 Acceptable product:

.1 Model Number EDHGS10 Surface. Wall mounted handgun lockers by Spacesaver Corporation, a division of KI, 1450 Janesville Ave., Fort Atkinson, WI 53538-2798. 1-800-492-3434. www.spacesaver.com. Distributed by HBI Office Plus Inc., Saskatoon, SK.

.2 Approved equivalent.

.2 Acceptable manufacturers:

.1 DSM Law Enforcement Products by Spacesaver Corporation

.2 Approved equivalent.

.3 Lockers: to CAN/CGSB-44.40, surface mounted.

.1 Door and hinge steel thickness: minimum 16 ga.

.2 Cabinet steel thickness: minimum 16 ga.

.3 Assembly: welded construction.

.4 Finish: Textured powder coated steel.

.5 Color: Selected by consultant from manufacturer's standard range.

.6 Doors: Each 132 mm high x 264 mm wide (5-3/16" high x 10-3/8" wide). 8 doors/compartments.

.7 Shelves: 1/8" neoprene shelf lining.

.8 Cabinet Size: 25" wide x 6.5" deep x 32-1/8" high.

.9 Hinges: piano hinges concealed behind door when door is closed.

.10 Door handle: none.

.11 Number tags: located on each door.

.12 Quantity: refer to drawings.

.4 Accessories

.1 Mounting: holes in back of cabinet for mechanical fastening of cabinet to wall. Provide wood blocking in wall to suit.

.5 Keying and Locking

.1 Keying and Locking system: Master keyed and all locks keyed differently. Keys removable only in locked position.

2.6 EVIDENCE LOCKERS – ROOM 142 (STG11, STG12, STG13)

.1 Acceptable manufacturer:

.1 Group Lincora Inc. 6255 Notre Dame Street East, Montreal, PQ, HIN 2E9.

.2 Approved Equivalent

.2 Acceptable product:

.1 GRC series by Lincora.

.2 Approved equivalent.

.3 Lockers: to CAN/CGSB-44.40, freestanding.

.1 Style: Non-pass through.

.2 Steel thickness: No. 18 ga

.3 Assembly: welded construction.

.4 Top: flat

.5 Doors: One piece welded. Formed from two pieces of minimum 18-gauge cold rolled steel box formed and welded together. Inner and outer door skins shall have a combined steel thickness of no less than 0.096 inches (2.4MM) thick. Provide neoprene silencers and anti-pry tabs. Provide surface mounted door numbers in sequence with other lockers in the same room.

.6 Hinges: Stainless steel spring loaded to keep door closed. Hinges to be welded to prevent pin removal.

.7 Shelves: Welded to frame. No. 18 ga. cold rolled steel. Sides to be turned up 90 degrees for cleaning.

.8 STG11: 36" wide x 24" deep x 82" high. 14 door unit – refer to drawings for door arrangement.

.1 Acceptable product: Lincora GRC series

.2 Approved equivalent.

.9 STG12: 36" wide x 24" deep x 82" high. 6 door unit – refer to drawings for door arrangement.

.1 Acceptable product: Lincora GRC series

.2 Approved equivalent.

.10 STG13: 24" wide x 24" deep x 82" high. 4 door unit – refer to drawings for door arrangement.

.1 Acceptable product: Lincora GRC series

.2 Approved equivalent.

.11 Door handle: recessed handle steel with nickel-plated finish.

.12 Bases: Welded. Complete with floor levelers and removable access panel for access to mounting holes and leveling points.

.13 Lock housing: structural, full height and depth of locker.

.14 Locking System: Padlocks provided by Departmental Representative. Hasps must accept padlocks with shackle height of 25mm (measurement from padlock body to inside loop of shackle) and shackle diameter of 8mm.

.15 Finish: Electrostatically applied powder coat. Color to be selected by Departmental Representative from manufacturer's standard range.

.16 Quantity: refer to drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Lockers

.1 Assemble and install lockers in accordance with manufacturer's written instructions.

.2 Securely fasten lockers to floor assembly and blocking in walls.

.3 Install locker bases and level as required.

.4 Install filler panels (false fronts) where indicated and where obstructions occur.

.5 Install finished end panels to exposed ends of locker banks.

.6 Install sloped false tops and gable ends.

.7 Install locker numbers.

.2 Benches

.1 Assemble benches in accordance with manufacturer's written instructions.

.2 Place as per locations in drawings. Do not secure to floor.

.3 Rifle Lockers and Evidence Lockers

.1 Assemble and install lockers in accordance with manufacturer's written instructions.

.2 Securely fasten lockers to floor assembly and blocking in walls.

.3 Level as required.

.4 Recessed Handgun Lockers

.1 Assemble and install lockers in accordance with manufacturer's written instructions.

.2 Ensure rough opening for recess is as per manufacturer’s instructions.

.3 Securely fasten lockers to wood blocking in walls.

.4 Adjust to provide smoothly operating, visually acceptable installation.

.5 See drawings for details.

.5 Surface Mounted Handgun Lockers

.1 Assemble and install lockers in accordance with manufacturer's written instructions.

.2 Securely fasten lockers to wood blocking in walls.

.3 Adjust to provide smoothly operating, visually acceptable installation.

3.2 CLEANING

.1 Immediately upon completion of installation, clean components and surfaces. Remove surplus materials, rubbish and debris resulting from installation upon completion of work and leave areas of installation in neat, clean condition.

3.3 SCHEDULE

.1 Quantities and configuration as indicated on drawings.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Section includes metal shelving, and steel storage cabinets.

1.2 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry.

1.3 REFERENCES

.1 CAN/CGSB-44.40-2001, Steel Clothing Locker.

.2 American Society for Testing and Materials (ASTM): ASTM A1008 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

.3 ASTM A1011 - Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

.4 ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

1.4 DESIGN REQUIREMENTS

.1 Layout: Refer to Drawings for configuration and quantities.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Schedule of shelving units indicating configuration, types, materials, quantities, sizes, and finishes.

.3 Design data to determining loads, gear ratio, and anti-tip restraints.

.4 Shop drawings showing layout plans, elevations, dimensions, required tolerances, clearances, and details for fabrication, installation, connections, anchors, accessories, and interface with other elements and systems.

1.6 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Minimum 75 mm square sample of each colour and texture to be exposed after installation.

.3 Finish color samples for selection by Departmental Representative.

1.7 QUALITY ASSURANCE

.1 Installer qualifications: Experienced in installation of storage systems and employee of manufacturer or certified by manufacturer for installation of specified system.

1.8 WARRANTY

.1 Provide under provisions of Section 01780 - Closeout Submittals the following warranties:

.1 5 years warranty to cover parts and materials against defects.

.2 2 years warranty to cover workmanship.

Part 2 Products

2.1 MATERIALS

.1 Steel sheet:

.1 Cold rolled steel sheet complying with ASTM A1008.

.2 Hot rolled, pickled steel sheet complying with ASTM A1011.

.2 Steel rail: SAE 1045.

.3 Extruded aluminum: ASTM B221, alloy 6063 Temper T-5.

2.2 GENERAL STORAGE CABINETS (STG3, STG6)

.1 All steel construction.

.1 Steel: cold rolled to ASTM #A1008.

.2 Galvanneal conforming to ASTM #653 zf 120 (A40).

.2 Frame:

.1 Horizontal components 1.27 mm (18 ga.)

.2 Vertical components 1.59 mm (16 ga.)

.3 Body:

.1 Side and back panels 0.63 mm (24 ga.)

.2 Top, shelf and bottom 1.59 mm (16 ga.)

.3 Shelves are adjustable with standards riveted to locker sides.

.4 Door:

.1 Outer and inner panels 0.95 mm (20 ga.), 30 mm thick honeycomb core.

.2 Hinge 64mm long, 5 knuckle, 14 gauge.

.3 Stainless steel handle box and pull

.4 Locking plate welded to one door.

.5 Pull and locking:

.1 Stainless steel handle, box and pull.

.2 Locking system: cylinder lock keyed to building keying system.

.6 Finish:

.1 Side, back panels, top, bottom and shelves; pre-painted galvanized, white in colour.

2.3 METAL SHELVING (STG1, STG5, STG7, STG8, STG9)

.1 Shelf:

.1 Cold-rolled furniture-grade steel,1.27 mm (18 ga.) . Double formed on all four sides. Corners are closed with double thickness steel forming a no-slip notch for the shelf clip.

.2 Clip: 12-gauge compression type; cadmium plated.

.3 Reinforcement: 25 mm x 12 GA. bent angle of steel, installed in the front and rear flange of the shelf to provide additional shelf capacity.

.4 Number of shelves per unit as indicated in drawings.

.2 T-Posts

.1 38 mm x 50 mm x 3.17 mm double-formed steel in a "T" style with a smooth, unperforated face.

.3 Closed End Panel Assembly

.1 Two "T" posts welded to a cold-rolled steel side panel to form a single unit providing greater strength and easier handling.

.2 Provide closed end panel between adjacent shelving units.

.4 Back Panel

.1 Cold-rolled steel panel attached to uprights with cadmium-plated back clips.

.5 Base Plates

.1 Formed top and bottom to provide support for the bottom shelf in addition to closing the space under the shelf. Utilize maximum 100 mm high (4”) base plate.

.6 Finish

.1 Prepared components for painting by being cleaned, iron phosphatized and rinsed. Electrostatically apply high-grade alkyd enamel. Bake to provide a hard, long lasting, furniture-grade finish.

.7 Minimum Shelf Capacity

.1 Shelf dimensions: 36 inch wide by maximum 15 inches deep: minimum load capacity 630 pounds.

.2 Shelf dimensions: 48 inch wide by maximum 18 inches deep: minimum load capacity 315 pounds.

Part 3 Execution

3.1 PREPARATION

.1 Verify dimensions and Project conditions prior to fabrication.

.2 Verify floor substrate is level and ready to receive storage system.

3.2 INSTALLATION GENERAL STORAGE CABINETS

.1 Assemble and install cabinets in accordance with manufacturer's written instructions.

.2 Install storage cabinets in numbers and configurations shown in drawings.

.3 Securely fasten cabinets to blocking in walls.

3.3 INSTALLATION METAL SHELVING

.1 Assemble and install cabinets in accordance with manufacturer's written instructions.

.2 Install storage cabinets in numbers and configurations shown in drawings.

.3 Ensure shelving units are installed square and plumb.

.4 Align shelving units adjacent to each other when they are installed end to end.

.5 Install shelving units parallel and perpendicular to walls according to the layout.

3.4 CLEANING

.1 Remove protective wrappings.

.2 Clean metal surfaces using clean water and mild detergent. Do not use abrasive agent, steel wool, or harsh chemicals. Rinse with clean water.

3.5 DEMONSTRATION

.1 Demonstrate to Owner's designated representatives, complete operation and required maintenance for mobile storage system.

3.6 SCHEDULE

.1 Refer to drawings for quantity and location.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCES

.1 ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

.2 ASTM B241 - Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

.3 CAN/CSA-B72-M87 (R2013) - Installation Code for Lightning Protection Systems.

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures

.2 Shop drawings shall clearly indicate detailed dimensions, base, attachment details, anchor requirements, and imposed loads.

.3 Product Data: Provide data on pole, accessories, and configurations.

.4 Maintenance Data: Provide lubrication and periodic maintenance requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

.2 Protect flagpole and accessories from damage or moisture.

PART 2 Products

2.1 POLE MATERIALS

.1 Aluminum: Tapered shaft, 7.5 meters in length. Colour: clear anodized.

2.2 COMPONENTS AND ACCESSORIES

.1 Finial Ball: Aluminum, 150mm diameter

.2 Fixed steel base attached to concrete pile.

.3 Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.

.4 Cleats: 230mm size, aluminum with stainless steel fastenings, two per halyard.

.5 Cleat Box: Aluminum, with built-in hinge and hasp assembly, attached to pole with tamper proof screws inside box.

.6 Pulleys: nylon or brass.

.7 Halyard: lockable internal, stainless steel aircraft control cable.

.8 Lightning control: ground spike conforming to CAN/CSA B72.

.9 Counterweight: stainless steel neoprene-covered.

PART 3 Execution

3.1 INSTALLATION

.1 Install flagpoles and fittings in accordance with manufacturer's instructions.

3.2 ERECTION TOLERANCES

.1 Maximum Variation From Plumb: 25mm.

3.3 ADJUSTING

.1 Adjust operating devices so that halyard functions smoothly.

END OF SECTION

PART 1 General

1.1 SECTION INCLUDES

.1 Ventilated metal shelves with integral closet rod.

.2 Security Mirror.

1.2 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 06 40 00 – Architectural Woodwork

.3 Section 09 21 16 – Gypsum Board Assemblies

.4 Section 09 91 23 – Interior Painting

1.3 REFERENCE STANDARDS

.1 National Building Code of Canada 2010 edition.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 Submittal Procedures. Provide overall layouts, colors, dimensions, product and accessory information, support and anchorage details.

.2 Indicate contents of spill kit.

PART 2 Products

2.1 VENTILATED METAL SHELVES

.1 Type 1: Indicated R+S on Drawings. Prefinished Ventilated Metal Wire Shelf with Integrated Closet Rod: 400 mm (16” depth). Length to suit - see drawings. Matching supporting brackets, anchors and accessories as per manufacturer’s written instructions to suit application. Color: White.

.1 Basis of design: ClosetMaid or approved alternate.

.2 Shelves, standards, brackets and all accessories are to be from a single manufacturer.

2.2 SECURITY MIRROR

.1 Arrangement: Quarter dome (90 Degree) corner installation, ceiling mount.

.2 Base material: optical grade 100% virgin acrylic.

.3 Reflective material: Vacuum metalised 99% pure aluminum.

.4 Size: 450mm x 450mm (18” x 18”) .

.5 Basis of Design: DuraVision or approved equivalent.

PART 3 Execution

3.1 INSTALLATION – VENTILATED METAL SHELVING

.1 Comply with manufacturer's installation requirements and instructions.

.2 Length to suit locations. See drawings.

.3 Coordinate installation of continuous wood blocking behind all adjustable shelf standards. Attach standards to studs at a maximum spacing of 400mm on centre.

.4 Ensure support and anchorage is adequate to meet intended use.

3.2 INSTALLATION – SECURITY MIRROR

.1 As per manufacturer's written instructions.

.2 Secure to ceiling with tamper-proof fasteners.

3.3 CLEANING

.1 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

3.4 SCHEDULE

.1 Ventilated Metal Shelves:

.1 Type 1: Rooms 163.1

.2 Security Mirror:

.1 See drawings for locations.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Appliances for Police Building .

1.2 REFERENCES

.1 CAN/CSA C300-08: Energy Performance and Capacity of Household Refrigerators, Refrigerator-Freezers, Freezers, and Wine Chillers.

.2 CAN/CSA-C22.2 NO. 150-M89 (R2014): Microwave ovens.

.3 CAN/CSA-E60335-2-43:13 – Household and Similar Electrical Appliances – Safety – Part 2-11

.4 CAN/CSA-C361-12 – Test Method for Measuring Energy Consumption and Drum Volume of Electrically Operated Household Tumble-Type Clothes Dryers

.5 CAN/CSA-C62301:11 – Household Electrical Appliances – Measurement of Standby Power

.6 CAN/CSA-E60335-2-6:13-Safety of Household and Similar Electrical Appliances – Safety – Part 2-6

.7 CAN/CSA-C360-03 (2009) – Energy Performance, Water Consumption and Capacity of Household Clothes Washers

.8 CAN/CSA-F325-M91 (R2010) – Residential Mechanical Ventilation Systems

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for furniture and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry and well-ventilated area.

.2 Store and protect furniture from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.6 WARRANTY

.1 Provide 1 year parts and labour warranty.

Part 2 Products

2.1 REFRIGERATORS

.1 Refrigerators are to be from same manufacturer.

.2 Type FR-FRZ – top freezer

.1 Width: maximum 30 inches.

.2 Height: maximum 69 inches.

.3 Capacity:

.1 Overall capacity: minimum 18 cubic feet.

.2 Freezer: maximum 4 cubic feet.

.4 Temperature controls: electronic.

.5 Shelving: adjustable in refrigerator with storage in refrigerator door.

.1 Refrigerator: minimum 3. Glass.

.5 Refrigerator Drawers: min. 2.

.6 Door: reversible.

.7 Light: refrigerator and freezer compartments.

.8 Defrost system: frost free.

.9 Energy Star qualified: No.

.10 Legs/Wheels: adjustable.

.11 Finish: white.

.12 Acceptable Manufacturers

.2 Kenmore, KitchenAid, Whirlpool, Frigidaire, LG or approved equivalent.

2.2 ELECTRIC WASHING MACHINES

.1 Washing machines and Dryers are to be matching pair, from same manufacturer.

.2 Type WASH: top load washing machine.

.1 Cabinet Height: maximum 37 inches. With lid open: max. 52 inches.

.2 Cabinet Depth: maximum 28 inches.

.3 Cabinet Width: maximum 28 inches.

.4 Washer Interior Capacity: minimum 4.0-4.5 cubic feet.

.5 Circuit rating/Voltage: 15 amps/ 110/120 V
.6 Top and Lid: powder coated white.
.7 Cabinet: white. Insulated for noise reduction.
.8 Wash basket material: stainless steel.
.9 High efficiency: No.
.10 Max spin speed: min. 770
.11 Wash agitator motion: Wash plate.
.12 Dispenser: Bleach.
.13 Number of Water Temperatures: Min. 5.
.14 Wash Cycles: Min. 7 with end of cycle signal.
.15 Energy Star compliant: No.
.16 Acceptable Manufacturers
.1 Kenmore, Panasonic, Bosch, Samsung, Whirlpool LG, GE or approved alternate.

2.3 ELECTRIC CLOTHES DRYERS

.1 Washing machines and Dryers are to be matching pair, from same manufacturer.
.2 Type DRY– front load
.1 Cabinet Height: maximum 37 inches. To top of control panel: 43 inches.
.2 Cabinet Depth: maximum 29 inches with door closed.
.3 Cabinet Width: maximum 29 inches.
.4 Dryer Interior Capacity: minimum 7.0 cubic feet.
.5 Drum Material: Powder coated.
.6 Power Source: 220/240V
.7 Min. Circuit Rating: 30 amps
.8 Venting: back (standard).
.9 Control type: Electromechanical.
.10 Top and Lid: powder coated white.
.11 Cabinet: white. Insulated for noise reduction.
.12 Sensor dry: yes.
.13 Dry cycles: Min. 3.
.14 High efficiency: No.
.15 Energy Star compliant: No.
.16 End of cycle signal: yes.
.17 Timed dry: yes.
.18 Wrinkle reduction: yes.
.19 Acceptable Manufacturers:
.1 Kenmore, Panasonic, Bosch, Samsung, Whirlpool LG, GE or approved alternate.

2.4 MICROWAVES

.1 Microwaves are to be from same manufacturer.

.2 Type MIC

.1 Width: maximum 22 inches.

.2 Height: maximum 13 inches.

.3 Depth: maximum 16 inches.

.4 Capacity: minimum 1.6 cubic feet.

.5 Power: minimum 1100 watts.

.6 Options:

.1 Turntable, auto defrost, auto reheat, auto cook, timer, minimum 10 programmable power levels.

.7 Oven liner: painted steel.

.8 Finish: white.

.9 Acceptable Manufacturers

.1 Kenmore, Panasonic, Bosch, Samsung, Whirlpool LG, GE or approved alternate.

2.1 CHEST FREEZERS

.1 Freezers are to be from same manufacturer.

.2 Type DEEP FREEZE –chest-style freezer

.1 Dimensions: maximum 850 high x 1092 wide x 762 mm deep (34” high x 43” wide x 31” deep)

.2 Capacity:

.1 Freezer: more than 10 cu. Ft. and less than 12 cu. Ft.

.3 Temperature controls: adjustable.

.4 Defrost system: manual.

.5 Defrost Water Drain: yes.

.6 Freezer Interior Light: yes.

.7 Number of Storage Baskets: two.

.8 Power Light Indicator: yes.

.9 Voltage: 115.

.10 Compressor Noise Level (dB): 0.

.11 Energy Star qualified: no.

.12 Finish: white.

.13 Acceptable Manufacturers

.1 Kenmore, KitchenAid, Whirlpool, Frigidaire, LG or approved equivalent.

Part 3 Execution

3.1 INSTALLATION

.1 Install according to manufacturer's written instructions.

.2 Install in locations as indicated on drawings.

.3 Set digital clocks to display correct time.

3.2 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Remove masking or protection after installation.

.3 Clean finished surfaces as recommended by panel manufacturer.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 08 54 13 - Fiberglass Windows

1.2 DESIGN REQUIREMENTS

.1 Design roller shades to following requirements:

.1 Be designed in a manner that allows wear susceptible parts to be replaceable by either the user or the manufacturer.

.2 A guarantee of at least five years of available replacement parts following discontinue of the products manufacture.

.3 Be accompanied by instructions for replacing or repairing worn parts, including inventory numbers for parts and procedures for ordering replacement parts.

.4 A program that allows for the refurbishing or return of used roller shades.

.5 Be designed in a manner that permits effective disassembly of components in order to permit recycling of materials for which recycling markets exist.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate dimensions in relation to window jambs, operator details, head and sill anchorage details, hardware and accessories details.

1.4 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit duplicate samples of manufacturer's standard colours for selection by Consultant.

.3 After approval samples will be returned for incorporation into the Work.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS / PRODUCTS

.1 Police Building:

.1 Basis of Design: Hunter Douglas Designer Dual Roller Shade FR. Double bracket assembly with offset roller shades. Two shades in single cassette. Independent shade operation. Independent concealed clutches and metal beaded cord loop with cord tensioner. White anodized aluminum cassette with matching end caps. Rear shade: Shearweave 2410 openness of 3%. Front shade: Shearweave 7000 openness to be 0%.

.1 Width Range for Single Shade: 305-3660 mm (12-144”).

.2 Height Range for Single Shade: 305-3048 mm (12-120”).

.3 Mounting: Inside window opening. Refer to drawings.

.4 Fabric Color: Consultant to select fabric colours from manufacturer's standard range. Submit samples as per Section 01 33 00.

.2 Acceptable manufacturers:

.1 Hunter Douglas.

.2 Altex SunProject.

.3 Approved equivalent.

2.2 MATERIALS AND FABRICATION

.1 To manufacturer's standard.

Part 3 Execution

3.1 INSTALLATION

.1 Include centre brackets where necessary to prevent deflection of headrail.

.2 Adjust to provide for operation without binding.

.3 Use non-corrosive metal fasteners for installation, concealed in final assembly.

.4 Install blinds mounted to inside of jambs.

.5 Provide white aluminum cassette typical at all locations.

3.2 SCHEDULE

.1 Police Building

Room Number	Number Of Shades per Room	Window Type
111	1	A
126	2	F
159	1	B
160	1	B
163	1	B
164	1	A

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Steamless.

.2 Canadian Standards Association (CSA International)

CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel.

CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

CSA W48-06(R2011), Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

CSA W59-13, Welded Steel Construction (Metal Arc Welding).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for furniture and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements: Store materials indoors and in accordance with manufacturer's recommendations in clean, dry and well-ventilated area.

.4 Store and protect furniture from nicks, scratches, and blemishes.

.5 Replace defective or damaged materials with new.

1.5 WARRANTY

.1 Provide 1 year parts and labour warranty.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21.

.2 Steel pipe: to ASTM A53/A53M standard weight.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Stainless steel tubing: to ASTM A269, commercial grade seamless welded with AISI No. 4 finish.

2.2 DRYING TABLE (DTAB)

.1 Work surface: stainless steel, 18 gauge top with 56 mm backsplash complete with minimum 2 heavy gauge channel supports.

.2 Hemmed safety edges.

.3 Legs: tubular 42 mm stainless steel with 25 mm adjustable levelling feet.

.4 Table top size 1524 mm long x 914 mm wide x 914 mm high

2.3 INTERVIEW TABLE (ITAB)

.1 Stainless steel top wrapped over steel plate.

.2 Stainless steel: No 7 finish.

.3 Steel finish: Chemically degreased & 1 coat universal rust inhibitive primer, paint.

.4 Table top size 1220 mm long x 760 mm wide x 750 mm high.

.5 Fasteners: roundhead security screws.

2.4 FLOOR STOOL (ST)

.1 Seat Top: 14 gauge type 304 stainless steel top 305mm diameter x 38 mm deep with a spun #4 finish.

.2 Reinforcement: 200 mm x 200 mmx7 gauge steel reinforcement plate, stitch welded to under side of seat & weld to pedestal.

.3 Pedestal: 50 mm schedule 40 (60 mm od) steel pipe pedestal, with overall height 457 mm from floor to top of seat.

.4 Base plate: 200 mm x 200 mm x 6 mm steel base plate, w/ 4- 12.7 mm diameter holes for bolting to floor. Weld to bottom of pedestal. All joints welded & ground smooth

.5 Finish: Chemically degreased & 1 coat universal rust inhibitive primer

.6 Standard of Acceptance: Kach Model No. 517, SecurityCosmos.com: Model 10-125-85-001 or approved equivalent.

Part 3 Execution

3.1 INSTALLATION

.1 Install according to manufacturer's written instructions.

3.2 DRYING TABLE (DTAB)

.1 Install one (1) table where indicated on drawings.

3.3 INTERVIEW TABLE (ITAB)

.1 Form 2 mm thickness stainless steel wrapped over 6 mm thickness steel plate top, welded to 2mm x 102 mm single steel round or square leg.

.2 Weld table leg to stainless steel base plate 400 mm square x 6 mm thickness with four 12.7 mm holes for fastening to floor.

.3 Fabricate table, leg and base with no exposed sharp edges.

.4 All joints welded & ground smooth.

.5 Place blocking between floor joists as required to suit holes for fasteners.

.6 Mechanically fasten table to floor.

.7 Paint steel leg. Refer to Section 09 91 23 Interior Painting.

.8 Install one (1) table where indicated on drawings.

3.4 FLOOR STOOL (ST)

.1 Place blocking between floor joists as required to suit holes for fasteners.

.2 Secure stool pipe support to floor as recommended by manufacturer.

.3 Install stools where indicated.

.4 Install stools in accordance with manufacturer's instructions, reviewed shop drawings and as directed by the Departmental Representative.

.5 Provide three (3) stools where indicated on drawings.

3.5 SEALANT

.1 Apply clear silicone sealant to exposed plate edges on floor plate and underside of floor base plate edges and around floor anchor bolts. Strike smooth to a 45° level.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Remove masking or protection after installation.

.3 Clean finished surfaces as recommended by panel manufacturer.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Building modules constructed “off-site” in a controlled environment; a significant portion of the work is to be completed at the modular builder’s facility (plant).

.2 All police building modules for this project must be constructed at a single plant in a single location.

.3 Building modules shall include:

.1 All specified interior and exterior finishes, specialties and accessories.

.2 Mechanical systems as noted.

.3 Electrical systems as noted.

.4 Preparation and protection of building modules for shipment to site.

.5 Shipment of building modules to site.

.6 Erection of building modules on prepared foundation.

.7 Repairs to modules on site after transportation.

1.2 RELATED REQUIREMENTS

.1 Section 01 11 00 – Summary of Work.

1.3 REFERENCES

.1 CSA Group

.1 CAN/CSA A277 (current version), Procedure for Certification of Prefabricated Buildings, Modules and Panels.

.2 Saskatchewan Department of Highways

.1 Road and loading restrictions.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Co-ordination: co-ordinate work of this Section with all requirements of technical specifications.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Required submittals:

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 As referenced in other Sections of technical specifications.

.2 Shop Drawings (Building Modules):

.1 If alternate structural methods or layouts are proposed for the modular components:

.1 Verify that the structural design meets the design intent and assume all costs associated with this verification.

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan, Canada.

.2 Indicate on drawings related provisions required for mechanical, electrical and other work.

.3 Indicate weight of each Building Module. Refer to 1.7.2 - Transportation Requirements and 2.1 - Designed Requirements.

1.6 QUALITY ASSURANCE / QUALITY CONTROL

.1 Modular builder shall have a QA/QC program in place for the design, fabrication, delivery and installation of building modules. The QA/QC program is subject to review and approval by the Departmental Representative prior to award of contract.

.2 Construct all modules in a single location in a heated facility to CAN/CSA A277. Provide and pay for any and all third party inspections required to ensure this standard is maintained. Provide copies of all third party inspections to Departmental Representative.

.3 Modular builder shall be responsible to have the building modules and systems inspected and tested at the facility as required by the requirements of the technical specifications and as may be required by the Owner, Province, or any other Authority Having Jurisdiction in addition their QA/QC program and CAN/CSA A277.

.4 Provide Inspection and Test Plan (ITP) to include:

.1 Schedule of in-plant reviews of selected modules by all required parties. Confirm list of required parties at pre-construction meeting.

.2 The condition of selected building module will be reviewed by all required parties for condition prior to its preparation for shipment.

.3 Test all mechanical and electrical systems and connections installed in factory prior to shipping in accordance with specifications including but not limited to Sections 23 08 01 and 23 05 94. Document test results and provide copies for Operations and Maintenance manuals. Systems shall be retested on site once final connections are completed.

.5 Comply with all applicable Provincial, National and Municipal Building Codes.

.6 Mock-ups:

.1 Refer to individual specification sections for required mock-ups.

.2 To expedite construction, mock-ups may be pre-qualified or constructed for review and approval by Departmental Representative prior to construction of modules. Confirm requirements at pre-construction meeting.

.3 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Building module transportation requirements:

.1 Arrange for all costs associated with transportation permits, and conduct a road survey of any and all maximum vehicular loading regulations and obstructions prior to transportation. Height, width and loading restrictions apply.

.2 Prepare building modules for shipment to site wrapped and protected in accordance with industry best practices to prevent damage from weather, dirt or debris during transport.

.3 Ensure openings between modules are temporarily framed and protected prior to being wrapped for shipment.

.4 Ship loose items shall be catalogued and marked for proper placement and use in each section. Ship loose items shall be installed by General Contractor at the site.

.5 Provide additional bracing to units as required by means of cable bracing or other means in order to prevent damage during building relocation.

.6 Include appropriate insurance for modules during transportation.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Designed weight of each building module is to ensure transportation Gross Vehicle Weight (GVW) does not exceed 41,500 kg.

2.2 MATERIALS

.1 Use only materials specified in other Sections of technical specifications.

2.3 FABRICATION

.1 Refer to the drawings and technical specifications.

.2 Floor Construction:

.1 Differences in floor elevation between each module at the seam line are not acceptable.

.2 Floor finishes, as scheduled, are to be installed prior to shipping.

.3 Wall Construction:

.1 All gypsum board shall be mechanically fastened.

.2 Differences in the wall planes at each seam line (hold back area) between modules are not acceptable.

.3 All walls (except for hold-backs at seam lines) are to receive at minimum tape, and prime coat of paint at the plant. Shipping module units with unfinished gypsum partitions is not permitted.

.4 Walls receiving finishes other than paint are to be completely finished prior to shipping.

.4 Roof Construction:

.1 Design roof structure to support the specified minimum live loads plus all dead loads for structure, finishes, ground snow loads, imposed snow loads, and building equipment.

.2 Roofing system shall be as specified in Division 7 of the technical specifications. Comply with all specified warranty requirements.

2.4 MECHANICAL SYSTEMS

.1 Schedule of work to be completed on site (not in plant) including but not limited to:

.1 Final cleaning, testing and commissioning.

.2 Plumbing lines and all associated fittings, valves and accessories running in the crawlspace including connections to pipe terminations in modules.

.3 Installation of trench drain and associated interceptors.

.4 Ductwork and all associated fittings and accessories running in space below modules including connections to ductwork terminations in modules.

.5 Installation and connection of equipment located in the space below modules (heaters, fans, etc.)

.6 Cross module connections for all mechanical systems routing between modules (all pipes, ducts, control wiring).

.7 Final placement and connection of all roof mounted equipment (includes placement of equipment, connection of equipment and all ductwork and piping on roof).

.8 Installation of water meter.

.9 Installation of Soil Gas Collector and associated accessories and discharge.

.10 Service connections in space below modules.

.11 Testing and certification of fire protection system and all other mechanical systems as required by individual specification sections.

2.5 ELECTRICAL SYSTEMS

.1 Schedule of work to be completed on site (not in plant) including but not limited to:

.1 Commissioning.

.2 Connection of cross over connections from module to module (looped, tagged, and identified in plant).

.3 Home run wiring.

.4 Low voltage devices, wiring, and systems.

.5 Site lighting installation including power cabling.

.6 Garage (Building 165) power and lighting systems installation including power cabling to Garage.

.7 Room 132 remote pedestal keyed switch.

.8 Fire alarm cabling.

.9 Security System/Card Access Cabling.

.10 Site testing and verifications.

Part 3 Execution

3.1 VERIFICATION OF CONDITIONS

.1 Verify areas to receive components of this Section are free of impediments interfering with access and installation.

3.2 ERECTION

.1 Set building modules on prepared foundations in accordance with reviewed Shop Drawings.

.2 A qualified supervisor from the building module manufacturer shall be on site during time of delivery and set.

.3 Provide skilled workers trained and approved by the building manufacturer to place the modular units in accordance with the building manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

.1 Maintain all requirements of QA/QC program and specified tolerances between building modules.

3.1 WARRANTY

.1 Submit manufacturer's standard warranty form for each product as required in the technical specifications.

.2 Extended warranties: Where extended warranties are listed in other specification Sections they shall be passed through from the building module manufacturer to the General Contractor.

END OF SECTION

Part 1 - General

1.1 RELATED WORK

.1	Access Doors	Division 08
.2	Fire Extinguishers	Division 10
.3	Specialties	Division 21
.4	Plumbing	Division 22
.5	Heating, Ventilating and Air Conditioning	Division 23
.6	Integrated Automation	Division 25

1.2 INTENT

.1 Provide a complete and fully operational mechanical system with facilities and services to meet requirements described herein and in complete accord with applicable codes and ordinances.

.2 Contract documents for mechanical scope are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.

.3 Should any discrepancies occur on drawings or in specifications which leaves doubt as to the intent and meaning of the drawings and specifications, obtain a ruling from the designer before submitting tender. If this is not done, it will be assumed that the most expensive alternate has been allowed for in the bid.

.4 Follow manufacturer's recommended installation details and procedures for equipment supplemented by details given herein and on plans subject to approval of the Departmental Representative.

.5 Install equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment to satisfaction of the Departmental Representative at no extra cost.

.6 Provide labour and materials required to install, test and place into operation complete mechanical system. Provide additional material for modifications required to correct minor job conflictions.

.7 Connect to equipment furnished in other Sections and by Departmental Representative, including uncrating equipment, moving in place and installing complete, start-up and test.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:
- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer’s written instructions.
- .3 Store and manage hazardous materials in accordance with cepa, tdga AND Regional and Municipal Regulations.

.2 Waste Management and Disposal:
- .1 Due to location, recycling is not required. Remove from site and dispose of packaging materials at appropriate disposal facilities.

.2 Unused sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
.3 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
.4 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial**.**

1.4 MATERIALS

.1 Replace materials or workmanship below specified quality and relocate work wrongly placed to satisfaction of the Departmental Representative.

.2 Materials and equipment installed shall be new, full weight and of the best quality specified. Use same brand or manufacturer for each specific application. Statically and dynamically balance rotating equipment for minimum vibration and low operating noise level.

.3 Each major component of equipment shall have manufacturer's name, address, catalog and serial number in a conspicuous place.

.4 Install materials and equipment in a neat and workmanlike manner by competent specialists.

1.5 CUTTING AND PATCHING

.1 Locate and provide holes and sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves at no extra cost.

.2 Drill for expansion bolts, hanger rods, brackets, and supports.

.3 Do no cutting or burning of structural members of building frame without obtaining prior written approval from the Departmental Representative.

.4 Provide openings and holes required in precast members for mechanical work. Cast holes larger than 100 mm (4") in diameter. Field-cut smaller than 100 mm (4").

.5 All patching of finished construction of building shall be performed under the sections of specifications covering these materials.

1.6 SEMI-FINAL AND FINAL INSPECTIONS

.1 Perform the following items prior to semi-final inspection.
.1 Heating and air conditioning systems capable of operation with alarm controls functional and automatic controls in operation generally, but not necessarily finally calibrated.
.2 Necessary tests on equipment made including those required by authorities and certificates of approval obtained.
.3 Rough balance of air and water systems completed.
.4 Valve tagging completed and equipment identified. Equipment and piping painted and escutcheons installed.
.5 Equipment lubricated as per manufacturer's data.
.6 Warranty forms have been mailed to manufacturer. Provide copy of original warranty for equipment which has warranty period longer than one year.

.7 Systems chemically cleaned, flushed and water treatment initiated. Provide report from manufacturer's representative to confirm status of treatment.
.8 Submit sample of Operating/Maintenance Manuals. Arrange Operating and Maintenance Instructions and submit schedule for approval.
.9 Review and ensure access doors are suitably located and equipment easily accessible including plumbing cleanouts.
.10 Have noise and vibration control devices and flexible connections inspected by manufacturer's representative and submit written report.
.11 Equipment alignment carried out by qualified millwright and certified report submitted.
.12 Check operations of plumbing systems and fixtures and ensure fixtures are solidly supported.
.13 Fan plenums cleaned, temporary filters removed and permanent filters installed.

.2 Provide declaration in writing that semi-final deficiencies and the following items have been completed prior to the final inspection:
.1 Equipment cleaned inside, outside and lubricated. Plumbing fixtures and brass cleaned.
.2 Final balancing completed and rough data of balance reports submitted.
.3 Final calibration of controls completed including point-to-point verification and confirmation that sequences are fully operational.

1.7 SHOP DRAWINGS

.1 Submittal procedures in accordance with Division 1.

.2 Submit materials and equipment by manufacturer, trade name and model number. Include copies of applicable brochure or catalog material. Do not assume applicable catalogues are available in the Departmental Representative's office. Maintenance and operating manuals are not suitable submittal material.

.3 Clearly mark each sheet of printed submittal material (using arrows, underlining or circling) to show particular sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pump seals, materials or painting.

.4 Include dimensional data for roughing in and installation, technical data sufficient to check that equipment meets requirements of drawings and specifications, wiring, piping, and service connection data, motor sizes complete with voltage ratings and schedules as applicable.

.5 Shop drawings to show all information identified under individual product specifications and in general shall show the following:
.1 Mounting arrangements.
.2 Operating and maintenance clearances.
.3 Detailed drawings of bases, supports, and anchor bolts.
.4 Acoustical sound power data, where applicable.
.5 Points of operation on performance curves.
.6 Manufacturer to certify current model production.
.7 Certification of compliance to applicable codes.

.6 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.8 OPERATING AND MAINTENANCE MANUALS

.1 Provide services of qualified and experienced personnel to prepare proper documentation and to instruct the Operating Staff in the operation and preventative maintenance of each piece of equipment and system supplied and installed. Complete and turn over documentation prior to final inspection.

.2 Provide 215 mm x 280 mm (8-1/2" x 11") capacity extension type catalogue binders bound with heavy fabric, hot stamped in gold lettering front and spine. Refer to Division 1 for colour and quantity.

.3 Each binder shall be indexed according to the following indexing system:

.4 Tab-1.0 Mechanical Systems: Title page with clear plastic protection cover.

.5 Tab-1.1 List of Mechanical Drawings.

.6 Tab-1.2 Description of Systems: Provide complete description of each system. Include detailed system description and components comprising that system, explanation of how each component interfaces with others to complete the system, location of each thermostat, controller or operating setpoints. Refer to 21 05 01, 1.1.5 for additional required information.

.7 Tab-1.3 Operation Division: Provide complete and detailed operation of each major component. Include how to energize and exact location of switches and controls, how the component interfaces with other components, operation of controls, including the operational sequence, operational characteristic changes for summer or winter operation, and how to accomplish the changeover, complete troubleshooting sequence, setpoints cannot be maintained, and safeguards to check if equipment goes off line. Refer to 21 05 01, 1.1.5 for additional required information.

.8 Tab-1.4 Maintenance and Lubrication Division: Provide detailed preventative maintenance and lubrication schedule for each of the major components to include daily, weekly, monthly, semi-annual and yearly checks and tasks. Explain how to proceed with each task required for each piece of typical equipment such as bearings, drives, motors and filters. Compile this information for each typical piece of equipment separate from the shop drawings section. Refer to 21 0-5 01, 1.1.5 for additional required information.

.9 Tab-1.5 List of Equipment Suppliers and Contractors: Provide complete list of equipment suppliers and contractors, including address and telephone number. Outline procedures for purchasing parts and equipment. Include steps to take in order to purchase new parts.

.10 Tab-Certification (2.0, 2.1, etc.): Include copy of test data degreasing and flushing of heating system analysis of system water taken at time system was put into operation, hydrostatic or air tests performed on piping systems, equipment alignment certificates, copy of balancing data for air and water systems, copy of valve tag identification and pipe colour code, inspection approval certificates for plumbing system, hot air heating and ventilation systems and fire damper schedule.

.11 Tab-Shop Drawings and Maintenance Bulletins (3.0, 3.1, etc.): Provide materials as received in compliance with clause "Shop Drawings".

.12 The divider tabs shall be laminated mylar plastic, and coloured according to section. The colouring is as follows: Mechanical Systems - 1.0 - 1.5 - Orange, Certification - 2.0 - 2.4 - Green, Shop Drawings and Maintenance - 3.0 - 3.17 - Yellow. Plastic tabs with typed insertions will not be accepted.

.13 Submit documents to the Departmental Representative for approval prior to being turned over to the Departmental Representative. At completion of project, hold a Seminar to instruct the Operating Staff in operation and preventative maintenance of each piece of equipment and system supplied and installed.

.14 Provide one digital copy on compact disk of the final operation and maintenance manual in each of the manuals (six in total).

1.9 RECORD DRAWINGS

.1 Refer to Division 1.

.2 Keep on site, an extra set of white prints and specifications recording changes and deviations daily. Allow for the work required to transfer site changes to Departmental Representative's original tracings and for providing the Departmental Representative with set of sepias marked "Record Drawings". Co-ordinate through Departmental Representative's office. Addenda corrections and Departmental Representative initiated construction changes to original tracings will be the responsibility of the Departmental Representative.

.3 Contractor shall utilize a different colour water proof ink for each service.

.4 Contractor shall ensure that white prints are available on site for reference purposes and inspection.

.5 Record drawings shall identify location of fire dampers, major control lines, access doors, tagged valves and actual room names or numbers.

.6 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.7 Submit to Departmental Representative for approval and make corrections as directed.

1.10 IDENTIFICATION

.1 Refer to Section 23 05 54, Mechanical Identification.

1.11 TEMPORARY FACILITIES

.1 Refer to General Requirements - Division 01.

1.12 SUPERVISION

.1 Refer to General Requirements - Division 01.

1.13 TEMPORARY HEAT AND/OR VENTILATION

.1 Refer to General Requirements - Division 01.

.2 Do not use the permanent system for temporary heating or ventilation purposes, without written permission from the Departmental Representative.

.3 Thoroughly clean and overhaul permanent equipment used during the construction period, replacing worn or damaged parts. Exchange equipment or components operating improperly at final inspection with new equipment or components.

.4 Use of permanent systems for temporary heat shall not modify the terms of warranty.

.5 Operate heating systems under conditions which ensure no temporary or permanent damage. Operate fans at proper resistance with filters installed. Change filters at regular intervals. Operate with proper safety devices and controls installed and fully operational. Operate water systems with proper water treatment.

.6 Where air systems are used during temporary heating, provide filter media on return and exhaust air outlets. Clean duct systems which have become dirty.

.7 When permanent systems are used for temporary heat, provide alarm indicating system failure. Connect alarm to independent alarm company system.

.8 Replace mechanical seals in pumps used for temporary heating purposes with new mechanical seals, regardless of condition.

.9 Provide one year warranty from date of Substantial Completion.

1.14 EQUIPMENT PROTECTION AND CLEAN-UP

.1 Protect equipment and materials in storage on site, during and after installation until final acceptance. Leave factory covers in place and take special precautions to prevent entry of foreign material into working parts of piping and duct systems.

.2 Protect equipment with polyethylene covers and crates.

.3 Operate, drain and flush out bearings and refill with new change of oil, before final acceptance.

.4 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances.

.5 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

1.15 TEMPORARY OR TRIAL USAGE

.1 Temporary or trial usage by the Departmental Representative of mechanical equipment supplied under contract and claimed complete before final acceptance shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Take responsibility for damage caused by defective materials or workmanship during temporary or trial usage.

1.16 ELECTRICAL MOTORS

.1 Supply mechanical equipment complete with electrical motors.

.2 Provide NEMA premium efficiency motors to CEMA and CSA standards for hard, continuous service, designed to limit temperature rise to 40 deg.C (100 deg.F) for open housing and 50 deg.C (125 deg.F) for drip proof housing, and operate at 1800 RPM unless otherwise specified.

.3 Motors shall have ball or roller type bearings with grease lubrication fittings.

.4 Motors used in conjunction with variable frequency drives shall be suitable for inverter duty, as specified by NEMA MGI-1993, Part 31. Refer to electrical specifications for inverters.

.5 Refer to mechanical equipment schedule and electrical specification for voltage, phase and cycle.

1.17 ACCESS DOORS

.1 Supply access doors for furred ceilings, ducts or spaces for servicing equipment and accessories or for inspection of safety, operating and fire devices for installation under section erecting the walls or ceilings.

.2 Provide access doors in ductwork in accordance with Section 23 33 00 - Air Duct Accessories

.3 Provide service access door in accordance with Section 08 31 00.01 - Access Doors - Mechanical.

1.18 COMMISSIONING

.1 Mechanical Contractor is responsible to ensure all mechanical systems are fully commissioned and detailed commissioning forms are completed and reviewed with Departmental Representative. Refer to Sections 01 91 13 General Commissioning (Cx) Requirements, 01 91 33 Commissioning Forms, 01 91 41 Commissioning Training for details on Mechanical Contractors responsibilities in addition to all commissioning activities identified under Division 21, 22, 23 and 25. As part of the commissioning process, the contractor is required to complete the Site Standard Equipment Labelling and Tracking sheets for the equipment they supplied, the sheets will be provided by the owner.

1.19 INSTRUCTION OF OPERATING STAFF

.1 Provide trained personnel to instruct operating staff on maintenance, adjustment and operation of mechanical equipment. Instruct staff on changes or modification in equipment made under terms of guarantee.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Where specified elsewhere in Mechanical manufacturers to provide demonstrations and instructions.

.4 Use operation and maintenance data manual for instruction purposes. On completion of instruction, turn one manual over to chief operating personnel, the balance to Departmental Representative.

.5 Record every instruction and training session on digital video.

.6 Time allocated for Instruction:

Plumbing Fixtures	One-half (1/2) hour instruction per fixture type.
Fire Protection	One (1) hour instruction
Pumps	One-half (1/2) hour instruction per pump type.
Tanks	One-half (1/2) hour instruction
Fans	One (1) hours instruction
Domestic Water Heater	Two (2) hours instruction
Split AC Units	One (1) hour instruction
Packaged Roof Top Units	One (1) hour instruction
Packaged Roof Top Unit Controls	Two (2) hours instruction
Semi-Custom Roof Top Units	Two (2) hours instruction
Semi-Custom Roof Top Unit Controls	Two (2) hours instruction
Boilers and Boiler Controls	Four (4) hours instruction
Stand Alone Controls	One (1) hour instruction per controller type

1.20 SUBSTANTIAL COMPLETION

.1 The mechanical portion of the project shall be deemed substantially complete when ALL mechanical systems are operational as designed. In addition, the air and/or water balance must be completed with the report submitted and approved by the Departmental Representative and the temperature control system must be complete, as designed, operational, with all control components calibrated and the maintenance manuals in final form must be submitted. The date will be established by the Departmental Representative and will set the date for the start of the one (1) year warranty on all mechanical systems.

1.21 EXCESSIVE ADMINISTRATION

.1 Following the "Substantial Completion" Inspection a "Final" Inspection will be conducted and a follow up inspection will be conducted to "check off" all outstanding mechanical deficiencies.

.2 If the mechanical portion of the project is not 100 percent complete at the time of the deficiency “checkoff” inspection, the cost of the failed deficiency “check-off” inspection and any and all additional inspections will be back charged directly to the Mechanical Contractor.

.3 The cost of each excessive inspection will be $2,000.00 plus travel, and will be deducted directly from the total Mechanical Contract amount.

.4 If the contractor fails the deficiency “checkoff” inspection, no additional money will be released and a subsequent inspection will be scheduled when the Contractor re-verifies that they are 100% complete.

.5 This process will repeat until the contractor can demonstrate that the project is 100% complete with all deficiencies rectified.

1.22 ALTERNATE MATERIALS & EQUIPMENT

.1 The design is based on the materials and equipment as specified. Any alternate materials or equipment that meet or exceed the performance, quality and design intent of that specified will be accepted unless specifically noted otherwise under this article.

.2 If alternate material or equipment will alter the design intent, make proposals to supply said materials or equipment in writing to the Departmental Representative at least ten working days prior to closing date of tender for Mechanical Trade. Clearly identify in

proposal exactly how the proposed material alters the design intent and the benefits and disadvantages of said proposal. Any material or equipment that alters the design intent must be formally approved to be accepted

.3 All proposed equipment is subject to the requirements of the drawings and specifications. Revisions required to adapt equipment other than that specified shall be made without extra charge to the contract. All suppliers, except those specified, shall guarantee in writing that their individual proposed products meet or exceed the performance and quality of specified products. If the departmental representative determines at any time that the equipment or material being supplied does not meet or exceed the performance, quality or design intent of that being specified, the contractor shall replace the article in question with a suitable product at the contractors expense.

.4 The following products shall be supplied as specified, there is no other products/ manufacturers that will be accepted:
- .1 Cell Comby, as listed in Section 22 42 03
- .2 Security Floor Drains and mounting, as listed in Section 22 42 01
- .3 Security Sprinkler heads, as listed in Section 21 13 13.
- .4 Security HVAC grilles, as listed in Section 23 37 13.
- .5 Any other products specifically noted to be supplied as specified.

1.23 SERVICE CONNECTIONS

.1 Connect to new sanitary sewer service, as indicated on Civil drawings and specifications. Mechanical contractor shall install piping within building to 2400mm outside perimeter of building. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing. Coordinate work with Site Services contractor.

.2 Connect to new water service, as indicated on Civil drawings and specifications. Provide new water service in building complete with water meter with bypass valves to requirements of authority having jurisdiction. Provide necessary thrust blocks on underground water piping as required and detailed. Provide sleeve in wall for service main and adequately support at wall with reinforced concrete bridge. Caulk enlarged sleeve and make watertight with plyable material. Securely anchor service main inside to concrete wall. Provide 18 gauge galvanized sheet metal sleeve around service main to 152 mm (6") above floor and 2 m (6') minimum below grade. Size for minimum 50 mm (2") of loose fill insulation. Provide backflow preventer at meter location to the stricter requirements of authority having jurisdiction or specified models. Mechanical contractor shall install piping within building to 2400mm outside perimeter of building. Coordinate work with Site Services contractor.

.3 Facility to have new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 14 kPa (2 psig). Coordinate work on site with Utility Provider from utility service to meter location. Route service from meter to serve building equipment. Provide regulators on each line serving gravity type appliances and as indicated on drawings, sized in accordance with equipment.

.4 Where propane filling plants or gas installations with an input rating that exceeds 5,000,000 BTU/hr (465 kW/hr) are being installed, added to or alerted, the Mechanical Contractor shall submit five copies of drawings and specifications with respect to the installation to SaskPower Gas and Electrical Inspections Department, and shall pay the review fee.

Part 2 - Materials

2.1 NOT USED

.1 Not Used

Part 3 - Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 General

1.1 REFERENCES

.1 Federal Sprinkler Standard, FCC#403 - Sprinkler Systems.

.2 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
- .1 ANSI/NFPA 13- 2013, Installation of Sprinkler Systems.

.3 Underwriters Laboratories of Canada (ULC)
- .1 ULC S543- 1984, Internal Lug Quick Connect Couplings for Fire Hose.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures and in accordance with ANSI/NFPA 13, working plans and design requirements.

.2 Sprinklers shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.3 ENGINEERING DESIGN CRITERIA

.1 Design system in accordance with required and advisory provisions of ANSI/NFPA 13, using following parameters:
- .1 Hazard:
  - .1 To suit occupancy as indicated.
- .2 Pipe size and layout:
  - .1 Hydraulic design.
  - .2 Sprinkler head layout: to ANSI/NFPA 13.
- .3 Water supply:
  - .1 Conduct flow and pressure test of water supply in vicinity of project to obtain criteria for bases of design in accordance with ANSI/NFPA13. Base design for bidding in accordance with the following:Water pressure at new municipal hydrant was measure in June 2016, with results as follows:
    Static Pressure: 50 psi.
    Flowing – 581 USGPM @ 10 psi
    Flowing – 396 USGPM at 25 psi
    Calculated to flow 497 USPGM at 20 psi.
  - .2 New service line as indicate on site plans.
- .4 Zoning:
  - .1 System zoning as indicated.

.2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.

.3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings

.4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.

.5 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.

.6 Location of Sprinkler Heads:
- .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 required hazard occupancy.
- .2 Uniformly space sprinklers on branch.
- .3 Sprinklers in secure areas shall be located in accordance with RCMP Security standards, as indicated on drawings.

.7 Water Distribution:
- .1 Make distribution uniform throughout the area in which sprinkler heads will open.
- .2 Discharge from individual heads in hydraulically most remote area to be 100% of specified density.

.8 Density of Application of Water:
- .1 Size pipe to provide specified density when system is discharging total maximum required flow.
- .2 Sprinkler Discharge Area:
  - .1 Area: hydraulically most remote area as defined in NFPA 13.
- .3 Outside Hose Allowances:
  - .1 Include allowance in hydraulic calculations for required outside hose streams.
- .4 Friction Losses:
  - .1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide spare sprinklers and tools as required by ANSI/NFPA 13.

2 Products

2.1 PIPE, FITTINGS AND VALVES

.1 Pipe:
.1 Steel Pipe: ASTM A53 or A120, Schedule 40 black, with malleable iron or forged steel welding type fittings, screwed or welded.

.2 Fittings and joints to ANSI/NFPA 13:
.1 Ferrous: screwed, welded, flanged or roll grooved.
.1 Grooved joints shall consist of two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts.
.1 Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity. Couplings shall be fully installed at visual pad-to-pad offset contact. (Tongue and recess type couplings, or any coupling that requires exact gapping of bolt pads on each side of the coupling at specified torque ratings, are not allowed.) Victaulic Style 009-EZ, 005, and 07.
.2 Flexible Type: For use in locations where vibration attenuation and stress relief are required, and for seismic applications. Victaulic Style 77.
.2 Copper tube: screwed, soldered, brazed, or roll grooved.
.1 Grooved joints shall be manufactured to copper-tube dimensions, with housings cast with offsetting angle-pattern bolt pads. Victaulic Style 606.
.3 Provide welded, threaded, grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.
.4 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.
.5 Rubber gasketted grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.
.6 Fittings: ULC approved for use in wet pipe sprinkler systems.
.7 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
.8 Side outlet tees using rubber gasketted fittings are not permitted.
.9 Sprinkler pipe and fittings: metal.

.3 Valves:
.1 ULC listed for fire protection service.
.2 Up to NPS 2: bronze, screwed or grooved ends, OS & Y; gate or indicating ball valve. Victaulic Style 728.
.3 NPS 2 1/2 and over: cast ductile iron, flanged or roll grooved ends, indicating butterfly valve. Victaulic Style 705W.
.4 Swing or spring-actuated check valves. Victaulic Series 717.
.5 Ball drip.
.6 Gate valves: open by counterclockwise rotation.
.7 Provide rising stem valve beneath each alarm valve in each riser when more than one alarm valve is supplied from same water supply pipe.
.8 Check valves: flanged clear opening swing-check type with flanged inspection and access cover plate for sizes 10 cm and larger.
.9 Provide gate valve in piping protecting elevator hoistways.

.4 Pipe hangers:
.1 ULC listed for fire protection services in accordance with NFPA.
.2 Refer to 23 05 05 and 23 05 29 for more detail.

2.2 GATE VALVES

.1 50 mm and under: Bronze body, bronze trim, non-rising stem, handwheel, inside screw, double disc, solder or threaded ends. To ASTM B61.

.2 Over 50 mm: Iron body, bronze trim, rising stem, handwheel, OS&Y, double disc or wedge, flanged or grooved ends. Victaulic series 771.

.3 Valves: Bear UL label or marking, manufacturer's name and pressure rating on valve body.

2.3 GLOBE VALVES

.1 Valves Up to 50 mm: Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable composition disc, solder or screwed ends, with back seating capacity. To ASTM B61.

.2 Valves Over 50 mm: Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

.3 Valves: Bear UL label or marking, manufacturer's name and pressure rating on valve body.

2.4 BALL VALVES

.1 Valves 50 mm (2") nominal and under: bronze to ASTM B584, chrome-plated brass ball, stainless steel stem, with weatherproof actuator, handwheel, supervisory switches, and grooved or threaded. UL/FM approved. Victaulic Series 728.

2.5 BUTTERFLY VALVES

.1 Valves: UL/FM approved, Iron Body, Bronze disc, resilient replaceable liner seat, wafer or lug ends, extended neck, handwheel and gear drive.

.2 Weatherproof actuator with handwheel, supervisory switches.

.3 Victaulic Series 705W.

2.6 SWING CHECK VALVES

.1 Valves Up to 50 mm: Bronze swing disc, renewable disc and seat, flanged ends to ASTM B61. Design for either horizontal or vertical mounting.

.2 Valves over 50mm: UL/ULC/FM pattern, iron body, bronze mounted, regrind-renew bronze or elastomer coated ductile iron disc and seat ring, bolted cap or one-piece body, flanged or grooved ends. Design for either horizontal or vertical mounting with stainless steel spring and shaft. Victaulic Series 717

2.7 SPRINKLER VALVE

.1 Provide approved Automatic Sprinkler Valve with one or two pole (as required) flow detectors with alarm circuits, pressure switch, pressure retard chamber, outside water motor gong, outside electric gong, inside electric gong, and circuit breaker.

2.8 ABOVE GROUND PIPING SYSTEMS

.1 Provide fittings for changes in direction of piping and for connections.
  .1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.
  .2 Perform welding in shop; field welding will not be permitted.
  .3 Conceal piping in areas with suspended ceiling and as indicated on drawings.

2.9 SPRINKLER HEADS

.1 General: to ANSI/NFPA 13 and ULC listed for fire services.

.2 New sprinkler heads to match equivalent types. Confirm on site.

.3 Temperature rating on fusible links shall suit specific hazard area with minimum of safety 10 deg.C.

.4 Sprinklers shall be listed with and bear certification marking of nationally recognized testing agency.

.5 Sprinklers with O-rings are not allowed.

.6 Provide minimum 12 mm (1/2") nominal diameter discharge orifice, except when approved by authorities having jurisdiction.

.7 Provide chrome plated finish for sprinklers in all areas: except mechanical rooms where bronze finish is acceptable.

.8 All pendant type heads to be semi-recessed where possible.

.9 All sprinkler heads located in Mechanical Rooms, Storage Rooms, IT/Equipment and other areas susceptible to damage to be complete with wire guards.

.10 Sprinkler heads shall be located in the centre half or quarter point of ceiling tiles.

.11 Provide quick response heads in all light hazard areas.

.12 Sprinkler body shall be integrally cast with hex-shaped wrench boss to reduce the risk of damage during installations.

.13 Wrenches shall be provided by the sprinkler manufacturer that directly engage the hex-shaped wrench boss integrally cast in the sprinkler body

.14 Provide security sprinkler heads in provost area.

2.10 UPRIGHT SPRINKLER HEAD

.1 Provide glass bulb type in areas indicated on drawings or specified. Bronze in mechanical rooms, chrome elsewhere.

2.11 PENDANT SPRINKLER HEAD

.1 Provide semi-recessed polished chrome glass bulb type in areas indicated on drawings or specified.

2.12 SIDE WALL SPRINKLER HEAD

.1 Provide polished chrome glass bulb type in areas indicated on drawings or specified.

2.13 SECURITY PENDANT SPRINKLER HEAD

.1 Only sprinklers listed as approved by RCMP Security Standards are permitted for installation in Cells. Sprinklers in cells shall be stamped with manufacturer and model number on faceplate of sprinkler.

.2 Escutcheons shall be ordered and supplied with heads.

.3 Approved sprinklers heads are as follows:
- .1 Viking Model HQR-2 institutional quick response standard coverage/extended coverage flush pendant sprinkler with sprinkler base part number 10554, sprinkler identification number VK410 and escutcheon package base part number 10627.

2.14 WET SPRINKLER SYSTEM

.1 Provide complete with the following:
- .1 Alarm valve.
- .2 Indicating control valves.
- .3 Inside electric gongs and circuit closer.
- .4 Specified water gauges.
- .5 Piping and fittings.
- .6 Valves.
- .7 Hangers.
- .8 Floor and ceiling escutcheon plates.
- .9 Backflow Preventer
- .10 Outside water gongs and circuit closer (this is required by authority)
- .11 Outside electric gongs and circuit closer

.2 Provide one alarm valve complete with excess pressure pump or retard chamber and standard accessories, drain valves, check valves, alarm connections and water gauges. Provide indicating type valves for controlling water supply and alarm shut-off.
- .1 Alarm valve internal components shall be replaceable without removing the valve from the installed position.
- .2 Victaulic Series 759 alarm valve with Series 752.

.3 Connect outside water rotary gong to alarm valve required by Authority Having Jurisdiction.

.4 Provide 100 mm (4") electric gong operated by alarm device.

.5 Provide standard water flow, valve alarm devices and main control valve. Provide trouble transmitter low air circuit closer for complete central station electrical supervision of system, including battery and rectifier and locate adjacent to alarm valve.

.6 Provide excess pressure pump capable of pumping system to 172 kPa (25 psi) within 30 minutes, in excess of normal pressure. Provide pump with supports, safety valve, gauge,

starter and connections to wet pipe sprinkler system. Set safety valve 10 kPa (1.5 psi) above operating pressure. Excess pressure pump is not required if alarm valve utilized meets requirements of NFPA 13 without a pressure pump.

2.15 MAKE-UP PRESSURE PUMP (if required)

.1 Provide electrically operated excess pressure pump to maintain higher pressure in sprinkler discharge piping.

.2 Pump shall be capable of producing pressure of 400 kPa in excess of that normally carried.

.3 Provide pump with necessary control valves, check valves, and relief valves with such on supply side of fire pump.

.4 Manually start and stop pump by operation of switch located near sprinkler valve.

.5 Control pump by combined manual/automatic start interconnected with high-low pressure switch installed on sprinkler discharge line.

.6 Rigidly support pump.

2.16 FIRE DEPARTMENT CONNECTION

.1 Siamese fire department connection as indicated to supply fire hose and standpipe system and sprinkler system.

.2 Type: Flush mounted non-freeze wall type with brass finish.

.3 Outlets: Provide connection with two 63 mm (2-1/2") nominal female hose connections fitted with caps and chains of matching material. Threads of 63 mm (2-1/2") nominal connection shall conform to those of local fire department.

.4 At the low-point near each fire department connection, install a 90 degree elbow with drain connection to allow for system drainage to prevent freezing. Elbow shall be Victaulic #10-DR

.5 Include horizontal check valve and automatic drip discharging to nearest floor drain for connection.

.6 Identify pumper connection with sign having raised letters at least 25 mm (1") in size cast on plate or fitting reading "Standpipe - Fire Department Connection".

2.17 SUPERVISORY SWITCHES

.1 General: to ANSI/NFPA 13 and ULC listed for fire service.

.2 Valves: Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.

.3 Flow switch type:
.1 With normally open and normally closed contacts and supervisory capability.

.4 Pressure alarm switch:
.1 With normally open and normally closed contacts and supervisory capability.

2.18 SIGNS

.1 Signs for control drain and test valves: to ANSI/NFPA 13.

2.19 SPARE PARTS CABINET

.1 Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each alarm valve. Number and types of extra sprinkler heads as specified in NFPA 13.

.2 Construct to sprinkler head manufacturer‘s standard.

2.20 INSPECTOR'S TEST CONNECTION

.1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3 m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.

.2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.

.3 Provide discharge orifice of same size as corresponding sprinkler orifice.

2.21 ESCUTCHEON PLATES

.1 Provide one piece type metal plates for piping passing through walls, in exposed spaces.

.2 Provide polished stainless steel plates in finished spaces.

.3 Provide paint finish on metal plates in unfinished spaces.

3 Execution

3.1 GENERAL INSTALLATION

.1 Install piping in accordance with NFPA 13 for sprinkler systems and in accordance with manufacturer's recommendations.

.2 Allow for expansion and contraction when installing pipe hangers.

.3 Install signs required by local Fire Protection Department.

.4 Secure outdoor signs with stainless steel bolts.

.5 Locate outside alarms on wall of building adjacent to fire department connection.

.6 Mechanical grooved joints may be used instead of threaded or welded joints.

.7 Grooved joints shall be installed in accordance with the manufacturer’s latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be moulded and produced by

the coupling manufacturer.

.8 Die cut screw joints with full cut standard taper pipe threads with read lead and linseed oil or other non-toxic joint compound applied to male threads only.

.9 Provide gate valves or approved butterfly valves, low points of piping and apparatus.

.10 Provide drain valves at main shut-off valves, low points of piping and apparatus.

3.2 SYSTEM TESTS

.1 Hydrostatically test entire system. Test shall be witnessed by Fire Marshall.

3.3 INSPECTION

.1 Do not recess, paint or conceal piping accessories or work prior to inspection and approval by authorities having jurisdiction or authorized representative.

3.4 FIRE DEPARTMENT CONNECTION

.1 Make connections for standpipe system before domestic water connection and meter. Provide two check valves on black steel pipe, or single soft seated check valve on galvanized steel or copper pipe with gate valves on both sides of check valves.

.2 During construction, make one standpipe outlet available on each floor without delay, for department use.

.3 Where the static pressure exceeds 690 kPa at hose station, provide pressure reducing valve to prevent pressure on hose exceeding 620 kPa.

.4 Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

3.5 FIELD QUALITY CONTROL

.1 Subject systems and equipment to operational test.

.2 Hydrostatically test water supply connections and fire department connections at 345 mm (13") in excess of normal working pressure but not less than 1400 kPa (203 psi) for 2 hours without loss under supervision.

.3 Upon complete installation of piping and apparatus for sprinkler systems, test joints for tightness and good condition of piping. When testing with water, install pressure gauge at highest point of installation. If impossible to test whole installation in single operation, subdivide into several zones and test each zone in manner described.

.4 The grooved coupling manufacturer’s factory trained representative shall provide on-site training for Contractor’s field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the job site and review Contractor is following best recommended practices in grooved product installation. (A distributor’s representative is not considered qualified to conduct the training or job site visits).

.5 During tests, stop any leaks and remove and repair any defective part. Perform test over again until satisfactory results are obtained.

.6 Provide hydraulic pump, temporary connections and labour required for tests.

3.6 SPRINKLER SYSTEM

.1 Install alarm valves and gongs as indicated or as specified.

.2 When water service is for building domestic supply and fire protection system, install testable double check valve and indicating control valve on branch line for fire protection system immediately after branch connection.

.3 Install horizontal valves with stems upright where space allows.

.4 Do not allow sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.

.5 Sprinkler bulb protector shall be removed by hand after installation. Do not use tools or any other devices to remove the protector that could damage the bulb in any way.

.6 Centre sprinkler heads in two directions in ceiling tile and provide piping offsets as required.

.7 Apply strippable tape or paper cover to ensure concealed sprinkler head cover plates do not receive field paint finish.

3.7 PROTECTION OF COMPLETE WORK

.1 Paint exposed steel pipe and fittings, except special finishes, in accordance with Architectural Specifications.

.2 Assume responsibility for protecting sprinkler heads during painting. Replace damaged and painted components.

.3 Provide red wire guards for sprinkler heads in mechanical and electrical rooms and around ventilation equipment, and all other areas required by code or intended usage.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Fire pump package.
.2 Fire pump motor.
.3 Electric jockey pump.
.4 Controllers.

1.2 REFERENCES

.1 CSA C22.2 No. 100-04 - Motors and Generators.
.2 FM - Factory Mutual System - Approval Guide.
.3 NEMA MG1-2006 - Motors and Generators.
.4 NEMA 250-2003 - Enclosures for Electrical Equipment (1000 Volt Maximum).
.5 NFPA 20 - Installation of Stationary Fire Pumps for Fire Protection, 2010 Edition.
.6 NFPA 37 - Installation and Use of Stationary Combustion Engines and Gas Turbines, 2006 Edition.
.7 UL - Fire Protection Equipment Directory.
.8 UL 448 (Amendment 2) - Pumps for Fire Protection Service.
.9 UL 778 (Revision 3) - Motor-Operated Water Pumps.
.10 UL 1478 - Fire Pump Relief Valves, 4th Edition.
.11 ULC - List of Equipment and Materials.

1.3 SYSTEM DESCRIPTION

.1 Fire pump assembly including drivers, controls and pump accessory items, connected to fire standpipe system.

1.4 PERFORMANCE REQUIREMENTS

.1 Conform to NFPA 20.

.2 Fire Pump Assembly: Capable of delivering not less than 150% of rated flow at not less than 65% rated head.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 33 00: Project management and coordination procedures.

.2 Pre-installation Meetings: Convene one (1) week before starting work of this section.

1.6 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide manufacturers literature including general assembly, pump curves showing performance characteristics with pump and system, operating point indicated, NPSH curve, controls, wiring diagrams, and service connections.

.3 Shop Drawings: Indicate layout, general assembly, components, dimensions, weights, clearances, and methods of assembly.

1.7 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Test Reports: Indicate results of hydrostatic test and field acceptance tests performed to NFPA 20.

.3 Installation Data: Indicate support details, connection requirements, for fire pump system.

1.8 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Maintenance Contracts: Provide service and maintenance of fire pump, driver, and controller for one year from date of Substantial Completion.

.3 Operation and Maintenance Data:
- .1 Include manufacturer's instructions, start-up data, trouble-shooting check lists, for pumps, drivers, and controllers.
- .2 Include manufacturer's literature, cleaning procedures, replacement parts lists, and repair data for pumps, drivers and controllers.

.4 Record Documentation: Record actual locations of components and accessories.

.5 Certificates: Certify that fire pumps meet or exceed specified requirements at specified operating conditions and that the installation complies with regulatory requirements. Submit summary and results of shop tests performed to NFPA 20.

1.9 MAINTENANCE MATERIAL SUBMITTALS

.1 Section 01 78 00: Maintenance and extra material requirements.

.2 Extra Stock Materials: Provide one (1) set of gaskets for each pump type and model supplied.

1.10 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 certification requirements.

.2 Perform Work to NFPA 20 and NFPA 37. Maintain one copy on site.

.3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience; capable of assuming complete responsibility for unit assemblies and proper operation of complete unit assembly as indicated by field acceptance test.

.4 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.

.5 Design fire pump system under direct supervision of a Professional Engineer experienced in design of this Work and licensed at the place where the Project is located.

1.11 REGULATORY REQUIREMENTS

.1 Conform to ULC.

.2 Perform work to NFPA 20 and NFPA 37 for installation and testing of fire pumps, drivers, and controllers.

.3 Provide certificate of compliance from authority have jurisdiction indicating approval of field acceptance tests.

.4 Equipment and Components: Bear ULC label or marking.

.5 Products Requiring Electrical Connection: Listed and classified by ULC as suitable for the purpose specified and indicated.

1.12 DELIVERY, STORAGE, AND PROTECTION

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Accept fire pumps and components on site in factory packing. Inspect for damage. Comply with manufacturers rigging and installation written instructions.

.3 Protect fire pumps and components from physical damage including effects of weather, water, and construction debris.

.4 Provide temporary inlet and outlet caps, and maintain in place until installation.

2 Products

2.1 VERTICAL IN-LINE PUMPS

.1 Pump Assembly: ULC listed assembly, including drivers, controls and pump accessory items, labeled and listed for fire service.

.2 Type: UL 448 and UL 778, vertical, single stage, close coupled, radially or horizontally split casing, for in-line mounting, for 1 720 kPa.

.3 Casing:
- .1 Cast or ductile iron, with suction and discharge gauge port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
- .2 Suction and discharge flange of identical dimensions and displaced 180° with center lines concentric on the same horizontal plane.

.4 Impeller: Bronze, fully enclosed, keyed directly to motor shaft.

.5 Shaft: Solid alloy steel with bronze sleeve.

.6 Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 110 degrees C maximum continuous operating temperature.
OR
Seal: Carbon rotating against a stationary ceramic seat viton fitted, maximum continuous operating temperature.

.7 Performance: As required to meet sprinkler design. Design is based on pump noted in equipment schedule.

2.2 HORIZONTAL BASE MOUNTED PUMPS

.1 Pump Assembly: ULC listed assembly, including drivers, controls and pump accessory items.

.2 Type: UL 448 and UL 778, horizontal shaft, single stage, double suction, direct connected, horizontally split casing, for 1 720 kPa maximum working pressure.

.3 Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

.4 Impeller: Bronze double suction fully enclosed, balanced and keyed to shaft.

.5 Bearings: Grease lubricated ball bearings, replaceable without opening casing.

.6 Shaft: Alloy steel with replaceable bronze shaft sleeve.

.7 Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 110 degrees C maximum continuous operating temperature.

.8 Drive: Flexible coupling with coupling guard.

.9 Baseplate: Cast iron or fabricated steel with integral drain rim.

.10 Performance: As required to meet sprinkler design. Design is based on pump noted in equipment schedule.

2.3 FIRE PUMP ACCESSORIES

.1 Eccentric suction reducer and OS&Y gate or butterfly valve on suction side of pump.

.2 Concentric increaser and check valve in pump discharge and OS&Y gate or butterfly valve on system side of check valve.

.3 Fire pump bypass fitted with OS&Y gate or butterfly valves and check valve.

.4 Main relief valve, UL 1478, and enclosed type waste cone.

.5 Suction pressure gauge, 110 mm diameter dial with snubber, valve cock and lever handle.

.6 Discharge pressure gauge mounted on board attached to pump, with snubber, valve cock and lever handle.

.7 Casing 20 mm relief valve.

.8 Float operated 20 mm automatic air release valve.

.9 Hose valve manifold with 65 mm hose gate valves with caps and chains.

.10 Drain valve.

.11 Water level gauge device (Vertical Turbine Fire Pumps only).

.12 Flow metering system for closed loop testing.

2.4 CONTROLLER WITH AUTOMATIC POWER TRANSFER SWITCH

.1 The electric fire pump controller and automatic power transfer switch shall meet the latest NFPA 20 and NFPA 70 requirements, be listed with cULus (UL218 and CSA C22.2 No. 14 Industrial Control Equipment) and approved by FM (Factory Mutual).

.2 Controller shall be full service combined manual and automatic type suitable for full voltage across the line starting of the electric fire pump motor.

.3 The automatic power transfer switch shall be housed in its own compartment with its own door and be mechanically attached to the electric fire pump controller and be suitable for connecting to a generator whose capacity exceeds 225 percent of the fire pump motor's full load amperage.

.4 The short circuit withstand rating of the electric fire pump controller only shall be: 50 kA RMS (600V).

.5 Enclosure:
- .1 Enclosure shall be a double door NEMA/UL/CSA type 2.
- .2 The enclosure shall incorporate bottom mounted gland plates for normal and alternate (emergency) power and or motor lead entrance.
- .3 The gland plates shall be field removable and meet the same NEMA rating of the enclosure
- .4 Lifting lugs shall be provided.

.6 The electric fire pump controller and automatic power transfer switch shall be supplied with the following power components:
- .1 Voltage surge arrestor.
- .2 One molded case isolating switch for normal power rated at a minimum of not less than 115% of full load motor current. The normal power isolating switch shall be of the same frame size as the motor circuit breaker.
- .3 One molded case isolating switch for alternate (emergency) power rated at a minimum of not less than 115% of full load motor current. The alternate (emergency) power isolating switch shall be of the same frame size as the motor circuit breaker.
- .4 One molded case motor circuit breaker for normal power rated at a minimum of not less than 115% of full load motor current. The motor circuit breaker shall be of the instantaneous magnetic trip type only and shall be adjusted to a minimum of 13 times the fire pump full load motor current. The motor circuit breaker shall be of the same frame size as the isolating switch.
- .5 One molded case motor circuit breaker alternate (emergency) power rated at a minimum of not less than 115% of full load motor current. The motor circuit breaker shall be of the instantaneous magnetic trip type only and shall be adjusted to a minimum of 13 times the fire pump full load motor current. The motor circuit breaker shall be of the same frame size as the isolating switch.
- .6 Lock rotor protector set to automatically trip within 8 to 20 seconds at 600% of full load current. The locked rotor protector shall be factory calibrated, set and tested. Electric fire pump controllers and automatic power transfer switches allowing for the field adjustment of the locked rotor value shall not be accepted.
- .7 One automatic power transfer switch mechanically held and electrically operated. Manual operation of the transfer switch shall be provided by means of manual operating handle.
- .8 An across the line electric motor starter.

.7 The electric fire pump controller and automatic power transfer switch shall be supplied with the following externally flange mounted components approved to match the NEMA rating of the enclosure.
- .1 One common operating handle for both the normal power isolating switch and the motor circuit breaker mechanically interlocked with the normal power side enclosure door to prohibit access to the interior in the "ON" position. The handle shall have a hidden interlock defeater and be lockable in the "OFF" position.
- .2 One common operating handle for both the alternate (emergency) power isolating switch and the motor circuit breaker mechanically interlocked with the alternate (emergency) power side enclosure door to prohibit access to the interior in the "ON" position. The handle shall have a hidden interlock defeater and be lockable in the "OFF" position.
- .3 "START" pushbutton.
- .4 "STOP" pushbutton.
- .5 "EMERGENCY START" and run handle mechanism latchable in the "ON" position
- .6 "RUN TEST" pushbutton.

.7 One alarm bell energized when the isolating switch is left in the "OFF" position Transfer switch test pushbutton.

.8 The electric fire pump controller and automatic power transfer switch shall be supplied with two (2) digital annunciator interfaces completely accessible without having to open the controller door. The normal power digital annunciator interface shall be comprised of a 4-line, 20-character and a separate 2-line 20-character continuously back lit digital display screens, keypad type pushbuttons, high luminosity LED's and have the same NEMA rated degree of protection as the enclosure of the electric fire pump controller and automatic power transfer switch. The normal power digital annunciator interface shall numerically display:

.1 Normal power source individual phase to phase incoming voltage and frequency.
.2 Individual phase motor current
.3 True pump elapsed run time
.4 Pump start counts
.5 Time and date
.6 Cut-In and Cut-Out pressure settings
.7 System pressure
.8 Minimum run period timer
.9 Sequential start timer
.10 Weekly test timer

.9 The alternate (emergency) power digital annunciator interface shall be comprised of a 4-line, 20-character continuously back lit digital display screen, keypad type pushbuttons and have the same NEMA rated degree of protection as the enclosure of the electric fire pump controller and automatic power transfer switch. The alternate (emergency) power digital annunciator interface shall numerically display:

.1 Normal power source individual phase to phase incoming voltage and frequency.
.2 Alternate (emergency) power source individual phase to phase incoming voltage and frequency
.3 Transfer switch status text indication.

.10 The voltage and frequency readings of all three phases of both the normal and alternate (emergency) power and amperage readings shall be simultaneously and independently displayed with true RMS technology. Measurement of the voltage, frequency and amperage shall be accomplished with the latest technology to provide the most accurate readings. Electric fire pump controllers and automatic power transfer switches with analog meters and selector switches for the selection of the phase being displayed of either the voltage or current shall not be accepted.

.11 Pump starts and elapsed pump run times shall only be considered if amperage is being drawn by the motor. Simple closure of the run contactor shall not be considered as the pump actually running nor should it count as pump elapsed run time.

.12 The cut-in, cut-out and system pressure indication shall be continuously displayed. The ability to change the unit of measurement from Psi to Bar shall be provided through the adjustment of a dipswitch located inside the controller. Electric fire pump controllers and automatic power transfer switches without the capability of digitally displaying the cut-in, cut-out and system pressure shall not be accepted.

.13 The normal power digital annunciator interface shall digitally indicate:

.1 Phase loss.
.2 Phase unbalance.
.3 Incoming over voltage.
.4 Incoming under voltage.
.5 Motor over current.
.6 Motor under current.
.7 Motor run.

.8 Fail to start.

.14 The alternate (emergency) power digital annunciator interface shall digitally indicate:
.1 Normal power available.
.2 Normal position.
.3 Transfer in progress.
.4 Generator start signal.
.5 Alternate power available.
.6 Alternate position.
.7 Retransfer in progress.
.8 Cooling time.

.15 Phase loss shall be indicated if the voltage of any phase drops below 85% of the nominal voltage. A separate phase unbalance indication shall be displayed if the difference of the minimum and maximum voltage is greater than 3% of the average voltage.

.16 Incoming over voltage shall be indicated if any phases are greater than 110% of the nominal voltage of the controller and incoming under voltage shall be indicated if any of the phases are lower than 85% of the nominal voltage of the controller.

.17 Motor over current shall be indicated after 20 seconds if any of the current phases are greater than 130% of the nominal full load amperage of the electric motor and motor under current shall be indicated if any of the phases are lower than 30% of the nominal full load amperage of the electric motor.

.18 A fail to start indication shall appear after 20 seconds of the motor run contactor being closed and the amperage drawn is lower than 5% of the electric motor full load amps.

.19 The normal power digital annunciator interface shall have high luminosity LED's for:
.1 Power available
.2 Phase reversal
.3 Pump on demand
.4 Weekly test

.20 Electric fire pump controllers and automatic power transfer switches supplied with traditional neon or incandescent bulb pilot lights with coloured lens shall not be accepted.

.21 The normal power digital annunciator interface shall have keypad type pushbuttons for:
.1 Alarm reset.
.2 Cut-in pressure setting.
.3 Cut-out pressure setting.
.4 Run test.
.5 Print

.22 The digital annunciator interface shall have a keypad type pushbutton for:
.1 Transfer switch bypass time delay
.2 Silence
.3 Alarm reset

.23 The cut-in and cut-out adjustments shall have independent pushbuttons accessible without having to open the controller door which will raise the setting one unit (Psi or Bar) at a time and also raise the setting by 10 units if held pressed for more than one second. The logic of adjustment shall be so that the cut-out setting must be set before the cut-in setting and that the cut-in setting cannot be raised above the cut-out setting. The adjustment of the cut-out and cut-in shall be tamper proof through the setting of a dipswitch installed inside the controller.

.24 Pressure and Event Recording: The electric fire pump controller shall be equipped with a pressure and event recorder. The recorder will register and keep in memory general system information, pressure fluctuations over time that have occurred over the previous fifteen (15) days and events and alarms that have occurred over the previous fifteen (15) days. General system information, events and alarms include the following:
- .1 Time and date of retrieval of data.
- .2 Cut-in and Cut-out setting.
- .3 Date of the last change of the cut-in and cut-out setting.
- .4 Date, time and pressure readings of the minimum and maximum pressure registered over the previous 15 days.
- .5 Weekly test information.
- .6 Minimum run period timer information.
- .7 Pump start time and date.
- .8 Pump stop time and date.
- .9 Pump on demand time and date.
- .10 Pump room alarm time and date.
- .11 Motor trouble time and date.
- .12 Power On date and time.
- .13 Power Off date and time.

.25 Pressure and Event Recording information shall be retrievable through a USB slave communication port accessible without having to open the controller door.

.26 Pressure Sensing Device: The electric fire pump controller shall be supplied with a 304 stainless steel pressure transducer rated for fresh water operation between 0 and 300psi with ±2% accuracy and a minimum burst pressure of 420psi. The pressure transducer shall be used to display the pressure in the sprinkler system and also control the automatic start circuit. The pressure transducer shall be installed inside the controller directly mounted to a bulkhead allowing for an external connection to the sprinkler system sensing line. Controllers supplied with mechanical pressure sensing devises with or without mercury shall not be accepted.

.27 Field Adjustments and Operation:
- .1 The manual START and STOP control circuit of the electric fire pump controller shall not be electrically linked to the micro-processor.
- .2 The electric fire pump controller shall ship from the factory set for manual stop and shall be field adjustable for automatic stop if required by adjusting a minimum run period timer. The minimum run period timer shall be accessed through the digital annunciator interface which shall display both a text indication and the remaining time of the timer.
- .3 A sequential start on delay timer shall be supplied and shall be field adjustable. The sequential start on delay timer shall be accessed through the digital annunciator interface and shall display the remaining time of the timer.
- .4 A weekly test timer shall be supplied as standard equipment. The timer shall allow for the setting of the date and start and stop times of the weekly test. This timer shall be field adjustable and accessed through the digital annunciator interface and shall display the remaining time of the timer.
- .5 A RUN TEST pushbutton shall be provided to electrically start the electric fire pump motor and hold it running automatically for 10 minutes. The RUN TEST pushbutton will energize the solenoid valve to create an artificial pressure drop which will be sensed by the pressure transducer starting the electric fire pump motor and hold it running for 10 minutes.
- .6 Voltage sensing on each phase of the normal power supply factory set at 85% to initiate actuation of the generator set start contact.
- .7 Voltage and frequency sensing of the alternate (emergency) power source factory set at 90% to initiate transfer to alternate (emergency) power.

.8 The voltage sensing on all phase of normal power factory set at 90% to initiate retransfer to normal power.
.9 One timing function to override momentary normal outages before activating engine start contact factory set at 3 seconds.
.10 One timing function to delay re-transfer to the normal power supply factory set at 5 minutes. Transfer to normal power shall be instantaneous in case of alternate power failure.
.11 One timing function to allow engine generator cool down after retransfer to normal source factory set at 5 minutes.
.12 Separate remote start and deluge valve start contacts shall be provided.
.13 A field simulation phase reversal system shall be provided in order to verify this alarm condition. The correction of the phase reversal shall be accomplished by the adjustment of a dipswitch mounted inside the controller.
.14 The ability of simultaneously verifying all inputs and outputs on the digital display screen shall be provided

.28 Alarm Contacts: Dry alarm contacts rate at 8A - 250VAC for remote indication shall be provided for the following conditions:
.1 Power or phase failure and/or circuit breaker in open position (DPDT)
.2 Phase reversal (DPDT)
.3 Pump run (1N/0 - 1N/C)
.4 Isolating switch in Off position (DPDT)
.5 Automatic transfer switch in normal power position (1 N/O)
.6 Automatic transfer switch in alternate power position (1 N/O)

2.5 CONTROLLER (Soft Start)

.1 The electric fire pump controller shall meet the latest NFPA 20 and NFPA 70 requirements, be listed with CUL US (UL218 and CSA C22.2 No. 14 Industrial Control Equipment) and approved by FM (Factory Mutual).

.2 Controller shall be full service combined manual and automatic type suitable for reduced voltage electronic soft start starting of the electric fire pump motor.

.3 The short circuit withstand rating of the electric fire pump controller only shall be: 100 kA RMS at 200V-480V or 50 kA RMS at 600V.

.4 Enclosure:
.1 Enclosure shall be a double door NEMA/UL/CSA type 2.
.2 The enclosure shall incorporate bottom entry gland plates for power and or motor lead entrance.
.3 The gland plates shall be field removable and meet the same NEMA rating of the enclosure.
.4 Lifting lugs shall be provided.

.5 The electric fire pump controller shall be supplied with the following power components:
.1 Voltage surge arrestor.
.2 Motor rated combination isolating switch and circuit breaker assembly. Both the isolating switch and circuit breaker shall be rated not less than 115% of the motor full load current..
.3 The circuit breaker overcurrent sensing shall be non-thermal type, magnetic only.
.4 Lock rotor protector set to automatically trip within 8 to 20 seconds at 600% of full load current. The locked rotor protector shall be factory calibrated, set and tested. Electric fire pump controllers allowing for the field adjustment of the locked rotor value shall not be accepted.
.5 An electronic soft start motor starter.

.6 The electric fire pump controller shall be supplied with the following externally flange mounted components approved to match the NEMA rating of the enclosure.
.1 One common operating handle for both the isolating switch and the circuit breaker assembly mechanically interlocked with the enclosure door to prohibit access to the interior in the "ON" position.

.7 One “Emergency Start" and run handle mechanism latchable in the "ON" position.

.8 Touch Screen Operator Interface:
.1 The electric fire pump controller shall be supplied with a 4.2" LCD color touch screen (HMI technology) operator interface powered by an embedded microcomputer with software PLC logic. The operator interface's touch screen shall allow navigation through the various operating screens.
.2 The following keypad type pushbuttons shall be provided:
.1 Start
.2 Stop
.3 Run test
.4 Navigation
.5 Help
.6 Home
.7 Alarms
.8 Settings/Configuration
.9 History/Statistics
.3 The touch screen operator interface shall graphically display:
.1 Voltage and amperage readings of all three phases simultaneously and independently displayed with true RMS technology.
.2 Motor starting transition
.3 Motor stopped / running
.4 Type of starting cause
.5 Actuation mode
.6 Type of controller
.7 Method of shutdown
.8 Time and date
.9 System pressure in 5 different user selectable units of measure;
.1 PSI
.2 kPA
.3 Bar
.4 Feet of head
.5 Meter of water
.4 The touch screen operator interface shall allow for the programming and display of:
.1 Cut-In and Cut-Out pressure settings
.2 Minimum run period timer
.3 Sequential start timer
.4 Periodic test timer
.5 The user shall be able to select the language of operation on-site.
.6 Contextual HELP screens shall be accessible to the user while navigating through the operator interface in the chosen language.

.9 Condition and Alarm Visual Indicators:
.1 The touch screen operator interface shall visually indicate the following alarms and differentiate the criticalness by color code:
.1 Normal power phase reversal
.2 Normal power phase loss
.3 Normal power loss
.4 Locked rotor
.5 Fail to start
.6 Service required

.7 Undercurrent
.8 Overcurrent
.9 Under voltage
.10 Overvoltage
.11 Phase unbalance
.12 Low water level
.13 Low system (discharge) pressure
.14 Periodic test cut-in not reached
.15 Run test solenoid valve check
.16 Faulty pressure transducer
.17 Pump on demand
.18 Over pressure
.19 Under pressure
.20 Low pump room temperature

.10 Pressure and Event Recording:

.1 The fire pump controller's touch screen operator interface shall be capable of logging pressure data and operational events with time and date stamp. It shall be able to display the last 500 operational events and display the pressure data in text and/or graphic form. Pressure data and operational events shall be stored in memory for the lifetime of the controller. The data shall also be retrievable and downloadable to a flash memory disk via the USB port accessible to the user without having to open the controller door. General system information, events and alarms include the following:

.1 Last service statistics
.1 Powered since
.2 On time
.3 Motor last run
.4 Motor run time
.5 Motor start count
.6 Minimum, maximum, average system pressure
.7 Minimum, maximum, average pump room temperature

.2 All time statistics
.1 First power up
.2 First start up
.3 On time

.3 Power statistics
.1 Voltage between phases with date stamp
.2 Amperage between phases with date stamp

.11 Wetted Parts:

.1 The electric fire pump controller shall be supplied with a pressure transducer and run test solenoid valve assembly. The pressure sensing line connection to the pressure transducer shall be ½" FNPT. Provision for a redundant pressure transducer shall be provided. This assembly shall be rated for 500psi working pressure and be externally mounted with a protective cover.

.12 Service/Flow Testing Capabilities:

.1 The electric fire pump controller's touch screen operator interface shall have the capability of scheduling maintenance reminders. It shall also have the capability of inputting pump flow test data, generate and display the pump curve and store this information in memory for the lifetime of the controller.

.13 Connection for External Devices:

.1 The electric fire pump controller shall provide terminals for the connection for the following external devices:

.1 Manual remote start device
.2 Automatic remote start device

.3 Deluge valve start

.14 Alarm Contacts for Remote Indication:
.1 SPDT dry alarm contacts rated for 8A - 250VAC for remote indication shall be provided for the following conditions;
.1 Power or phase failure and/or circuit breaker in open position
.2 Phase reversal
.3 Pump run (X2)
.4 Common pump room alarm
.5 Common motor trouble
.2 Removable alarm contact terminals shall be provided.

.15 Audible Alarm:
.1 A 4" alarm bell rated for 85dB at 10ft (3m) shall sound during boot up and internal communication error.

.16 Basis of Specification
.1 The specifications are based on an electric fire pump controller Model GPS with ViZi Touch operator interface as manufactured by Tornatech Inc.

2.6 PRESSURE BOOSTER (JOCKEY) PUMP

.1 Electrically operated, horizontal turbine type with standard open drip-proof horizontal motor. Refer to 21 13 13.

.2 Control by automatic jockey pump controller with full voltage starter and minimum run timer to start pump on pressure drop in system and stay in operation for minimum period of time. Fire pump to start automatically on further pressure drop or on jockey pump failure.

.3 Electrical Characteristics: As noted in equipment schedule.

2.7 SOURCE QUALITY CONTROL

.1 Manufacturer's Factory Tests: Prior to shipment, hydrostatically test and run each individual pump at a pressure of not less than one and one-half (1-1/2) times the no flow (shut-off) head of the pump's maximum diameter impeller plus the maximum allowable suction head, but in no case less than 250 psig.

3 Execution

3.1 INSTALLATION

.1 Install to NFPA 20.

.2 Provide access space around pumps for service; no less than minimum as recommended by manufacturer.

.3 Install piping to applicable sections. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For base mounted pumps, provide supports under elbows on pump suction and discharge.

.4 Provide drains for bases and seals, piped to and discharging into floor drains.

.5 Mount unit on vibration isolators. Refer to Section 23 05 48.

.6 Provide for connection to electrical service. Refer to Section 26 05 80.

.7 Lubricate pumps before start-up.

.8 Check, align, and certify base mounted pumps by qualified millwright prior to start-up.

3.2 FIELD QUALITY CONTROL

.1 Section 01 45 00: Field inspection.

.2 Perform flow test on entire system to NFPA 20.

.3 Flow water through calibrated nozzles, approved flow meters or other accurate device as selected by authority having jurisdiction.

.4 Require test to be witnessed by Fire Marshall,

3.3 CLOSEOUT ACTIVITIES

.1 Demonstration: Demonstrate automatic operation of system including verification of pressure switch set points.

1 General

1.1 RELATED REQUIREMENTS

.1 Materials and installation for domestic water service used in the following:
- .1 Incoming domestic water service, up to NPS 2 1/2.
- .2 Hard domestic hot and cold water services inside building.
- .3 Soft tubing inside building.
- .4 Soft buried tubing outside building, as in between potable water source and meter inside building.

.2 Sustainable requirements for construction, verification and operation.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
- .1 ANSI/ASME B16.15-06, Cast Bronze Threaded Fittings, Classes 125 and 250.
- .2 ANSI/ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
- .3 ANSI/ASME B16.22-01, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .4 ANSI/ASME B16.24-01, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.2 ASTM International Inc.
- .1 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 ASTM A536-84(2004)e1, Standard Specification for Ductile Iron Castings.
- .3 ASTM B88M-05, Standard Specification for Seamless Copper Water Tube (Metric).

.3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
- .1 ANSI/AWWA C111/A21.11-07, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International)
- .1 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.

.5 Department of Justice Canada (Jus)
- .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
- .1 MSS-SP-67-02a, Butterfly Valves.
- .2 MSS-SP-70-06, Gray Iron Gate Valves, Flanged and Threaded Ends.
- .3 MSS-SP-71-05, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
- .4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.

.8 National Research Council (NRC)/Institute for Research in Construction
- .1 NRCC 38728, National Plumbing Code of Canada (NPC) - 1995.

.9 Transport Canada (TC)
.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:
.1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Closeout Submittals:
.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

2 Products

2.1 WATER PIPING, BURIED

.1 Copper tubing type K annealed; wrought copper fittings 95/5 solder or silver braze joints. Copper tubing to be in long lengths and with no buried joints.

.2 Plastic "BLUE BRUTE" pipe and fittings; solvent weld joints.

.3 All piping and fitting shall be rated to a minimum of 1034 kPa (150 PSI)

2.2 WATER PIPING, UNBURIED

.1 Type L hard copper; with cast brass or wrought copper fittings; 95/5 solder joints.

.2 Stainless steel pipe, Schedule 10; grooved fittings.

.3 Cross Linked Polyethylene (PEX) pipe with mechanical joints.

.4 Polypropylene: Pipe shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389 or CSA B137.11. All pipe shall be made in an extrusion process. Hot water piping shall contain a fiber layer (faser) to restrict thermal expansion. All pipe shall comply with the rated pressure requirements of ASTM F 2389 or CSA B137.11. Fittings: Fittings shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. All pipe and fittings shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.11. The pipe and fittings shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe system shall be plenum-rated with pipe wrapped and/or insulated with standard pipe insulation, field installed. The pipe wrap or insulation shall meet the requirements of CAN/ULC-S102.2-03 or ASTM E84. The system shall have a Flame Spread Classification of less than 25 and Smoke Development rating of less than 50. It is assumed pipe will be exposed to direct UV light and shall be provided with a Factory applied, UV-resistant coating or alternative UV protection.

2.3 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.

.2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI/ASME B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 NPS 2 and larger: ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.

.6 NPS 1 1/2 and smaller: wrought copper to ANSI/ASME B16.22; with 301stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

2.4 JOINTS

.1 Rubber gaskets, latex-free mm thick: to AWWA C111.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: 95/5.

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM gasket.

.6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.5 GATE VALVES

.1 NPS 2 and under, soldered:
- .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 and under, screwed:
- .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.

.3 NPS 2 1/2 and over, in mechanical rooms, flanged:
- .1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02 - Valves - Cast Iron.

.4 NPS 2 1/2 and over, other than mechanical rooms, flanged:
- .1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

2.6 GLOBE VALVES

.1 NPS2 and under, soldered:
- .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 23.01 - Valves - Bronze.
- .2 Lockshield handles: as indicated.

.2 NPS 2 and under, screwed:
- .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 23 05 23.01 - Valves - Bronze.
- .2 Lockshield handles: as indicated.

2.7 SWING CHECK VALVES

.1 NPS 2 and under, soldered:
- .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 and under, screwed:
- .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.

.3 NPS 2 1/2 and over, flanged:
- .1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, regrind seat, bronze disc, bolted cap specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

2.8 BALL VALVES

.1 NPS 2 and under, screwed:
- .1 Class 150.
- .2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 and under, soldered:
- .1 To ANSI/ASME B16.18, Class 150.
- .2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01 - Valves - Bronze.

2.9 BUTTERFLY VALVES

.1 NPS 2-1/2 and over, wafer:
- .1 To MSS-SP-67, Class 200.
- .2 Cast iron body, ductile iron chrome plated disc, stainless steel stem, EPT liner.
- .3 Lever operated, NPS8 and over, gear operated.

.2 NPS 2-1/2 and over, grooved ends:
- .1 Class 300 psig CWP, bubble tight shut-off, bronze body EPDM coated ductile iron disc with integrally cast stem.
- .2 Operator:
  - .1 NPS 4 and under: lever handle.
  - .2 NPS 6 and over: gear operated.

3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with NPC.

.2 Install pipe work in accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified herein.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Install cold piping below and away from all other hot piping so as to maintain temperature of cold water as low as possible.

.5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.3 ROUTES AND GRADES

.1 Route piping in orderly manner and maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls. Group piping wherever practical at common elevations. Install concealed pipes close to the building structure to keep furrings to a minimum.

.2 Slope water piping 25 mm in 12 m (1" in 40') and arrange to drain at low points.

.3 On closed systems, equip low points with 20 mm (3/4") drain valves and hose nipples. Provide, at high points, collecting chambers and high capacity float operated automatic air vents.

.4 Make reductions in water pipes with eccentric reducing fittings installed to provide drainage and venting.

.5 Grade horizontal drainage and vent piping 22 mm per meter (1/4" per foot) minimum unless otherwise indicated on drawings.

3.4 VALVES

.1 Isolate equipment, fixtures and branches with gate valves.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

.3 Install valves with stems upright or horizontal, not inverted.

.4 Install gate, ball and butterfly valves for isolating service, to isolate equipment, part of systems or vertical risers.

.5 Install globe, ball or angle valves for throttling service and control device or meter bypass.

.6 Use plug cocks in water systems for throttling service. Use non-lubricated plug cocks only when shut-off or isolation valves are also provided.

.7 Provide drain valves at main shut-off valves, low points of piping and apparatus.

3.5 PRESSURE TESTS

.1 Conform to requirements of Section 21 05 01 - Common Work Results for Mechanical.

.2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.6 FLUSHING AND CLEANING

.1 Disinfect and rinse entire system to requirements of authority having jurisdiction and RCMP site standards.

.2 Flush entire system for minimum of 8 hours. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean copper. Let system flush for additional 2 hours, then draw off another sample for testing.

.3 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval. Include one copy of approved test reports in Operation and Maintenance Manual.

3.7 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

3.8 START-UP

.1 Timing: start up after:
- .1 Pressure tests have been completed.
- .2 Disinfection procedures have been completed.
- .3 Certificate of static completion has been issued.
- .4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:
- .1 Establish circulation and ensure that air is eliminated.
- .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
- .3 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.
- .4 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.9 PERFORMANCE VERIFICATION

.1 Scheduling:
- .1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.

.2 Procedures:
- .1 Verify that flow rate and pressure meet Design Criteria.
- .2 Verify performance of temperature controls.
- .3 Verify compliance with safety and health requirements.
- .4 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
- .5 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

.3 Reports:
- .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, using report forms as specified in Section 01 91 13 - General Commissioning (Cx) Requirements: Report Forms and Schematics.
- .2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

3.10 OPERATION REQUIREMENTS

.1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products with Section 23 05 05 - Installation of Pipework.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 The installation of drainage waste and vent piping. Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
- .1 ASTM B32-03, Specification for Solder Metal.
- .2 ASTM B306-02, Specification for Copper Drainage Tube (DWV).
- .3 ASTM C564-03a, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 Canadian Standards Association (CSA International).
- .1 CSA B67-1972 (R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
- .2 CAN/CSA-B70-02, Cast Iron Soil Pipe, Fittings and Means of Joining.
- .3 CAN/CSA-B125-01, Plumbing Fittings.

1.3 QUALITY ASSURANCE

.1 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary, storm and vent Type DWV to: ASTM B306.
- .1 Fittings.
  - .1 Cast brass: to CAN/CSA-B125.
  - .2 Wrought copper: to CAN/CSA-B125.
- .2 Solder: 95:5, type TA, to ASTM B32.

2.2 CAST IRON PIPING AND FITTINGS

.1 Above ground sanitary, storm and vent: to CAN/CSA-B70.
- .1 Joints.
  - .1 Hub and spigot.
    - .1 Caulking lead: to CSA B67.
  - .2 Mechanical joints.
    - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

3 Execution

3.1 INSTALLATION

.1 In accordance with Section 23 05 05 - Installation of Pipework.

.2 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

3.2 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts:
- .1 Ensure accessible and that access doors are correctly located.
- .2 Open, cover with linseed oil and re-seal.
- .3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:
- .1 Verify domes are secure.
- .2 Ensure weirs are correctly sized and installed correctly.
- .3 Verify provisions for movement of roof system.

.4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 The installation of drainage waste and venting piping - plastic.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
  .1 ASTM D2564-02, Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 Canadian Standards Association (CSA International).
  .1 CSA-Series B1800-02, Plastic Nonpressure Pipe Compendium.
  .2 CSA-B181.2-02, PVC Drain, Waste and Vent Pipe and Pipe Fittings.
  .3 CSA-B182.1-02, Plastic Drain and Sewer Pipe and Pipe Fittings.

2 Products

2.1 PIPING AND FITTINGS

.1 For buried and or above ground DWV piping to:
  .1 CSA-B181.1.
  .2 CSA-B181.2.
  .3 CSA-B182.1.

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

3 Execution

3.1 INSTALLATION

.1 In accordance with Section 23 05 05 - Installation of Pipework.

.2 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

.3 Refer to 23 05 05 Installation of Pipework for fire stopping requirements.

3.2 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts:
- .1 Ensure accessible and that access doors are correctly located.
- .2 Open, cover with linseed oil and re-seal.
- .3 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:
- .1 Verify domes are secure.
- .2 Ensure weirs are correctly sized and installed correctly.
- .3 Verify provisions for movement of roof system.

.4 Ensure fixtures are properly anchored, connected to system and effectively vented.

END OF SECTION

1 General

1.1 REFERENCES

.1 American National Standards Institute/Canadian Standards Association (ANSI/CSA)
- .1 ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
- .2 ANSI Z21.10.1A-2006/CSA 4.1A-2006, Addenda 1 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
- .3 ANSI Z21.10.1b-2006/CSA 4.1b-2006, Addenda 2 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
- .4 ANSI Z21.10.3A-2007/CSA 4.3-2007, Gas Water Heaters - Volume III - Storage Water Heaters, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous.

.2 Canadian Standards Association (CSA International)
- .1 CSA B51-03(R2007), Boiler, Pressure Vessel, and Pressure Piping Code.
- .2 CAN/CSA-B139-04, Installation Code for Oil Burning Equipment.
- .3 CAN/CSA-B140.0-03, Oil Burning Equipment: General Requirements.
- .4 CAN/CSA-B149.1-05, Natural Gas and Propane Installation Code.
- .5 CAN/CSA-B149.2-05, Propane Storage and Handling Code.
- .6 CSA B140.12-03, Oil-Burning Equipment: Service Water Heaters for Domestic Hot Water, Space Heating, and Swimming Pools.
- .7 CAN/CSA C22.2 No.110-94(R2004), Construction and Test of Electric Storage Tank Water Heaters.
- .8 CAN/CSA-C191-04, Performance of Electric Storage Tank Water Heaters for Household Service.
- .9 CAN/CSA-C309-M90 (R2003), Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:
- .1 Provide manufacturer's printed product literature and datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
- .1 Indicate:
  - .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 WARRANTY

.1 For the Work of this Section 22 30 05 - Domestic Water Heaters, 12 months warranty period prescribed in subsection GC 32.1 of General Conditions "C" is extended to number of years specified for each product.

.2 Contractor hereby warrants domestic water heaters in accordance with CCDC2, but for number of years specified for each product.

2 Products

2.1 CONDENSING WATER HEATER

.1 Natural gas water heater(s) shall be condensing style with minimum 95% thermal efficiency, integral storage capacity and a maximum hydrostatic working pressure of 160 PSI. Size and performance as noted on equipment schedule. Water heater(s) shall:

1. Modulating gas burner that automatically adjusts the input based on demand.
2. Powered anodes that are non-sacrificial and maintenance free.
3. Have seamless glass-lined steel tank construction, with glass lining applied to all water-side surfaces after the tank has been assembled and welded;
4. Meets the thermal efficiency and/or standby loss requirements of current edition of ASHRAE/IESNA 90.1.
5. Have foam insulation and a CSA Certified and ASME rated T&P relief valve;
6. Have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up.
7. Be approved for 0″ clearance to combustibles.

.2 The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout.

1. All models shall be design certified by Underwriters Laboratories (UL), Inc., according to ANSI Z21.10.3 - CSA 4.3 standards governing storage type water heaters.
2. Meet the thermal efficiency and standby loss requirements of the current edition ASHRAE/IESNA 90.1.
3. Unit shall comply with SCAQMD Rule 1146.2 for low NOx emissions.

.3 Manufacturer and contractor shall ensure supplied unit can be vented in accordance with manufacturer’s requirements for total distance of equivalent feet of vent piping.

2.2 TRIM AND INSTRUMENTATION

.1 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.

.2 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's recommendations.

.2 Provide structural steel for horizontal mounted tanks.

.3 Provide insulation between tank and supports.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.
.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Materials and installation for plumbing specialties and accessories.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).
- .1 ASTM A126-95 (2001), Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
- .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.

.2 Canadian Standards Association (CSA International).
- .1 CSA-B64 Series-01, Backflow Preventers and Vacuum Breakers.
- .2 CSA-B79-94 (R2000), Floor, Area and Shower Drains, and Cleanouts for Residential Construction.
- .3 CSA-B356-00, Water Pressure Reducing Valves for Domestic Water Supply Systems.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .1 Material Safety Data Sheets (MSDS).

.4 Plumbing and Drainage Institute (PDI).
- .1 PDI-G101-96, Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.
- .2 PDI-WH201-92, Water Hammer Arresters Standard.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
- .2 Indicate dimensions, construction details and materials for specified items.

.3 Shop Drawings:
- .1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details and accessories.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 Provide materials, equipment and labour to install plumbing as required by Provincial and Local Codes and as specified herein.

.3 Provide water and drainage connections to equipment furnished in other sections of this specification and by the Departmental Representative.

.4 Fittings of same type shall be product of one manufacturer.

2 Products

2.1 FLOOR DRAINS

.1 Floor Drains: to CSA B79.

.2 Provide trap primer tapping on all floor drains where trap primers are required by Code and authority having jurisdiction.

.3 FD-1 – Regular Floor Drain
- .1 Type 1 (General Duty): Epoxy coated cast iron body with double drainage flange, reversible clamping collar with primary and secondary weep holes, combined two piece body and adjustable nickel-bronze strainer. Shower and washroom floor drains shall have a removable perforated sediment bucket.
- .2 Type 2 (Heavy Duty): Epoxy coated cast iron body with double drainage flange, reversible clamping collar with primary and secondary weep holes, combined two piece body and adjustable heavy duty nickel-bronze strainer.
- .3 Type 3 (Combination Funnel Floor Drain): Epoxy coated cast iron body with double drainage flange, reversible clamping collar with primary and secondary weep holes, combined two piece body and adjustable nickel-bronze strainer with integral 102 mm x 229 mm oval nickel bronze funnel.

.4 FD-2 (Security Drain) Floor drain for security areas shall be 75mm (3") drain with flush mounted tamper proof grille. Grille openings shall have a maximum dimension of 12mm (note that square openings shall be 12mm or less on diagonal dimension of opening). Grille shall be secured with security screws and each screw shall be mounted using Loctite Liquid Thread Locker, Series 262 Mil-Spec S-46163A Type II Grade 0 (no equivalent product).

2.2 TRENCH DRAINS

.1 Trench Drains: to CSA B79.

.2 Interior Trench Drain: Presloped polyester polymer concrete trench drain with stainless steel edge rail channel system and stainless steel grate. System to be rated for Load Class B to EN 1433.

.3 Material: The trench system bodies shall be manufactured from polyester polymer concrete with minimum properties as follows: Compressive Strength – 14,000 PSI, Flexural Strength – 4,000 PSI, water absorption – 0.07%, frost proof, salt proof

.4 The nominal clear opening shall be 4" (100mm) with overall width of 6.30" (160mm). Pre-cast units shall be manufactured with either an invert slope of 0.5% and have a wall thickness of at least 0.67" (16mm). Each unit will feature a partial radius in the trench bottom and a male to female interconnecting end profile. Units shall have horizontal cast in anchoring keys on the outside wall to ensure maximum mechanical bond to the surrounding bedding material and concrete surface. The stainless steel edge rail will be integrally cast in by the manufacturer to ensure maximum homogeneity between polymer concrete body and edge rail. Each edge rail shall be at least 1/4" (6mm) thick.

.5 Grates and Frame: longitudinal grates manufactured from 16 ga. Grade 304 Stainless steel. Frame to be anchored into concrete with 0.25" x 3" long anchors no more than 17" on center to ensure entire load is carried to floor and not to polymer drain. After removal of grates there shall be uninterrupted access to the trench to aid maintenance. Grates shall be secured with a locking mechanism utilizing multiple locking points per grate.

.6 Basis of Design is ACO KlassikDrain – KS100

2.3 CLEANOUTS

.1 Cleanout: Adjustable floor cleanout with lacquered cast iron body and anchor flange, secondary O ring test seal, 4" diameter cleanout opening and combined scoriated satin finished nickel bronze cover and plug top assembly with stainless steel vandal-proof allan key screws and primary gasket seal. Provide membrane clamp for all membrane floors. Specification based on Mifab Model C1100.

.2 Access Covers:

- .1 Wall Access: face or wall type, polished nickel bronze with chrome plated cap, round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
- .2 Floor Access: round cast iron body and frame with adjustable secured nickel bronze top and:
  - .1 Plugs: bolted bronze with neoprene gasket.
  - .2 Cover for Unfinished Concrete Floors: round, nickel bronze, gasket, vandal-proof screws.
  - .3 Cover for Terrazzo Finish: Polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws.
  - .4 Cover for Tile and Linoleum Floors: polished nickle bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.
  - .5 Cover for Carpeted Floors; polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal–proof locking screws.
- .3 Provide bolted cover plates on all vertical rainwater leaders.

2.4 WATER HAMMER ARRESTORS

.1 Stainless steel bellow type or copper piston type to PDIWH201.

.2 Air chamber same size as supply line or 19 mm minimum, and minimum 450 mm long.

2.5 EXTERIOR HOSE BIBBS AND SEDIMENT FAUCETS (HB-1)

.1 A.S.S.E. 1019-B certified encased key operated non-freeze self-draining wall hydrant with A.S.S.E. 1011 approved anti-siphon and vandal resistant integral vacuum breaker and 19 mm diameter male hose connection. Length to suit wall thickness. Hydrant assembly complete with neoprene plunger to control both the flow and drain functions, hardened bronze operating stem, drain port under the hexagon nut, heavy duty brass casing, 360 degree swivel inlet connection, heavy duty chrome plated bronze head casting, polished chrome plated face plate and satin finished nickel bronze box with hinged locking cover. Operating key to be furnished with each hydrant.

.2 Specification based on Mifab Model MHY-20.

2.6 INTERIOR HOSE BIBBS AND SEDIMENT FAUCETS (HB-2)

.1 Cast brass anti-contamination faucet; exposed type, mild climate, anti-contamination wall faucet with 19 mm male hose connection and anti-siphon vacuum breaker. Exterior finish to be polished chrome plated, operating handle to be cast iron wheel handle, and inlet connection to be 19 mm F.P.T. unless specifically noted as 12 mm on drawings. Vacuum breaker to be certified to the ASSE Standard 1011 and listed by IAPMO.

.2 Specification based on Mifab Model MHY-90.

2.7 SECURE INTERIOR HOSE BIBBS (HB-3)

.1 Housing: Flush mounted cast brass wall box for hydrant complete with matched hydrant. Box to have chrome finish and be complete with cylinder key lock.

.2 Hose Bibb: Cast brass anti-contamination faucet; exposed type, mild climate, anti-contamination wall faucet with 19 mm male hose connection and anti-siphon vacuum breaker. Exterior finish to be polished chrome plated, operating handle to be cast iron wheel handle, and inlet connection to be 19 mm F.P.T. unless specifically noted as 12 mm on drawings. Vacuum breaker to be certified to the ASSE Standard 1011 and listed by IAPMO.

.3 Specification based on Housing: Mifab Model MHY-95-49-K, Hose bibb: Mifab Model MHY-90.

2.8 TRAP SEAL PRIMERS (Electronic)

.1 Group Trap Seal Primer:
- .1 MIFAB Series MI-100-10 (6-10 outlet ports) enclosed electronic trap seal primer system with timer, ½" F.I.P. plastic ball valve, lead free bronze vacuum breaker, 1/2" solenoid valve and plastic Manifold with distribution ports. Electrical components to include single point power connection at 120VAC, manual override switch, minimum 5 amp breaker, 24 hour timer with relay and adjustable delay. All components to be factory assembled and installed into a 16 gauge satin coated steel box for recessed (standard) or surface mounted installation as indicated on drawings. The entire assembly is tested and certified to the ASSE 1044 Standard. 100 p.s.i. operating pressure.
- .2 Specification based on Mifab Model MI 100.

.2 Air Gap Fitting:
- .1 Copper air gap fitting complete with a 12 mm male NPT fitting at the inlet supply incorporating a stream directing nozzle, a 12 mm NPT female outlet, and a ANSI/ASME A112.1.2 air gap in plumbing systems standard.
- .2 Specification based on Mifab Model MI-GAP.

2.9 VACUUM BREAKERS

.1 Breakers: To CSA-B64 Series.

2.10 STRAINERS

.1 Size 50 mm and under: Screwed brass, Y pattern with 0.7 mm stainless steel perforated screen.

.2 Size 63 mm to 100 mm: Flanged iron body with bolted cap, Y pattern with 1.2 mm stainless steel perforated screen.

.3 Size 127 mm and larger: Flanged iron body, basket pattern with 3 mm stainless steel perforated screen.

.4 Screen free area shall be minimum three times area of inlet pipe. Provide valved drain and hose connection off strainer bottom.

2.11 EYE WASH EW-1

.1 Eyewash: wall mounted recessed swing down eye/face wash with drain pan shall include stainless steel cabinet for recess mounting in finished wall. Unit shall include all welded 16 gauge type 304 stainless steel construction, chrome plated brass eye/face wash supply fittings, ½" IPS brass rotating plug-type valve with Teflon coated O-ring seals. Supplied with in-line strainer to prevent debris from affecting the valve, and 2" IPS drain. Unit shall have (2) polypropylene 'FS Plus' spray heads with integral filters and 3.2 GPM flow control orifices. Activate valve by rotating 90 degree from stored position. Unit shall include ANSI compliant sign. Unit shall be fully factory assembled and hydrostatically tested to meet or exceed ANSI Z358.1 - 2009, and come with a full 2 year warranty.

.2 Tempering System: prepackaged, fully engineered and tested system that mixes hot and cold water to supply tempered water to eyewash fixtures requiring flow up to 5 gpm. System consists of a thermostatic mixing valve, a high temperature limit valve, a bypass valve, and an outlet temperature gauge. Unit is constructed of bronze, brass, copper and stainless steel. Maximum inlet pressure: 125 psi. Maximum inlet temperature: 180 deg.F (82 deg.C). Recommended inlet temperature: 140 deg.F (60 deg.C). Pressure requirements: 50 psi to adequately supply water for eye/face wash. Inlet and Outlet: 1/2" IPS. Dielectric outlet union provided.

.3 Provide check valves on hot and cold supply risers.

.4 Design based on: Eyewash Guardian GBF1735DB, Tempering System Guardian TMV.

2.12 HOSE REEL HR-1

.1 Spring retractable hose reel, all steel construction with baked-on powder coat finish. Hose reel to have the following features:

.1 Hose anti latch-out feature ensures hose retracts every time.
.2 Guide arm is field adjustable for wall or ceiling mounting positions.
.3 Dual pedestal base and guide arm design are structurally reinforced.
.4 Five-in-one, heat-treated aluminium casting incorporates main shaft, ratchet, spring arbor and inlet/outlet plumbing in one-piece casting.
.5 Containerized spring assembly to provide safe and easy handling during maintenance.
.6 Two sealed ball bearings for smooth rotation of main shaft.

.2 Unit to be complete with 23m (75ft) of 19mm (3/4”) I.D. low pressure PVC hose rated to 65 Deg.C (150 Deg.F) at 17 Bar (250 PSI).

.3 Wall-Mounted Swing Bracket: Provide bracket matched to hose reel that shall pivot approximately 180°. All steel construction with a durable baked on powder coat finish.

.4 Unit to be complete with 19mm (3/4”) flexible inlet hose assembly to connect from hosebibb to reel inlet. Length to match site requirements, assumed to be 0.91m (3’).

.5 Unit to be complete with all required mounting accessories.

.6 Specification is based on ReelCraft Series 8000, Model D83075 OLP reel with hose, 601034-3 inlet hose, 600980 swing bracket.

2.13 LAUNDRY SERVICE BOX (Fire Rated LB-1)

.1 Fire Rated double outlet washing machine outlet box complete with ¼ turn brass ball valves with copper seat connections and 50mm PVC drain opening. Fire rating to meet or exceed fire rating on Architectural wall detail.

.2 Box to be bulk molded compound of thermoset fire-rated plastic.

.3 Unit to be complete with drain piece sleeve of galvanized steel with integrated intumescent pad.

.4 Unit to be complete with bulk molded compound thermoset fire-rated plastic plugs.

.5 Unit to be complete with PVC test cap.

.6 Unit to be complete with box fire rated pad, UL classified FyreWrap Insulation Material

.7 Unit to have adjustable mounting bracket to secure into stud wall.

.8 Unit to be complete with snap-on faceplate that accommodates up to two-layers of 5/8" drywall.

.9 Specification based on Oatey Fire Rated.

2.14 EXPANSION TANKS

.1 Construction: Welded steel with heavy duty butyl air/water interface, tank style to match equipment schedule. Tank shall be cleaned, prime coated, and supplied with steel support saddles; with tappings for installation of accessories.
- .1 Pressure rating: 860 kPa.
- .2 Size: As noted on equipment schedule.

.2 Tank shall be tested and stamped to ASME SEC 8-D.

.3 Quick Connect Air Inlet:
- .1 Expansion Tank: Inlet tire check valve, manual air vent, tank drain, and pressure relief valve.

.4 Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check back flow preventer, test cocks, strainer, vacuum breaker, and valved bypass.

.5 Hot Water Heating System:
- .1 Select expansion tank pressure relief valve to match heater.
- .2 Set pressure reducing valve at select 35 kPa.

.6 Precharge air side to 84 kPa (12 PSI) initial fill pressure of system.

2.15 AUTOMATIC FLOW RESTRICTOR

.1 Automatic flow control valve complete with isolation and strainer, sized for design flow rate

.2 Construction: Forged or cast brass or bronze body with union on inlet, temperature and pressure test ports on inlet and outlet. To be rated for potable applications.

.3 Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 13.7 kPa.

.4 Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.

.5 In-line strainer with 20 mesh stainless steel filter screen and drain valve.

.6 Isolation Valve: Ball valve with Teflon seats, refer to valve specifications.

2.16 SOLIDS INTERCEPTOR TANK (IT-1)

.1 Interceptor shall be lifetime guaranteed and made of seamless, rotationally-molded High Density Polyethylene with minimum 3/8" uniform wall thickness furnished for above grade installation.

.2 Interceptor shall be furnished with filter basket and connection for extending handle for access from floor above. Filter basket to utilize medium filter with openings 0.1” x 0.08”.

.3 Cover shall provide water/gas-tight seal and have a minimum 2,000 lbs load capacity.

.4 Refer to drawings for tank connection sizes, connections to match pipe size.

.5 Maximum unit weight – 90 lbs

.6 Unit shall be “floor” mounted on steel plate with plate suspended from structure in crawlspace. Contractor to provide plate and supports, which shall be rated for 2000 lbs.

.7 Unit to be complete with teleguide field adjustable service access risers as required to permit service access from floor above. Coordinate service access, access extensions and mounting height.

.8 Internal components to be removable for service/maintenance.

.9 Basis of Design: Schier Prospector™ solids interceptor model PS-35-B

2.17 OIL AND SAND INTERCEPTOR TANK (IT-2)

.1 Interceptor shall be lifetime guaranteed and made of seamless, rotationally-molded High Density Polyethylene with minimum 3/8" uniform wall thickness furnished for above grade installation.

.2 Unit to be furnished with internal inlet and outlet diffusers. The inlet diffuser shall split incoming effluent into two paths that utilize the entire liquid volume of the tank for efficient oil separation. Diffuser to be complete with calibrated openings that greatly reduce effluent turbulence such that effluent enters the main chamber without disturbing the existing oil or sediment layers. The outlet diffuser shall be designed such that the intake only allows effluent to exit free of oil.

.3 Tank to have built-in flow control set to 35 gpm and vent connections

.4 Cover shall provide water/gas-tight seal and have a minimum 2,000 lbs load capacity.

.5 Refer to drawings for tank connection sizes, connections to match pipe size.

.6 Maximum unit weight – 80 lbs

.7 Unit shall be “floor” mounted on steel plate with plate suspended from structure in crawlspace. Contractor to provide plate and supports, which shall be rated for 2000 lbs.

.8 Unit to be complete with teleguide field adjustable service access risers as required to permit service access from floor above. Coordinate service access, access extensions and mounting height.

.9 Internal components to be removable for service/maintenance.

.10 Basis of Design: Schier oil/sand separator model # OS-35

2.18 SOIL GAS MAT

.1 Soil gas collector system comprised of soil gas mat collector and matched riser. Soil gas mat to be installed on ground below fill material and crawlspace membrane.

.2 Soil Gas Collector Core: A polystyrene core with a compressive strength of 4300 PSF in accordance with ASTM D-1621 (Modified). Core to be a double sided waffle like geometry ¾" x 5/8".

.3 Soil Gas Collector Fabric:
Weight – 4 in accordance with ASTM D-1910,
Tensile Strength – 145 in accordance with ASTM D-1682
Elongation at break (96) – 115 in accordance with ASTM D-1682-64
Mullen burst strength (PSD) - 170 in accordance with ASTM D-75 1
Puncture strength – 5 in accordance with ASTM D-75 1
A.O.S.(Equivalent sieve) - 70/100 in accordance with COE CW-02215
Modulas at 10% elongation (Lbs) - 785 in accordance with ASTM D-1682
Trap tears (Lbs) - 75 in accordance with ASTM D-2263
Coefficient of permeability (Cm/sec) - 0.03 in accordance with ASTM D-737
Permittivity (Sec-1) - .8 in accordance with ASTM D4491-85
Accelerated weathering strength (Fed) - 80 in accordance with STD #191-5804

.3 Soil Gas Collector Binding to be sewn with nylon thread.

.4 Basis of Design: Professional Discount Supply Soil Gas Collector™

2.19 BACK FLOW PREVENTERS

.1 Reduced Pressure Back flow Preventers: Bronze body with bronze and plastic parts and stainless steel springs; two independent spring loaded check valves; diaphragm type differential pressure relief valve; check valve for diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks; Back siphonage protection shall include provision to admit air directly into the reduced pressure zone via a separate channel from the water discharge channel, or directly into the supply pipe via a separate vent. Refer to equipment schedule for size.

.2 Double Check Valve Assemblies: Bronze body with stainless steel springs; two independent check valves with intermediate atmospheric vent, tight closing resilient seated shut-off valves, and test cocks. Each check module shall have a captured spring and be accessible through a bolted cover plate. Seats shall be replaceable without special tools. Refer to equipment schedule for size.

.3 Quality Assurance:
- .1 Reduced pressure backflow preventers shall meet the requirements of ASSE Std. 1013; AWWA Std. C-511-92; and CSA B64.4.
- .2 Double Check Valve assemblies shall meet the requirements of ASSE No. 1015; AWWA C510-92; CSA B64.5 and UL Classified File No. EX3185.

2.20 SUMP PUMPS

.1 Type: Vertical centrifugal, direct connected, simplex or duplex arrangement as indicated on drawings.

.2 Construction: Cast iron volute casing with inlet strainer impeller keyed to steel shaft, with forced grease lubricated bronze sleeve bearings, flexibly coupled to vertical, solid shaft ball bearing electric motor.

.3 Sump: Steel cover plate with steel curb frame for grouting into concrete sump with inspection opening and cover, and alarm fittings.

.4 Controls (Simplex): Float switch and separate high level alarm with alarm bell.

.5 Controls (Duplex): Float operated mechanical alternator and separate high level alarm with alarm bell.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Install in accordance with Provincial Codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.3 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required by Code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

.4 Lubricate cleanout plugs with mixture of graphite and linseed oil. Prior to building turnover remove cleanout plugs, relubricate and reinstall using only enough force to ensure permanent leak proof joint.

3.4 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures as required to eliminate water hammer.

3.5 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of risers, at low points to drain systems, and as indicated.

.2 Install complete with isolation valve upstream of hose bibbs.

3.6 TRAP SEAL PRIMERS

.1 Install for floor drains and elsewhere, as required by Code and/or where indicated on drawings. Trap primers shall be electronic.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Departmental Representative.

.3 Install plastic PEX tubing to floor drain.

3.7 STRAINERS

.1 Install with sufficient room to remove basket.

3.8 VACUUM BREAKERS

.1 Install vacuum breakers on plumbing lines where contamination of domestic water may occur; generally make-up lines, hose bibbs, and flush valves.

3.9 HOSE REEL

.1 Install hose reel on wall bracket to permit reel to be placed against wall with hose end facing door.

.2 Connect to hose bibb with flexible inlet hose supplied with reel. Ensure hose bibb location is suitable for length of hose purchased.

3.10 START-UP

.1 Timing: Start-up only after:
- .1 Pressure tests have been completed.
- .2 Disinfection procedures have been completed.
- .3 Certificate of static completion has been issued.
- .4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

3.11 EXPANSION TANKS

.1 Support tanks inside building from building structure.

.2 Refer to equipment schedule and drawings for size and configuration.

.3 Adjust expansion tank pressure to suit actual site conditions.

.4 Install lockshield type valve at inlet to tank.

3.12 AUTOMATIC FLOW RESTRICTOR

.1 Install automatic flow control valve complete with additional isolation valve to permit servicing of valve without draining system.

3.13 TESTING AND ADJUSTING

.1 Timing:
- .1 After start-up deficiencies rectified.
- .2 After certificate of completion has been issued by authority having jurisdiction.

.2 Application tolerances:
- .1 Pressure at fixtures: within tolerance allowable by manufacturer.
- .2 Flow rate at fixtures: +/- 10%.

.3 Adjustments:
- .1 Verify that flow rate and pressure meet design criteria.
- .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.

.4 Floor drains:
- .1 Verify operation of trap seal primer.
- .2 Prime, using trap primer. Adjust flow rate and timer to suit site conditions.
- .3 Check operations of flushing features.
- .4 Check security, accessibility, removeability of strainer.
- .5 Clean out baskets.

.5 Vacuum breakers, backflow preventers, backwater valves:
- .1 Test tightness, accessibility for O&M of cover and of valve.
- .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
- .3 Verify visibility of discharge from open ports.

.6 Access doors:
- .1 Verify size and location relative to items to be accessed.

.7 Cleanouts:
- .1 Verify covers are gas-tight, secure, yet readily removable.

.8 Water hammer arrestors:
- .1 Verify proper installation of correct type of water hammer arrester.

.9 Strainers:
- .1 Clean out repeatedly until clear.
- .2 Verify accessibility of cleanout plug and basket.
- .3 Verify that cleanout plug does not leak.

.10 Hose bibbs, sediment faucets:
- .1 Verify operation of vacuum breakers.

.11 Training:
- .1 In accordance with Section 21 05 01 Common Work Results - Mechanical, Training of Operation and Maintenance Personnel, supplemented as specified.
- .2 Demonstrate full compliance with Design Criteria.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 The supply and installation of Plumbing Fixtures and Trim.

.2 Products Installed but not Supplied Under this Section:
- .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
- .2 Equipment installed by others.
  - .1 Connect with unions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
- .1 CAN/CSA-B45 Series-02, Plumbing Fixtures.
- .2 CAN/CSA-B125-01, Plumbing Fittings.
- .3 CAN/CSA-B651-95 (R2001), Barrier-Free Design.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Closeout Submittals:
- .1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity, material, water consumption and details of all items noted under specification..
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

1.4 GENERAL REQUIREMENTS

.1 Provide new fixtures, CSA approved, free from flaws and blemishes with finished surfaces clear, smooth and bright.

.2 Provide CSA approved plumbing fittings. Visible parts of fixture brass and accessories shall be heavily chrome plated.

.3 Fixtures shall be product of one manufacturer. Fittings of same type shall be product of one manufacturer.

.4 Protect fixtures against use and damage during construction.

1.5 JOB CONDITIONS

.1 Check millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

2.2 WATER CLOSET WC-1

.1 Handicapped close coupled floor mounted 300 mm rough-in, tank style with 4.8 LPF (1.1 GPF) siphon jet flushing action. Water closet to be capable of flushing 1000 grams of waste under bulk waste removal protocols conducted by a CSA certified laboratory. Water closet to be complete with 5 year limited warranty.

.2 Bowl/Tank: 419 mm (16-1/2") high, white, vitreous china, elongated bowl, oversized flush valve, 54 mm (2-1/4") fully glazed trapway, siphon jet, 2 bolt caps, insulated tank complete with fittings and bolt down lid on tank.

.3 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.4 Seat: White, elongated, open front, moulded plastic seat with cover and self-sustaining stainless steel hinges and stainless steel insert post.

.5 Design based on the following: Bowl/Tank - American Standard Cadet 3 FloWise Right Height Elongated, Seat - Bemis 1950SS, Supplies – Delta 47T2312SD

2.3 WATER CLOSET WC-2

.1 Provide and install 450 mm (18") wide Lav/Toilet Suicide Resistant Comby. Contractor to confirm angled left, central or angled right units based on plans. Provide hemispherical cabinet design to reduce the risk of fixture being used as a suicide device. Fixture shall be fabricated from 14 gauge, type 304 stainless steel. Constructions hall be seamless welded exposed surfaces shall have a satin finish. Provide D shaped lavatory bowl.

.2 Fixture shall have air controlled pneumatically operated, push button valves. Valves shall require less than 2.3 kg to activate. Valves to comply with NSF 61, section 9-1997 lead free requirements.

.3 Provide BPH hemispherical penal bubbler and hemispherical penal pushbuttons. Provide toilet bowl housing to prohibit the attachment of objects. Toilet shall be concealed blowout jet type with an elongated bowl, self-draining flushing rim, and an integral contoured seat with a sanitary high polish finish.

.4 Toilet trap shall pass a 66 mm (2-5/8") diameter ball and shall be fully enclosed. Toilet shall conform to ANSI 112.19.2M. Cabinet interior shall be sound deadened with fire resistant material. Fixture shall withstand loading of 1360 kg without permanent damage. Fixture shall be furnished with necessary fasteners for proper installation.

.5 Fixture shall be furnished with necessary fasteners for proper installation. The following options shall be provided with the units: Pinned cleanout plug, rear outlet P-trap, wall sleeve (Contractor to confirm wall depth) and 75 mm (3") waste outlet. Acceptable product: Acorn Penal-Ware 144-2-BPH-4-FV (1.6)-PC-PT-SW-W03 or Willoughby Model ECW-18060R/L-MOD.

.6 Provide a hot water tempering valve on the hot water supply line to the lavatory. Acceptable product: Symmons Model 4-10B. Note: unit shall be stamped with the manufacturer's model number on the face of the unit. Fixture to be installed with epoxy sealant between all flush mounted surfaces and the walls and/or floor.

2.4 LAVATORY L-1

.1 Bowl: ADA compliant wall hung stainless steel lavatory, 600 mm x 480 mm with 540mm x 340mm x 150mm deep basin, 19 Ga type 304 stainless steel with seamless welded bowl, 100mm center set, with overflow and faucet ledge. Exposed surfaces are #4 Satin Finish

.2 Trim: ADA compliant chrome plated single lever manual faucet, 0.5 GPM/1.9 LPM vandal proof spray head, 100mm centerset, cast brass lead free waterway, ceramic drip-free disc valve cartridge, 89 mm lever.

.3 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.4 Tailpiece and Trap: offset grid drain assembly with open grid stainless steel strainer. Chrome plated cast brass adjustable P-trap complete with cleanout, plug with chain and escutcheon.

.5 Insulate trap and supplies with Truebro Lavguard accessibility approved pipe insulation assembly complete with PVC jackets for supplies tailpiece and trap assembly, white.

.7 Design is based on the following: Bowl – Franke WT600C-8, Trim – Delta 22C151, Carrier: Zurn - Z1231, Supplies - Delta 47T2312SD, Tailpiece - Delta 33T290-1, Trap - Delta 33T311.

2.5 LAVATORY L-2

.1 Bowl: ADA compliant wall hung stainless steel lavatory, 600 mm x 480 mm with 540mm x 340mm x 150mm deep basin, 19 Ga type 304 stainless steel with seamless welded bowl, 100mm center set, with overflow and faucet ledge. Exposed surfaces are #4 Satin Finish

.2 Trim: ADA compliant chrome plated single lever manual faucet, 0.5 GPM/1.9 LPM vandal proof spray head, 100mm centerset, cast brass lead free waterway, ceramic drip-free disc valve cartridge, 89 mm lever.

.3 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.4 Tailpiece and Trap: grid drain assembly with open grid stainless steel strainer. Chrome plated cast brass adjustable P-trap complete with cleanout, plug with chain and escutcheon.

.5 Design is based on the following: Bowl - Bowl – Franke WT600C-8, Trim – Delta 22C151,, Carrier: Zurn - Z1231, Supplies - Delta 47T2312SD, Tailpiece - Delta 33T290-1, Trap - Delta 33T311.

2.6 LAVATORY L-3

.1 Bowl: ADA compliant self-rimming countertop lavatory, 533 mm x 457 mm, 18 ga. type 304 stainless steel, mirror finish rim with #4 stain finish basin, hole drilling to match trim, back overflow with faucet ledge. Basin to be undercoated to reduce condensation.

.2 Trim: ADA compliant chrome plated single lever manual faucet, 0.5 GPM/1.9 LPM vandal proof spray head, 100mm centerset, cast brass lead free waterway, ceramic drip-free disc valve cartridge, 89 mm lever.

.3 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.4 Tailpiece and Trap: open grid drain assembly with open grid strainer. Chrome plated cast brass adjustable P-trap complete with cleanout, and escutcheon.

.5 Provide anti-scald temperature mixing controls: pressure independent thermostatic mixing valve complete with integral check valves, service isolation valves, and vandal resistant temperature setting adjustments.

.6 Design based on the following: Bowl – Franke OV1812/6, Trim – Delta 22C151, Supplies – Delta 47T2312SD, Tailpiece – Delta 33T290-1, Trap - Delta 33T311.

2.7 URINAL UR-1

.1 Wall hung siphon jet flush valve urinal 1.9 LPF (0.5 GPF). Urinal to be complete with 5 year limited warranty.

.2 Bowl: Vitreous china, top spud siphon-jet action with integral fully glazed trapway. Bowl to have anti-microbial surface equivalent to a double coated mirror finish. Nominal Dimensions: 356 mm (14") wide x 356 mm projection x 546 mm (21-1/2") high.

.3 Flush Valve: 1.9 litre exposed chrome plated automatic hard wire operated diaphragm style flush valve with recessed wall mounted infrared sensor, sensor range adjustment, true mechanical override button, dual filtered bypass, high back pressure vacuum breaker, adjustable tailpiece, bak-chek angle stop with vandal resistant cap and cast wall flange with setscrew. Provide 102mm square electrical box for mounting sensor plate and box mount hard wired transformer to convert 120V / 1 phase to 24 VA 50 A.

.4 Carrier, epoxy coated with heavy gauge steel uprights with welded feet supports and with top and bottom universal steel hanger plates with plated hardware, heavy gauge epoxy coated steel offset uprights, plated hardware. Each carrier to support one unit. Carrier to be suitable for installation in 102 mm (4") finished metal stud wall.

.5 Design based on the following: Bowl/Valve - Sloan WEUS-1005.1401-0.5 G2, Carrier – Watts CA-321.

3. Execution

3.1 INSTALLATION

.1 Install each fixture that is to be operational with its own trap, easily removable for servicing and cleaning. At completion thoroughly clean plumbing fixtures and equipment.

.2 Provide chrome plated rigid or stainless steel flexible supplies to fixtures that are to be operational complete with screwdriver stops, reducers and escutcheons.

.3 Install wall mounted lavatories, urinals and water closets with approved wall carriers, model to suit installation.

.4 Mounting heights:
- .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified by architect.
- .2 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.

.5 Install hose and faucets and hose connections with vacuum breakers.

3.2 PLUMBING FIXTURE ROUGH-IN SCHEDULE

.1 Rough-in fixture piping connections in accordance with the following table of minimum sizes or as required for particular fixtures:

	Hot Water	Cold Water	Waste	Vent
Lavatories	12 mm (½") (½")	12 mm (1-1/2")	38 mm (1-1/4")	32 mm
Water Closet (flush valve)	-----	32 mm (1-1/4")	75 mm (3")	51 mm (2")
Water Closet (tank)	-----	12 mm (1/2")	75 mm (3")	51 mm (2")
Urinals (flush valve)	-----	19 mm (3/4")	51 mm (2")	38 mm (1-1/2")
Hose Bibbs	19 mm (3/4")	19 mm (3/4")	-----	-----

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:
- .1 Adjust water flow rate to design flow rates.
- .2
- .3 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:
- .1 Aerators or Laminar Flow Control: operation, cleanliness.
- .2 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls:
- .1 Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 The supply and installation of Plumbing Fixtures and Trim.

.2 Products Installed but not Supplied Under this Section:
- .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
- .2 Equipment installed by others.
  - .1 Connect with unions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
- .1 CAN/CSA-B45 Series-02, Plumbing Fixtures.
- .2 CAN/CSA-B125-01, Plumbing Fittings.
- .3 CAN/CSA-B651-95 (R2001), Barrier-Free Design.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Closeout Submittals:
- .1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity, material, water consumption and details of all items noted under specification.
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

1.4 GENERAL REQUIREMENTS

.1 Provide new fixtures, CSA approved, free from flaws and blemishes with finished surfaces clear, smooth and bright.

.2 Provide CSA approved plumbing fittings. Visible parts of fixture brass and accessories shall be heavily chrome plated.

.3 Fixtures shall be product of one manufacturer. Fittings of same type shall be product of one manufacturer.

.4 Protect fixtures against use and damage during construction.

1.5 JOB CONDITIONS

.1 Check millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

2.2 SINK SK-1 (Single Compartment)

.1 Bowl: single compartment, 18-10 stainless steel, 18 gauge, self-rimming sink 520 mm x 510 mm x 250 mm, complete with 89 mm removable drain assembly and 89 mm crumb cup strainer.

.2 Trim: heavy duty cast brass 200mm (8”) center two handle sink faucet complete with 150mm (6”) radius vandal resistant spout with 5.7 L/minute vandal resistant laminar flow control and limited swing. Handles to be 152mm (6”) wrist blade handles.

.3 Trap: cast brass adjustable swivel pattern P-trap with cleanout.

.4 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.5 Design based on the following: Bowl - Franke LBS6810P-1, Trim - Delta 26C3925-LS, Supplies – Delta 47T2312SD, Tailpiece - Delta 33T290-1, Trap - Delta 33T311.

2.3 SINK SK-2

.1 Bowl: Type 304, 18-10 stainless steel, 16 gauge, 690 mm x 700 mm floor mounted single compartment sink with 225 mm backsplash and 610 mm x 610 mm x 360 mm deep basin with 89 mm (3-1/2") crumb cup waste assembly. Unit to have stainless steel tubular legs with adjustable feet.

.2 Trim: 203 mm two handle wall mount centerset complete with 150 mm radius, 264 mm high vandal resistant gooseneck swivel spout with 5.7 LPM (1.5 GPM) antimicrobial laminar flow control. ADA compliant 102 mm wrist blade handles. Unit to have integral check stops.

.3 Trap: Cast brass adjustable swivel pattern P-trap with cleanout.

.4 Supplies: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.5 Provide check valves on hot and cold supply risers.

.6 Design based on: Bowl - Kindred Model SL2424-1, Trim - Delta 28T6924, Supplies - Delta Model 47T2512SD.

2.4 SINK SK-3

.1 Bowl: single compartment, 18-10 stainless steel, 18 gauge, self-rimming sink 520 mm x 510 mm x 250 mm, complete with 89 mm removable drain assembly and 89 mm crumb cup strainer.

.2 Trim: Polished chrome-plated cast brass faucet body with integral shanks, quarter turn ceramic disc cartridges and a 6-1/4" [159mm] centerline swing double bend spout. Unit is furnished with a 1.0 GPM [3.8 L] pressure compensating vandal resistant laminar flow control in base of spout (complying with ANSI A112.18.1 Standard for flow), 2-1/2" [64mm] vandal-resistant color coded metal lever handles, mounting hardware and 1/2" NPSM coupling nuts for standard lavatory risers.

.3 Trap: cast brass adjustable swivel pattern P-trap with cleanout.

.4 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.5 Design based on the following: Bowl - Franke LBS6810P-1, Trim – Zurn Z812Y1 with G67694-FC-22F spout, Supplies – Delta 47T2312SD, Tailpiece - Delta 33T290-1, Trap - Delta 33T311.

2.5 SINK SK-4

.1 Bowl: single compartment, 18-10 stainless steel, 18 gauge, self-rimming sink 520 mm x 510 mm x 250 mm, complete with 89 mm removable drain assembly and 89 mm crumb cup strainer.

.2 Trim: heavy duty cast brass 200mm (8") center two handle sink faucet complete with 150mm (6") radius vandal resistant spout with 5.7 L/minute vandal resistant laminar flow control and limited swing. Handles to be 152mm (6") wrist blade handles.

.3 Trap: cast brass adjustable swivel pattern P-trap with cleanout.

.4 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.5 Design based on the following: Bowl - Franke LBS6810P-1, Trim - Delta 26C3925-LS, Supplies – Delta 47T2312SD, Tailpiece - Delta 33T290-1, Trap - Delta 33T311.

2.6 MOP SINK MS-1 (Floor Mount Mop Sink)

.1 Bowl: 610 mm x 610 mm x 254 mm deep white moulded stone, floor mounted sink with 24 mm wide shoulders, SS strainer, complete with 76 mm brass drain assembly.

.2 Trim: Exposed wall type supply with cross handles, spout adjustable wall brace, vacuum breaker, pail hook and 3/4" hose thread on spout. Unit to be complete with hose and hose bracket, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges. Provide 760 mm of 12 mm diameter plain end reinforced hose, hose clamp and mop hanger. Provide stainless steel bumper guards.

.3 Provide and install check valves on hot and cold supply risers.

.4 Design is based on the following: Bowl - Fiat MSB2424, Spout: Fiat 830-AA, Hose and Bracket - Fiat 832AA, Mop Hangar - Fiat 889-CC, Bumper Guards - Fiat E-88-AA.

3 Execution

3.1 INSTALLATION

.1 Install each fixture that is to be operational with its own trap, easily removable for servicing and cleaning. At completion thoroughly clean plumbing fixtures and equipment.

.2 Provide chrome plated rigid or stainless steel flexible supplies to fixtures that are to be operational complete with screwdriver stops, reducers and escutcheons.

.3 Install wall mounted lavatories, urinals and water closets with approved wall carriers, model to suit installation.

.4 Mount fixtures above finished floor as noted on Architectural drawings.

.5 Install hose and faucets and hose connections with vacuum breakers.

.6 Mounting heights:

.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified by architect.

.2 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.

3.2 PLUMBING FIXTURE ROUGH-IN SCHEDULE

.1 Rough-in fixture piping connections in accordance with the following table of minimum sizes or as required for particular fixtures:

	Hot Water	Cold Water	Waste	Vent
Sink	12 mm (½")	12 mm (½")	38 mm (1-1/2")	32 mm (1-1/4")
Mop Sink	19 mm (3/4")	19 mm (3/4")	50 mm (2")	38 mm (1-1/2")

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:

.1 Aerators or laminar flow control: operation, cleanliness.

.2 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls:

.1 Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 The supply and installation of Plumbing Fixtures and Trim.

.2 Products Installed but not Supplied Under this Section:
- .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
- .2 Equipment installed by others.
  - .1 Connect with unions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
- .1 CAN/CSA-B45 Series-02, Plumbing Fixtures.
- .2 CAN/CSA-B125-01, Plumbing Fittings.
- .3 CAN/CSA-B651-95(R2001), Barrier-Free Design.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Closeout Submittals:
- .1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity, material, water consumption and details of all items noted under specification..
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

1.4 GENERAL REQUIREMENTS

.1 Provide new fixtures, CSA approved, free from flaws and blemishes with finished surfaces clear, smooth and bright.

.2 Provide CSA approved plumbing fittings. Visible parts of fixture brass and accessories shall be heavily chrome plated.

.3 Fixtures shall be product of one manufacturer. Fittings of same type shall be product of one manufacturer.

.4 Protect fixtures against use and damage during construction.

1.5 JOB CONDITIONS

.1 Check millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

2.2 SHOWER SH-1 (Standard Shower)

.1 Cabinet: Acrylic finish reinforced fibreglass shower, one piece seamless unit with smooth rounded corners, integrated shelves and without cap. Complete with centre drain and textured floor. Shower shall not exceed 1065 mm (41-7/8") x 890 mm (35") and a height of 1830mm (72"). Colour - White.

.2 Trim: Concealed in-wall single lever pressure balancing mixing valve control, polished chrome plated metal trim, integral stops and checks, and vandal resistant metal lever handle; combination integral diverter and adjustable stop screw to limit handle turn. Wall-mounted shower head with arm and flange, and polished chrome plated finish. Wall/hand shower with flexible metal hose, in-line vacuum breaker, wall connection and flange, 30" slide bar for hand shower mounting. Volume control - 7.6 LPM flow control. Unit to be vandal resistant. Trim to have 5-year warranty in commercial installation. Shower trim to mounted such that there is a minimum 1830mm (6') clearance below bottom edge of discharge head.

.3 Design based on: Cabinet – MAAX SS42, Trim - Symmons - Temptrol 96-500-B30-L-V-2.0-X-CHKS-VP

2.3 SHOWER SH-2 (Security Shower)

.1 Cabinet: Refer to Architectural.

.2 Shower Trim:

.1 Shower system shall be complete with shower head, push button actuator and remote valve installed in service space above shower room.

.2 Shower panels shall be fabricated from 14 gauge, type 304 stainless steel and shall have a satin finish. Trim shall be stainless steel or chrome-plated brass. Shower valve shall be Air-Control, metering, nonhold open type. Fixture shall be furnished with necessary fasteners for proper installation.

.3 Shower is arranged to be installed on finished wall. Back of shower is provided with anchor tappings. Fixture is fabricated from 14 gauge, type 304 stainless steel with a satin finish.

.4 Shower Head - chrome plated brass and vandal-resistant. The nozzle is threaded into the body and then locked into place by a set screw from the rear. The spray pattern can only be changed by use of an allen wrench inserted through the nozzle. Unit shall have penal locakable up/down ball joint

.5 Valve - pneumatically operated, pushbutton Air-Control valve using atmospheric air. Hemispherical pushbutton is vandal-resistant and requires less than 5 pounds to activate valve. Valve is metering, non-hold open type. Valve timing is adjustable from 5 to 60 seconds. Valve to be single temperature with 1.6 GPM flow control and can be remotely located up to 10 feet from the operating pushbutton. Valve conforms with lead free requirements of NSF61, Section 9, 1997.

.6 Provide and install the remote electronic modular valve controller system using low voltage, 24 VAC power. Unit to be complete with transformer for 120 VAC to 24 VDC. Provide a solenoid valve made with non-corrosive wet parts. Stainless steel fixture pushbutton shall be vandal resistant and shall pneumatically actuate the Modular Valve Controller, with no electrical impulse at the pushbutton. Valve timing/lockout cycle shall have 10 preset intervals ranging from 1 second to 9 minutes, easily adjustable with a knob. Modular Valve Controller shall have colored lights to indicate system is functioning and permit easy trouble shooting.

.3 Design based on: Shower Panel – Acorn Penal-Ware 1743-MVC1-F1.6-MT-SW-PZZ-PBH

3. Execution

3.1 INSTALLATION

.1 Install each fixture that is to be operational with its own trap, easily removable for servicing and cleaning. At completion thoroughly clean plumbing fixtures and equipment.

.2 Provide chrome plated rigid or stainless steel flexible supplies to fixtures that are to be operational complete with screwdriver stops, reducers and escutcheons.

.3 Mounting heights:
- .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified by architect.
- .2 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.
- .3 Fixed shower heads shall be installed 1800mm (6') above shower basin, measured from basin to underside of discharge.

3.2 PLUMBING FIXTURE ROUGH-IN SCHEDULE

.1 Rough-in fixture piping connections in accordance with the following table of minimum sizes or as required for particular fixtures:

	Hot Water	Cold Water	Waste	Vent
Shower	19 mm (3/4")	19 mm (3/4")	50 mm (2")	38 mm (1-1/4")

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:
- .1 Adjust water flow rate to design flow rates.
- .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:
- .1 Aerators or Laminar Flow Control: operation, cleanliness.
- .2 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls:
- .1 Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

1. General

1.1 SECTION INCLUDES

.1 Domestic Booster Variable Speed Pumping Package
.2 Pump Control Panel
.3 Variable Frequency Drive
.4 Sensor Transmitters
.5 Sequence of Operation

1.2 REFERENCES

.1 ASHRAE 90A - Energy Conservation in New Building Design.
.2 AWWA - American Water Works Association
.3 ANSI - American National Standards Institute
.4 ASTM - American Standards for Testing Materials
.5 HI - Hydraulic Institute
.6 ASME - American Society of Mechanical Engineers
.7 UL - Underwriters Laboratories
.8 ISO - International Standards Organization
.9 NEMA - National Electrical Manufacturers Association
.10 ETL - Electrical Testing Laboratories
.11 CSA - Canadian Standards Association
.12 NEC - National Electrical Code
.13 IEC - International Electrotechnical Commission
.14 NSF - NSF International

1.3 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data:
  .1 System profile analysis including variable speed pump curves and system curve. The analysis shall also include pump, motor, job specific load profile, staging points and VFD efficiencies horsepower and kilowatt/hour consumption.
  .2 Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
  .3 Provide electrical characteristics and connection requirements.

.3 Shop Drawings:
  .1 Indicating dimensions, required clearances and location and size of each field connection.
  .2 Power and control wiring diagrams.

1.4 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

1.5 CLOSEOUT SUBMITTALS

.1 Section 01 78 10: Submission procedures.

.2 Record Documentation: Record actual locations of components.

.3 Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

.4 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 certification requirements.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 10 years documented experience.

.3 The pumping package shall be assembled by the pump manufacturer. An assembler of pumping systems not actively engaged in the design and construction of centrifugal pumps shall not be considered a pump manufacturer. The manufacturer shall assume "Unit Responsibility" for the complete pumping package. Unit responsibility shall be defined as responsibility for interface and successful operation of all system components supplied by the pumping system manufacturer.

.4 All functions of the variable speed pump control system shall be tested at the factory prior to shipment

.5 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

.6 The pumping package shall be certified by an approved independent testing and certification organization as being compliant with the requirements of NSF/ANSI 61 for potable drinking water and NSF-61 Annex G for low lead content.

.7 Manufacturer shall be listed by UL as a manufacturer of packaged pumping systems under UL/cUL category QCZJ.

.8 Manufacturer shall be listed by UL as a manufacturer of control panels under UL 508A.

.9 The manufacturer's production facility shall be certified by an approved independent testing and certification organization as being compliant with the requirements of NSF/ANSI 61 and NSF-61 Annex G. The manufacturing facility shall be subjected to periodic inspections and audits.

1.7 DELIVERY, STORAGE, AND PROTECTION

.1 Section 01 61 00: Transport, handle, store, and protect products in strict accordance with manufacturer’s requirements.

.2 Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 WARRANTY

.1 Section 01 78 10: Warranties.

2 Products

2.1 MANUFACTURED UNITS

.1 Furnish and install as shown on the plans a Variable Speed System, refer to Equipment Schedule for performance. Suction and discharge headers shall be 6.0 in and constructed of 304 series stainless steel.

.2 Manufacturer shall be listed by Underwriters Laboratories as a manufacturer of packaged pumping systems.

.3 The entire pumping package shall be NSF/ANSI/NSF-61 certified for potable drinking water and NSF-61 Annex G for a wetted area, weighted average lead content =0.25%.

.4 The control system shall include, as a minimum, the programmable logic station controller, variable frequency drives, a manifold mounted 4-20mA pressure transducer and any additional equipment as specified or as required to properly execute the sequence of operation.

.5 System shall require only suction, discharge and drain connections and single point power connections with service entrance disconnect functionality.

.6 All components shall be mounted and shipped as a single unit.

.7 The discharge of each pump shall be fitted with a control valve appropriate for station operation. Each pump and discharge valve assembly shall also be equipped with isolation valves so that the pump can be serviced while system is still filled.

.8 Pressure gauges shall be installed on the suction and discharge headers.

.9 Piping shall be sized so that water velocity shall not exceed 10.0 ft/sec in either the branches or manifolds.

.10 Pumps shall be protected from thermal accumulation via individual thermal relief mechanisms.

2.2 VARIABLE SPEED PUMP LOGIC CONTROLLER

.1 Design is based on The Technologic 1500 pump logic controller

.2 Controller shall be listed by and bear the label of Underwriter's Laboratory, Inc. (UL/cUL). The controller shall be specifically designed for packaged pressure booster applications.

.3 The pump logic controller shall be microcomputer based and hold its software in non-volatile memory. On-line field modified data entries, such as stage point, alternation, serial communication, and sensor setup, as a minimum, shall be stored in flash memory with capability to prevent accidental loss of data due to voltage surge or spike. In the event of a complete power outage, all factory preset or last saved data values remain stored and available for recall by the operator.

.4 The variable speed pump controller shall function to a proven program that safeguards the pumps/system against damaging hydraulic conditions including:

.1 Motor Overload
.2 Pump Flow Surges
.3 Hunting
.4 Integral Curve Limiting Feature: The pump logic controller shall automatically protect the system from overload through frequency/current optimization.
.5 End of Curve Protection: The pump logic controller through a factory pre-programmed algorithm shall be capable of protecting the pumps from hydraulic damage due to operation beyond their published end-of-curve. This feature requires an optional flow meter for activation.

.5 The pump logic controller shall be capable of accepting individual analog inputs from zone sensor/transmitters as indicated on the plans. Analog input resolution shall be 12-bit minimum, and the controller shall scan each analog input a minimum of once every 100 milliseconds. Use of a multiplexer for multiple sensor inputs is not acceptable. All

sensor/transmitter inputs shall be individually wired to the pump logic controller for continuous scan and comparison function. All analog inputs shall be provided with current limit circuitry to provide short circuit protection and safeguard against incorrect wiring of sensors.

.6 Hydraulic stabilization program shall utilize a proportional-integral-derivative control function. The proportional, integral and derivative values shall be user-adjustable over an infinite range. The scan and compare rate that selects the command set point and process variable signal shall be continuous and automatically set for optimum performance. Each sensor shall be scanned at least once every 100 milliseconds.

.7 The pump logic controller shall be self-prompting. All messages shall be displayed in plain English.
The following features shall be provided: Multi-fault memory and recall On-screen help functions LED pilot lights and switches Soft-touch membrane keypad switches.

.8 The variable speed pumping controller shall be provided with a user friendly operator interface complete with membrane switches and numeric keypad. Display shall be no less than four lines with each line capable of displaying up to twenty characters. The human interface panel shall display the following values:
.1 Pump On/Off Status
.2 Pump % Speed
.3 Individual Alarm Conditions
.4 Troubleshooting Diagnostics
.5 User-adjustable parameters such as alternation, PID, set points, etc.

.9 The system shall utilize the QuickStart feature to simplify programming and startup of the pump control system. The feature shall be specific to pump systems and use suitable pump terminology.

.10 A data-logging feature shall be provided as a function of the pump logic controller. The Alarm log shall include the last 40 alarms with date/time stamp. The Pump data log shall display individual pump run timers and pump cycle counters. A Signal log shall be provided to display the maximum and minimum values with date/time stamps for each process variable.

.11 The Logic controller shall incorporate a Flash Memory for saving and reloading customized settings.
These field determined values shall be permanently retained in Flash memory for automatic reloading of the site specific setup values in the event of data corruption due to external disturbances. The Controller shall also employ a sensor setup copy feature.

.12 The pump controller shall be capable of communicating with the Energy Managment Control System (EMCS) by both hard-wired and serial communications. The following communication features shall be provided to the BAS in hardwired form via 4-20ma analog output signals and digital input/outputs:
.1 Remote system start/stop (dry contact supplied by EMCS).
.2 General Alarm (qty. 1, relay output from pump controller).
.3 Process variable or VFD speed (qty. 1 4-20ma analog output supplied by pump controller).
.4 System on/off status (qty. 1 relay output supplied by pump controller)

.13 The following communication features shall be provided to the EMCS via an onboard RS-485 port utilizing a protocol compatible with the winning EMCS contractor (either LonWorks or Ethernet):
.1 All sensor process variables
.2 Individual zone setpoints
.3 Individual pump failure

.4 Individual pump on/off status
.5 Individual VFD on/off status
.6 VFD speed
.7 Individual VFD Failure
.8 Individual sensor failure

.14 Enclosure shall be NEMA 1 with NEMA 4 operator interface.

2.3 VARIABLE FREQUENCY DRIVE

.1 The Drive shall be rated to operate from 3-phase power as indicated in Equipment Schedule, +10%
/-15%, 48Hz to 63Hz. The drive shall employ a full wave rectifier to prevent input line notching and operate at a fundamental (displacement) input power factor of 0.98 at all speeds and nominal load. The drive efficiency shall be 98% or better at full speed and load. An internally mounted AC line reactor or DC choke shall be provided to reduce input current harmonic content, provide protection from power line transients such as utility power factor correction capacitor switching transients and reduce RFI emissions. When a DC choke is utilized it shall be of swinging choke design to mitigate harmonics substantially more than conventional choke designs and shall provide equivalent to 5% impedance. Refer to Section 23 05 14 Variable Frequency Drives.

.2 The VFD, including all factory-installed options, shall have UL and cUL approval.

.3 Enclosure shall be NEMA 1 ventilated for installation as a wall mounted or freestanding unit, depending on the amp rating. Drive shall be equipped with an integrated fusible disconnect switch, pad lockable in the open position for safety during maintenance, and fuses to protect against ground faults.

.4 VFD shall utilize a full wave rectifier to convert three phase AC to a fixed DC voltage. Power factor shall remain above 0.98 regardless of speed or load. VFD's employing power factor correction capacitors shall not be acceptable.

.5 An internal line reactor (5% impedance) shall be provided to lower harmonic distortion of the power line and to increase the fundamental power factor.

.6 The VFD shall be suitable for elevations to 3300. ft above sea level without derating. Maximum operating ambient temperature rating shall not be less than 104 deg F. VFD shall be suitable for operation in environments up to 95% non-condensing humidity.

.7 The VFD shall be capable of displaying the following information in plain English via an alphanumeric display:
.1 Output Frequency
.2 Output Voltage
.3 Motor Current
.4 Kilowatts per hour
.5 Fault identification with text
.6 Percent torque
.7 Percent power
.8 RPM

.8 The VFD shall have the ability to automatically restart after an over-current, overvoltage, under- voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable.

.9 Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.

.10 Operator Control Panel (Keypad)

.1 Each VFD shall be equipped with a front mounted operator control panel (keypad) consisting of a backlit, alphanumeric, graphic display and a keypad with keys for Start/Stop, Local/Remote, Up/Down and Help. Two (2) Softkeys will be provided which change functionality depending upon the position within the parameter hierarchy or state of panel.

.2 All parameter names, fault messages, warnings and other information shall be displayed in complete English words or Standard English abbreviations to allow the user to understand what is being displayed without the use of a manual or cross-reference table.

.3 The Display shall have contrast adjustment provisions to optimize viewing at any angle.

.4 The control panel shall provide a real time clock for time stamping events and fault conditions.

.5 The control panel shall include a feature for uploading parameter settings to control panel memory and downloading from the control panel to the same Drive or to another Drive.

.6 All Drives throughout the entire power range shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating.

.7 The keypad shall be able to be installed or removed from the drive while it is powered, capable of remote mounting, and shall have its own non-volatile memory.

.11 Protective Functions

.1 For each programmed warning and fault protection function, the Drive shall display a message in complete English words or Standard English abbreviations. The three (3) most recent fault messages along with time, current, speed, voltage, frequency and DI Status shall be stored in the Drive's fault history. The last ten (10) fault names shall be stored in Drive memory.

.2 The Drive shall include internal MOV's for phase to phase and phase to ground line voltage transient protection.

.3 Output short circuit withstand rating and ground fault protection rated for 100,000 AIC shall be provided per UL508C without relying on line fuses. Motor phase loss protection shall be provided.

.4 The Drive shall provide electronic motor overload protection qualified per UL508C.

.5 Protection shall be provided for AC line or DC bus overvoltage at 130% of maximum rated or under voltage at 65% of min. rated and input phase loss.

.6 A power loss ride through feature will allow the Drive to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.

.7 Output short circuit withstand rating and ground fault protection rated for 100,000 AIC shall be provided per UL508C without relying on line fuses. Motor phase loss protection shall be provided.

.8 The Drive shall provide electronic motor overload protection qualified per UL508C.

.9 Protection shall be provided for AC line or DC bus overvoltage at 130% of maximum rated or under-voltage at 65% of min. rated and input phase loss.

.10 A power loss ride through feature will allow the Drive to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.

.12 Electrical

.1 Pump Logic Controller Enclosure. Main station disconnect shall have a through door operator and shall be sized as shown in the technical data sheet. Individual integrated fusible drive disconnects shall have exterior operators, and shall be sized as shown in the technical data sheet. Station disconnect panel shall be housed in a NEMA 1 enclosure with integral latches. The control enclosure shall be constructed of 14-gauge steel and the back plate assembly shall be constructed of 14-gauge steel.

.2 Controls and Enclosure. The control panel with controls shall be built in accordance with NEC, and shall comply with UL standards. Pump station manufacturer shall be authorized under UL508A to manufacture its own control panels. All equipment and wiring shall be mounted within the enclosure and each device shall be labeled with proper identification. All adjustments and maintenance shall be accessible from the front of the control enclosure. A complete wiring circuit diagram and legend with terminals, components, and wiring completely identified shall be provided. Main disconnect shall be interlocked with door.

.13 Sensor / Transmitters

.1 Pressure transducer shall be utilized for providing all pressure signals for the pump control logic. Pressure transducer shall be a solid-state bonded strain gage type with an accuracy of < ±0.5% BFSL and constructed of 316 stainless steel. Transducer shall be rated for a pressure of 300 psi and shall provide gauge pressure output, rather than an absolute. Pressure transducer constructed of plastic is not acceptable. Pressure transducer shall be 4-20mA analog type with 10-28 VDC supply range and utilize a packard type connector to prevent moisture intrusion.

.14 Variable Speed System Sequence of Operation

.1 The system shall consist of a pump logic controller with multi-pump parallel operation control, duty-standby pump selection, automatic alternation and automatic transfer to the standby pump upon pump/VFD failure.

.2 The pumping system shall start upon the closure of customer's contact when the pump logic controller Mode of Operation is in REMOTE.

.3 When the pump logic controller mode in LOCAL, the pumping system shall operate automatically.

.4 Each sensor/transmitter shall send a 4-20mA signal to the pump logic controller, indicative of process variable condition.

.5 When the set point is satisfied by the process variable, the pump speed shall remain constant at the optimum energy consumption level.

.6 The pump controller shall automatically start the lag pumps as necessary to satisfy system demand.

.7 As demand is satisfied, the controller shall automatically stop lag pumps as necessary to conserve energy.

.8 In the event of a pump failure or a VFD fault, the pump logic controller automatically initiates a timed sequence of operation to start the redundant pump/VFD set in the variable speed mode.

.9 In the event of the failure of a zone sensor/transmitter, its process variable signal shall be removed from the scan/compare program. The redundant zone sensor/transmitters, if available, shall remain in the scan/compare program for control.

.10 PUMP or VFD fault shall be continuously scrolled through the display on the operator interface of the pump logic controller until the fault has been corrected and the controller has been manually reset.

.11 When the system is satisfied, the pump controller shall shut down the single running lead pump and enter energy saving / no flow shutdown mode.

2.4 STATION FRAME

.1 The pump station frame shall be designed and fabricated to provide structural support for all attached equipment, and provide anchor bolt support. The base shall supply sufficient rigidity to withstand the stresses of reasonable and competent transportation to site, off loading, installation, and operation.

2.5 PIPING

.1 All piping shall be constructed from 304 stainless steel, schedule 10 or heavier pipe as required to maintain a 3 to 1 pressure safety factor (including 0.062 in corrosion allowance).

2.6 ISOLATION VALVES

.1 Ball Valves

.1 Isolation ball valves shall be certified to NSF-61 for use with potable drinking water.

.2 Isolation ball valves shall be certified as low lead having wetted surface area with a weighted average lead content<0.25%.

.3 Valves shall be rated for 600.0 psi g WOG / 150.0 psi g WSP for valves 0.25 in to 2.0 in and 400.0 psi g WOG / 125.0 psi g WSP for valves 2.5 in to 4.0 in.

.4 Seats and stem packing shall be virgin PTFE. Stem shall be bottom loaded blowout proof design with fluorocarbon elastomer O-ring to prevent stem leaks.

.5 Valves shall be 2-piece full port design.

.2 Grooved Butterfly Valves

.1 Valves shall be certified to NSF-61 for use with potable drinking water.

.2 Valve bodies shall be investment cast C8FM to ASTM A743 with integral neck and ISO mounting top.

.3 Valve handle shall be a 304 stainless steel.

.4 The disc shall be a dual-seal type, encapsulated either with Gr. E EPDM for cold and hot water services.

.5 Valves shall be rated for 300.0 psi g CWP

.3 Lug Style Butterfly Valve

.1 Valve shall be certified to NSF-61 for use with potable drinking water.

.2 Valve body shall be made of ASTM 536 ductile iron and will be coated with an FDA approved epoxy. Valve face to face dimensions shall comply with API 609 and MSS-SP-67.

.3 Disc shall be made of ASTM A-351 stainless steel. Shaft shall be made of 316SS.

.4 Bushing shall be made of a Teflon®-Darcon inner liner bonded to fiberglass-epoxy resin outer shell.

.5 Seat shall be EPDM.

.6 Valve shall be rated to 200.0 psi g WOG.

2.7 CHECK VALVES

.1 Threaded Check Valves

.1 All valve metallic components shall be 316SS.

.2 Seat shall be Viton.

.3 Valve shall be rated for 400.0 psi g WOG.

.2 Wafer Check Valves

.1 The valve body shall be constructed of ASTM A126 Class B cast iron for Class 125/150 and Class 250/300 valves.

.2 The seat and disc shall be ASTM B584 Alloy C83600 cast bronze or ASTM B148 Alloy C95200 aluminum bronze.

.3 The compression spring shall be ASTM A313 Type 316 Stainless Steel with ground ends.

.4 Valve interiors and exteriors shall be coated with an NSF/ANSI-61 certified fusion bonded epoxy in accordance with AWWA C550.

.5 The exterior of the valve shall be coated with a universal alkyd primer.

.6 The valve design shall incorporate a center guided, spring loaded disc, guided at opposite ends and having a short linear stroke that generates a flow area equal to the nominal valve size.

.7 The operation of the valve shall not be affected by the position of installation. The valve shall be capable of operating in the horizontal or vertical positions with the flow up or down.

.8 All component parts shall be field replaceable without the need of special tools. A replaceable guide bushing shall be provided and held in position by the spring. The spring shall be designed to withstand 100,000 cycles without failure and provide a cracking pressure of 0.5 psi g.

.9 The valve disc shall be concave to the flow direction providing for disc stabilization, maximum strength, and a minimum flow velocity to open the valve.

.10 The valve disc and seat shall have a seating surface finish of 16 micro-inch or better to ensure positive seating at all pressures. The leakage rate shall not exceed the allowable rate for metal seated valves allowed by AWWA Standard C508 or 1 oz (30 ml) per hour per inch (mm) of valve diameter.

.11 The valve flow way shall be contoured and unrestricted to provide full flow areas at all locations within the valve. Cv flow coefficients shall be equal to or greater than specified below and verified by an independent testing laboratory.

Valve Size	Wafer Style Cv
50 (2")	43
65 (2.5")	88
75 (3")	130
100 (4")	228
150 (6")	350

.12 The valves shall be hydrostatically tested at 1.5 times their rated cold working pressure and seat tested at the valve CWP

2.8 PRESSURE GAUGES

.1 Gauges shall be provided for the suction and discharge manifold.

.2 Accuracy shall be ±1.5%

.3 Bourdon tube and connection shall be constructed of 316SS.

.4 Case, bezel and internals shall be constructed of 316SS.

.5 Gauge shall be filled with glycerin in order to dampen pulsation and vibration and to provide lubrication to the internal parts.

.6 Gauge range shall be selected to cover the largest operating range for the specific conditions and pump selected.

2.9 FLANGE BOLTS

.1 Bolts shall be zinc plated and shall meet ASTM Grade A193 B7.

2.10 FINISH

.1 The finish coat shall be acrylic enamel to a thickness of no less than 3 mils.

3 Execution

3.1 INSTALLATION

.1 Install equipment in accordance with manufacturer's instructions.

.2 The contractor shall align the pump and motor shafts to within the manufacturer's recommended tolerances prior to system start-up.

.3 Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per manufacturer's instructions and applicable state, federal and local codes.

.4 Control wiring for remote mounted switches and sensor / transmitters shall be the responsibility of the controls contractor. All wiring shall be performed per manufacturer's instructions and applicable state, federal and local codes.

.5 Pumps:
- .1 Provide air cock and drain connection on horizontal pump casings.
- .2 Support piping adjacent to pump such that no weight is carried on pump casings.
- .3 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

3.2 DEMONSTRATION

.1 The system manufacturer or factory trained representative shall provide start-up of the packaged pumping system. This start-up shall include verification of proper installation, system initiation, adjustment and fine tuning. Start-up shall not be considered complete until the sequence of operation, including all alarms, has been sufficiently demonstrated to the owner or owner's designated representative. This job site visit shall occur only after all hook-ups, tie-ins, and terminations have been completed and signed-off on the manufacturer's start-up request form.

.2 The system manufacturer or factory trained representative shall provide on-site training for owner's personnel. This training shall fully cover maintenance and operation of all system components.

.3 The system manufacturer must have a complete pressure booster training program available for owner's personnel. The training sessions shall take place at the manufacturer's facility and cover all aspects of pressure booster system design, service and operation.

3.2 START-UP SERVICE

.1 When discharge piping, electrical connections, and electrical inspection have been completed, the pump station representative shall be contacted for start up. A minimum two-week notice shall be given to manufacturer representative prior to scheduled start up date. During start up, the complete pumping system shall be given a running test of normal start and stop, and fully loaded operating conditions. During this test, each pump shall demonstrate its ability to operate without undue vibration, or overheating, and shall demonstrate its general fitness for service. All defects shall be corrected and adjustments shall be made to the pumping station for satisfactory operation. System problems or concerns will be corrected by the general contractor or site station staff, in conjunction with the appropriate factory representative. Testing shall be repeated until satisfactory results are obtained, as determined by the engineer. Start up assistance will be provided by the factory representative as required to complete start-up and commissioning.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Use of mechanical systems during construction.

1.2 USE OF SYSTEMS

.1 Use of new permanent heating and ventilating systems for supplying temporary heat or ventilation is permitted only under following conditions and with the express written permission of Departmental Representative:
- .1 Entire system is complete, pressure tested, cleaned, flushed out.
- .2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.
- .3 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
- .4 There is no possibility of damage.
- .5 Supply ventilation systems are protected by 80% filters, inspected daily, changed every week or more frequently as required.
- .6 Return systems have approved filters over openings, inlets, outlets.
- .7 Systems will be:
  - .1 Operated as per manufacturer's recommendations and instructions.
  - .2 Operated by Contractor.
  - .3 Monitored continuously by Contractor.
- .8 Warranties and guarantees are not relaxed.
- .9 Regular preventive and other manufacturers recommended maintenance routines are performed by Contractor at own expense and under supervision of Departmental Representative.
- .10 Refurbish entire system before static completion; clean internally and externally, restore to "as- new" condition, replace filters in air systems.

.2 Filters specified in this Section are over and above those specified in other Sections of this project.

.3 Exhaust systems are not included in approvals for temporary heating ventilation.

.4 Contractor shall not assume at time of bidding that permission will be given to use permanent heating and/or ventilation systems.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.2 REGULATORY REQUIREMENTS

.1 Conform to ASME B31.9 - Building Services Piping.

.2 Contractor to supply shop drawings for all grooved end components. Do piping system work including hangers in accordance with ANSI B31.1. Install all grooved end components as per manufacturer's latest recommendations. All grooved joint couplings, fittings, valves and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

.3 All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.3 WELDING

.1 Welding materials and labour must conform to ASME Code and the Provincial Board of Labour Regulations.

.2 Use welders fully qualified and licensed by Provincial Authorities.

1.4 SUBMITTALS

.1 Submit shop drawings to requirements of Section 01 33 00.

.2 Submit shop drawings and product data for manufactured products and assemblies required for this project. Include data on pipe material, pipe fittings, valves and accessories.

.3 Shop drawings shall clearly indicate product description, make, model, dimensions, component sizes, rough-in requirements, location, type, size, service clearances, finishes, and pressure rating.

.4 Submit copies of valve "ordering schedule" for approval before ordering valves.

1.5 QUALITY ASSURANCE

.1 Domestic water, drainage and vent piping shall meet the requirements of the National Building Code and the Provincial and Municipal Codes.

.2 Automatic sprinkler system piping shall conform to the requirements of NFPA No. 13.

.3 Contractor to supply shop drawings for all grooved end components. Do piping system work including hangers in accordance with ANSI B31.1-1983. Install all grooved end components as per manufacturer's latest recommendations. All grooved joint couplings, fittings, valves and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

.4 All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

2 Products

2.1 PIPE

.1 Heating Water (to 110 Deg.C)

.1 Steel Pipe: ASTM A53 or A120, Schedule 40 Black, with malleable iron (1034 KpA) or forged steel welding type fittings (2065 KpA), screwed, grooved mechanical, or welded. For pipe sizes 300mm (12") and larger, wall thickness to be 9.5mm (3/8")

.2 Copper Pipe: Type L hard copper, with cast brass or wrought copper fittings, 95/5 solder.

.3 Polypropylene: Pipe shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389 or CSA B137.11. All pipe shall be made in an extrusion process. Hydronic hot water and heating piping shall contain a fibre layer (faser) to restrict thermal expansion. All pipe shall comply with the rated pressure requirements of ASTM F 2389 or CSA B137.11. Fittings: Fittings shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F2389. All pipe and fittings shall be certified by NSF International as complying with NSF 14, and ASTM F2389 or CSA B137.11. The pipe and fittings shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe system shall be plenum-rated with pipe wrapped and/or insulated with standard pipe insulation, field installed. The pipe wrap or insulation shall meet the requirements of CAN/ULC-S102.2-03 or ASTM E84. The system shall have a Flame Spread Classification of less than 25 and Smoke Development rating of less than 50. It is assumed pipe will be exposed to direct UV light and shall be provided with a Factory applied, UV-resistant coating or alternative UV protection. Pipe shall be rated for continuous operation of 215 psi gauge pressure at 120 deg.F (1482 kPa at 48.9 deg.C), 100 psi gauge pressure at 180 deg.F temperature (690 kPa at 82 deg.C) and 45 psi gauge at 200 deg.F temperature (310 kPa at 93.3 deg.C).

.2 Refrigerant Piping

.1 Copper Tubing: ASTM B280, Type ACR hard drawn or annealed. Fittings: ASME B16.22 wrought copper. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 640 to 805 degrees (1190 to 1480 degrees F).

.3 Equipment Drains/Overflow

.1 Steel Pipe: ASTM A53 or A120, Schedule 40 galvanized, with galvanized cast iron or malleable iron fittings, screwed joints or grooved mechanical couplings.

.2 Plastic Pipe buried or crawlspace may be PVC Pipe: Schedule 40 or SDR 21 or 26, with PVC fittings, solvent weld or grooved mechanical joints.

.3 Plastic Pipe in ceiling space shall be fire rated PVC Pipe: Schedule 40 or SDR 21 or 26, with fire rated PVC fittings, solvent weld or grooved mechanical joints. Rating to meet 25/50 flame and smoke spread.

.4 Copper Pipe: Type L hard copper, with cast brass or wrought copper fittings, 95/5 solder.

.4 Sanitary Drainage and Vent (unburied)

.1 Cast iron pipe and fittings; hub-and spigot, neoprene gaskets; or hubless with neoprene gaskets and stainless steel clamp-and-shield assemblies.

.2 Type "M" or "DWV" copper with cast brass, or bronze or wrought copper fittings; 95/5 solder joints or grooved mechanical.
.3 Plastic PVC-XFR-15/50 or CPVC pipe and fittings; solvent weld joints or grooved mechanical. Plastic pipe to be plenum rated.

.5 Water Piping (buried)
.1 Copper tubing type K annealed; wrought copper fittings 95/5 solder or silver braze joints.
.2 Plastic "BLUE BRUTE" pipe and fittings; solvent weld joints.
.3 All piping and fitting shall be rated to a minimum of 1034 kPa (150 PSI)

.6 Water Piping (unburied)
.1 Type L hard copper; with cast brass or wrought copper fittings; 95/5 solder joints.
.2 Stainless steel pipe, Schedule 10; grooved mechanical.
.3 Cross Linked Polyethylene (PEX) pipe, mechanical joints.
.4 Polypropylene (PP) with heat fused joints.

.7 Natural Gas Piping
.1 Steel pipe, Schedule 40 black. Fittings: Malleable iron 1034 kPa (150 PSI) threaded for pipe sizes under 50mm (2"). Fittings: forged steel welding fittings and welded joints for pipe sizes 50mm (2") and above.

.8 Use factory fabricated butt welded fittings for welded steel pipes.

.9 Use long radius elbows for steel and cast iron water piping.

3 Execution

3.1 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and unions or flanges (as indicated) for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.3 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve complete with isolation at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to nearest floor drain where indicated. Discharge to be visible.

.4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 AIR VENTS

.1 Install manual air vents at high points in piping systems complete with isolation valve and u-bend copper tubing to allow discharge to bucket.

.2 Install automatic air valve at each air separator and where indicated.

.3 Install isolating valve at each automatic air valve.

.4 Install drain piping to approved location and terminate where discharge is visible.

3.5 DIELECTRIC COUPLINGS

.1 General: Compatible with system, to suit pressure rating of system.

.2 Locations: Where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: Isolating flanges.

3.6 ROUTE AND GRADES

.1 Route piping in orderly manner and maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls. Group piping wherever practical at common elevations. Install concealed pipes close to the building structure to keep furrings to a minimum.

.2 Slope water piping 25 mm in 12 m and arrange to drain at low points.

.3 On closed systems, equip low points with 20 mm drain valves and hose nipples. Provide, at high points, collecting chambers and high capacity float operated automatic air vents.

.4 Make reductions in water pipes with eccentric reducing fittings installed to provide drainage and venting.

.5 Grade horizontal drainage and vent piping 20 mm per meter minimum.

3.7 PIPEWORK INSTALLATION

.1 Screwed fittings jointed with Teflon tape.

.2 Protect openings against entry of foreign material.

.3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.
- .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .2 Do not project branch pipe inside the main pipe.

.6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.9 Install, except where indicated, to permit separate thermal insulation of each pipe.

.10 Provide clearance for proper installation of insulation and for access to valves, air vents, drains and unions. Valves to be complete with valve handle extensions where insulation is thicker than 25mm, extension to suit insulation thickness.

.11 Group piping wherever possible.

.12 Ream pipes, remove scale, welding slag and other foreign material, inside and outside before assembly.

.13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.14 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.

.15 Screw joint steel piping up to and including 38 mm . Weld piping 63 mm and larger, including branch connections. Screw or weld 50 mm piping.

.16 Make screwed joints with full cut standard taper pipe threads with red lead and linseed oil or other approved non-toxic joint compound applied to male threads only.

.17 Clamp cast iron water pipe at fittings with 20 mm rods and properly anchor and support.

.18 Use grooved mechanical couplings and mechanical fasteners in accessible locations, risers, pipe chases, and in other locations as approved by Departmental Representative. Use flexible couplings at pumps, coils and all vibration isolated equipment in lieu of flexible connectors, all other couplings to be rigid.
- .1 Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions.
- .2 The grooved coupling manufacturer's factory trained representative shall provide on-site training for Contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the job site and review Contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or job site visits.)

.19 Make connections to equipment and branch mains with unions or flanges, as indicated:
- .1 Unions are not required in installations using grooved mechanical joint couplings (The couplings shall serve as disconnect points.)

.20 Provide non-conducting type connections wherever jointing dissimilar metals in systems. Brass adaptors and valves are acceptable. Refer to dielectric couplings.

.21 Pressfit piping and fittings are not permitted.

.22 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.

.1 For mechanical pipe jointing systems, use adequate numbers of Victaulic Style 77 flexible couplings in header piping to accommodate thermal growth and contraction, and for the elimination of expansion loops. (In accordance with Victaulic instructions and as approved by the Departmental Representative.) Where expansion loops are required, use Victualic Style 77 couplings on the loops.

.23 Install piping material specified as inside the building to 2.4 meters outside of building unless indicated otherwise on Mechanical Drawings.

.24 Use of PVC or other plastic pipe allowed where approved by the authority having jurisdiction. Plastic pipe run in plenum spaces shall have flame and smoke rating for that purpose. All plastic pipe to be complete with ULC labelled intumescent fire stopping wherever penetrating fire separations. The piping shall be sealed at the penetration by a fire stop that has an F rating not less than the fire resistance rating required for the fire separation when subjected to the fire test method CAN/ULC-S115, “Fire Tests of Firestop Systems,” with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side. Combustible piping shall not be permitted in a vertical service space.

.25 Valves:

.1 Shall be flanged for steam and condensate 38 mm and larger.
.2 Install in accessible locations.
.3 Remove interior parts before soldering.
.4 Install with stems upright or horizontal, not inverted.
.5 Valves accessible for maintenance without removing adjacent piping.
.6 Install globe valves in bypass around control valves.
.7 Use ball valves up to 50 mm or butterfly valves 63 mm and larger at branch take-offs for isolating purposes except where otherwise specified.
.8 Install butterfly valves between weld neck flanges to ensure full compression of liner.
.9 Install ball valves for glycol service and domestic water.
.10 Use chain operators on valves NPS 2-1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.
.11 Install gate, ball and butterfly valves for isolating service, to isolate equipment, part of systems or vertical risers.
.12 Install globe, ball or angle valves for throttling service.
.13 Use plug cocks in water systems for throttling service. Use non-lubricated plug cocks only when shut-off or isolation valves are also provided.
.14 Use butterfly valves in fire protection systems where approved.
.15 Provide drain valves at main shut-off valves, low points of piping and apparatus.
.16 Valve operators to be complete with extensions on systems with insulation thicker than 25mm, extension to suit insulation thickness.

.26 Check Valves:

.1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and elsewhere as indicated.
.2 Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.

.27 Provide thermometers, thermometer wells, and sensor wells where thermometers are indicated on drawings and schematics.

.28 Provide plug cocks at all pressure tapping locations.

3.8 SLEEVES

.1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.

.2 Material: Schedule 40 black steel pipe.

.3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Installation:
- .1 Concrete, masonry walls, concrete floors on grade: Terminate flush with finished surface.
- .2 Other floors: Terminate 25 mm above finished floor.
- .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.6 Sealing:
- .1 Foundation walls and below grade floors: Fire retardant, waterproof non-hardening mastic.
- .2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.
- .3 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.
- .4 Ensure no contact between copper pipe or tube and sleeve.

3.9 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: One piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.

.3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.10 PREPARATION FOR FIRESTOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Firestopping.

.2 Uninsulated unheated pipes not subject to movement: No special preparation.

.3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.

.4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.11 FLUSHING OUT OF PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems. Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11- Cleaning supplemented as specified in relevant sections of Mechanical.

.2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections of Mechanical or to 1.5 times maximum operating pressure. All installed piping to be tested unless noted otherwise.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of Mechanical.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of Departmental Representative.

.6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Electrical motors, drives and guards for mechanical equipment and systems.
- .2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
- .3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22, 23 and 25. Refer to Division 26 for quality of materials and workmanship. Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
- .1 ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.2 Electrical Equipment Manufacturers' Association Council (EEMAC)

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Shop Drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan.

.3 Closeout Submittals
- .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial /Territorial regulations.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 GENERAL

.1 Motors: premium efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

.2 Must be inverter duty for all variable frequency drive applications.

.3 Must be CSA approved.

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 Motors 373 W (1/2 HP) and under: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.3 Motors 373 W (3/4 HP) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, 208V, unless otherwise indicated.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Departmental Representative for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.

.3 For motors under 7.5 kW (10 HP): standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW (10 HP) and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave determined during commissioning.

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

.8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;
- .1 Expanded metal screen welded to steel frame.
- .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
- .3 38 mm diameter holes on both shaft centres for insertion of tachometer.
- .4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.-

.5 Guard for flexible coupling:
- .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
- .2 Securely fasten in place.
- .3 Removable for servicing.

.6 Unprotected fan inlets or outlets:
- .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
- .2 Net free area of guard: not less than 80% of fan openings.
- .3 Securely fasten in place.
- .4 Removable for servicing.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Materials and installation for flexible connections, expansion joints, anchors and guides for building services piping.

.2 Sustainable requirements for construction, verification and operation.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM A53/A53M-02, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A105/A105M-03, Standard Specification for Carbon Steel Forgings, for Piping Applications.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit product data and indicate for items as applicable:

.1 Manufacturer, model number, line contents, pressure and temperature rating.

.2 Movement handled, axial, lateral, angular and the amounts of each.

.3 Nominal size and dimensions including details of construction and assembly.

.3 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.

.4 Data to include:

.1 Servicing requirements, including special requirements, stuffing box packing, lubrication and recommended procedures.

1.4 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 GENERAL REQUIREMENTS

.1 Verify, prior to installation, required anchors and expansion joints to adequately protect system.

.2 Base expansion calculations on -10 deg.C installation temperature to 100 deg.C for hot water heating and 60 deg.C for domestic hot water, plus 30% safety factor.

2 Products

2.1 FLEXIBLE LOOP EXPANSION JOINT (Manufactured)

.1 Construction to be 3 equal length sections of annular corrugated 321 / 304L stainless steel or bronze for models TFLBSW and TFLBHM close-pitch hose with stainless steel or bronze over-braid that will absorb or compensate for pipe movements in all 6 degrees of freedom (3 coordinate axes, plus rotation about those axes) simultaneously.

.2 The corrugated metal hose, braid(s), and a stainless steel ring-ferrule/band (material gauge not less than .048") must be integrally seal welded using a 100% circumferential, full penetration TIG welds. End fittings shall be selected per application. Fittings must be attached using a 100% circumferential TIG weld.

.3 Braided stainless steel Loops must be suitable for operating temperatures up to 850 degrees F (455 degrees C). Braided bronze Loops must be suitable for operating temperatures up to 400 degrees F (204 degrees C)

.4 Loop must be designed for pressure testing to 1.5 times their maximum rated working pressure and a minimum 4:1 (burst to working) safety factor.

.5 Each braided Loop shall be individually leak tested by the manufacturer using air-under-water and/or hydrostatic pressure.

.6 Loops shall be prepared for shipment in a method that maintains the manufactured length during shipping. Shipping supports must be removed prior to system start-up.

.7 Manufacturers approved hanger assembly kit shall be used to support and hang the Loop. The UL Listed Seismic Wire/Cable assemblies conform to the requirements of the ASCE (American Society of Civil Engineers) guidelines for structural applications of wire rope, in that the cable is pre-stretched and the permanent end fittings maintain the break strength of the cable with a safety factor of two.

.8 The pre-manufactured flexible loop shall be installed and guided following the manufacturer's published installation instructions. Specification is based on a product that does not require pipe guides. Manufactured loops that require pipe alignment guides shall use "Spider" type with outer housing ring affixed to building structure with rigid elements. Units shall be fabricated from carbon steel. Pipe hangers and/or roller supports shall not be considered acceptable for use as guides.

.9 The pre-manufactured flexible loop design shall be tested by an independent third party to confirm simultaneous movement in X, Y, and Z planes plus rotation about those axes. Third party testing will document and confirm motion capabilities of the device. Device testing to include large and irregular movements similar to movement that may be caused by seismic movement analytically using finite element modeling and computer simulation as well as physical testing of the device. Independent third party testing data and documentation are to be furnished upon the engineers request during pre-qualification process or at the time of submission.

.10 The pre-manufactured flexible loop shall meet the requirements of the 2009 International Building Code (IBC) and the American Society of Civil Engineers code requirements for Total Maximum Displacement and accidental torsion as directed in IBC Chapter 13 and ASCE 7-05, Chapter 17.1.2.

.11 When used for potable water (in copper tubing systems) product shall be third party tested and, listed (by a laboratory in compliance with all applicable requirements of ISO/IEC 17025) and marked in accordance with NSF/ANSI 61-2011.

.12 When used for potable water (in copper tubing systems) product shall be third party tested and, listed (by a laboratory in compliance with all applicable requirements of ISO/IEC 17025) and marked in accordance with Section 1417(d) of the Safe Drinking Water Act. Must meet the lead content requirements of Section 116875 of the California Health & Safety Code, and the criteria of NSF/ANSI 372 for low lead.

.13 When used for potable water (in steel piping systems) product shall be third party tested and, listed (by a laboratory in compliance with all applicable requirements of ISO/IEC 17025) and marked in accordance with NSF/ANSI 61-2011

.14 When used for potable water (in steel piping systems) product shall be third party tested and, listed (by a laboratory in compliance with all applicable requirements of ISO/IEC 17025) and marked in accordance with Section 1417(d) of the Safe Drinking Water Act. Must meet the lead content requirements of Section 116875 of the California Health & Safety Code, and the criteria of NSF/ANSI 372 for low lead.

.15 When used for potable water (in stainless steel piping systems) products shall be third party tested and, listed (by a laboratory in compliance with all applicable requirements of ISO/IEC 17025) and marked in accordance with NSF/ANSI 61-2011

.16 When used for potable water (in stainless steel piping systems) products shall be third party tested and, listed (by a laboratory in compliance with all applicable requirements of ISO/IEC 17025) and marked in accordance with Section 1417(d) of the Safe Drinking Water Act. Must meet the lead content requirements of Section 116875 of the California Health & Safety Code, and the criteria of NSF/ANSI 372 for low lead.

.17 Loop material shall reasonably match pipe material.

.18 Pre-Manufactured Loop must have a 5-year full replacement warranty when installed in accordance with all specifications and installation instructions as described in the Manufacturers Installation and Maintenance Instructions. If it is deemed that installation did not meet Manufacturers Installation and Maintenance requirements, then contractor shall be responsible for 5 year warranty.

.19 Specifications are based on the Tri-Flex series of product offered by Flex-Hose including models TFLBSW, TFLSMP, TFLSMN, TFLSVG, TFLSSMP6, TFLSSMN6 and TFLSSVG6.

2.2 GROOVED PIPE EXPANSION JOINTS

.1 Grooved end expansion joints for steel piping:
- .1 Packless, gasketed, slip expansion joints: 2400 kPa maximum working pressure, steel pipe fitting consisting of telescoping body and slip-pipe sections, PTFE modified polyphenylene sulfide coated slide section, with grooved ends. Suitable for axial end movement to 80 mm Victaulic Style 150.
- .2 Expansion joint consisting of a series of grooved end pipe nipples joined in tandem with Victaulic Style 77 flexible couplings. Total joint movement dependent on the number of couplings and nipples used. Victualic Series 155.

2.3 FLEXIBLE CONNECTION

.1 Application: to suit motion as indicated.

.2 Minimum length in accordance with manufacturer's recommendations to suit offset as indicated.

.3 Inner hose: bronze corrugated for copper pipe, inner hose stainless steel corrugated for steel pipe.

.4 Braided wire mesh bronze outer jacket, for copper pipe.

.5 Braided wire mesh stainless steel after jacket for steel pipe.

.6 Diameter and type of end connection: as indicated under Section 23 05 01.

.7 Operating conditions:
- .1 Working pressure: 1034 kPa minimum.
- .2 Working temperature: 232 degrees C minimum.
- .3 To match system requirements.

3 Execution

3.1 INSTALLATION

.1 Install expansion joints and flexible connections in accordance with manufacturer's instructions.

.2 Install pipe anchors and guides as indicated and required. Anchors to withstand 150% of axial thrust.

.3 Provide flexible pipe connectors on pipes connected to all equipment supported by vibration isolation and where shown on drawings and schematics.

.4 Provide structural work and equipment required to control expansion and contraction of piping, loops, pipe offsets, and swing joints and provide corrugated bellows type expansion joints where indicated or required.

.5 Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor at other end.

.6 Rigidly anchor pipe to building structure at points shown and where required, where necessary provide pipe guides so that movement takes place along axis of pipe.

.7 Three Victualic Style 77 couplings may be used in lieu of a flexible connector for vibration attenuation and stress relief. The couplings shall be placed in close proximity to the source of the vibration.

.8 Rigidly anchor pipe to building structure at points shown, and where necessary provide pipe guides so that movement takes place along axis of pipe only.

3.2 CLEANING AND START-UP

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

3.3 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01 - Performance Verification: Mechanical Piping Systems.

END OF SECTION

1 General

1.1 REFERENCES

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
- .1 ANSI/ASME B31.1-1998, Power Piping.
- .2 ANSI/ASME B31.3-2000, Process Piping Addenda A.
- .3 ANSI/ASME B31.3-2001, Process Piping Addenda B.
- .4 ANSI/ASME Boiler and Pressure Vessel Code-1998:
  - .1 Section I: Power Boilers.
  - .2 Section V: Nondestructive Examination.
  - .3 Section IX: Welding and Brazing Qualifications.

.2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
- .1 ANSI/AWWA C206-97, Field Welding of Steel Water Pipe.

.3 American Welding Society (AWS)
- .1 AWS C1.1-2000, Recommended Practices for Resistance Welding.
- .2 AWS Z49.1-1999, Safety Welding, Cutting and Allied Process.
- .3 AWS W1-2000, Welding Inspection Handbook..

.4 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-48.2-92, Spot Radiography of Welded Butt Joints in Ferrous Materials.

.5 Canadian Standards Association (CSA International)
- .1 CSA W47.2-M1987 (R1998), Certification of Companies for Fusion Welding of Aluminum.
- .2 CSA W48 series-01, Filler Metals and Allied Materials for Metal Arc Welding.
- .3 CSA B51-97, Boiler, Pressure Vessel and Pressure Piping Code.
- .4 CSA-W117.2-01, Safety in Welding, Cutting and Allied Processes.
- .5 CSA W178.1-02, Certification of Welding Inspection Organizations.
- .6 CSA W178.2-01, Certification of Welding Inspectors.

1.2 QUALIFICATIONS

.1 Welders
- .1 Welding qualifications in accordance with CSA B51.
- .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
- .3 Furnish welder's qualifications to Departmental Representative.
- .4 Each welder to possess identification symbol issued by authority having jurisdiction.
- .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.

.2 Inspectors
- .1 Inspectors qualified to CSA W178.2.

1.3 QUALITY ASSURANCE

.1 Registration of welding procedures in accordance with CSA B51.

.2 Copy of welding procedures available for inspection.

.3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

2 Products

2.1 ELECTRODES

.1 Electrodes: in accordance with CSA W48 Series.

3 Execution

3.1 WORKMANSHIP

.1 Welding: in accordance with ANSI/ASME B31.1, B31.3, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and applicable requirements of provincial authority having jurisdiction.

3.2 INSTALLATION REQUIREMENTS

.1 Identify each weld with welder's identification symbol.

.2 Backing rings:
- .1 Where used, fit to minimize gaps between ring and pipe bore.
- .2 Do not install at orifice flanges.

.3 Fittings:
- .1 NPS 2 and smaller: install welding type sockets.
- .2 Branch connections: install welding tees or forged branch outlet fittings.

3.3 INSPECTION AND TESTS - GENERAL REQUIREMENTS

.1 Review weld quality requirements and defect limits of applicable codes and standards with Departmental Representative before work is started.

.2 Formulate "Inspection and Test Plan" in co-operation with Departmental Representative.

.3 Do not conceal welds until they have been inspected, tested and approved by inspector.

.4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by Codes and as specified.

3.4 SPECIALIST EXAMINATIONS AND TESTS

.1 Hydrostatically test welds to requirements of ANSI/ASME B31.1.

.2 Visual examinations: include entire circumference of weld externally and wherever possible internally.

.3 Failure of visual examinations:
- .1 Upon failure of welds by visual examination, perform additional testing as directed by Departmental Representative of total of up to 10% of welds, selected at random by Departmental Representative by radiographic particle tests.

.4 Full radiographic tests for piping systems.
  .1 Spot radiography to CAN/CGSB-48.2.
    .1 Conduct spot radiographic tests of up to 10% of welds, selected at random by Departmental Representative from welds which would be most difficult to repair in event of failure after system is operational.
  .2 Radiographic film:
    .1 Identify each radiographic film with date, location, name of welder, and submit to Departmental Representative. Replace film if rejected because of poor quality.
  .3 Interpretation of radiographic films:
    .1 By qualified radiographer.
  .4 Failure of radiographic tests:
    .1 Extend tests to welds by welder responsible when those welds fails tests.

.5 Magnetic particle tests for piping systems.

3.5 DEFECTS CAUSING REJECTION

.1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

.2 In addition, chilled water systems:
  .1 Undercutting greater than 0.8 mm adjacent to cover bead on outside of pipe.
  .2 Undercutting greater than 0.8 mm adjacent to root bead on inside of pipe.
  .3 Undercutting greater than 0.8 mm at combination of internal surface and external surface.
  .4 Incomplete penetration and incomplete fusion greater than total length of 38 mm in 1500 mm length of weld depth of such defects being greater than 0.8 mm.
  .5 Repair cracks and defects in excess of 0.8 mm in depth.
  .6 Repair defects whose depth cannot be determined accurately on basis of visual examination or radiographic particle tests.

3.6 REPAIR OF WELDS WHICH FAILED TESTS

.1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Bronze - valves.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B1.20.1-1983 (R2001), Pipe Threads, General Purpose (Inch).
  .2 ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.

.2 American Society for Testing and Materials International, (ASTM).
  .1 ASTM A276-04, Specification for Stainless Steel Bars and Shapes.
  .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.
  .3 ASTM B283-99a, Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
  .4 ASTM B505/B505M-02, Specification for Copper-Base Alloy Continuous Castings.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  .1 MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
  .2 MSS-SP-80-2003, Bronze Gate Globe, Angle and Check Valves.
  .3 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
  .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
  .2 Submit data for valves specified in this section.

.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 MATERIALS

.1 Valves:
- .1 Except for specialty valves, to be single manufacturer.
- .2 All products to have CRN registration numbers.

.2 End Connections:
- .1 Connection into adjacent piping/tubing:
  - .1 Steel pipe systems: Screwed ends to ANSI/ASME B1.20.1.
  - .2 Copper tube systems: Solder ends to ANSI/ASME B16.18.
  - .3 Provide flanged ends as indicated under 23 05 05, Installation of Pipework.

.3 Lockshield Keys:
- .1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.

.4 Gate Valves:
- .1 Requirements common to gate valves, unless specified otherwise:
  - .1 Standard specification: MSS SP-80.
  - .2 Bonnet: union with hexagonal shoulders.
  - .3 Connections: screwed with hexagonal shoulders.
  - .4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
  - .5 Packing: non-asbestos.
  - .6 Handwheel: non-ferrous.
  - .7 Handwheel Nut: bronze to ASTM B62.
- .2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125
  - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
  - .2 Operator: Handwheel.
- .3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:
  - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
  - .2 Operator: Handwheel.
- .4 NPS 2 and under, rising stem, split wedge disc, Class 125:
  - .1 Body: with long disc guides, screwed bonnet.
  - .2 Disc: split wedge, bronze to ASTM B283, loosely secured to stem.
  - .3 Operator: Handwheel.
- .5 NPS 2 and under, rising stem, solid wedge disc, Class 125:
  - .1 Body: with long disc guides, screwed bonnet.
  - .2 Operator: Handwheel.
- .6 NPS 2 and under, rising stem, solid wedge disc, Class 150:
  - .1 Body: with long disc guides, screwed bonnet.
  - .2 Operator: Handwheel.

.5 Globe Valves:
- .1 Requirements common to globe valves, unless specified otherwise:
  - .1 Standard specification: MSS SP-80.
  - .2 Bonnet: union with hexagonal shoulders.
  - .3 Connections: screwed with hexagonal shoulders.
  - .4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.

.5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.
.6 Handwheel: non-ferrous.
.7 Handwheel Nut: bronze to ASTM B62.

.2 NPS 2 and under, composition disc, Class 125:
.1 Body and bonnet: screwed bonnet.
.2 Disc and seat: renewable rotating PTFE disc, composition to suit service conditions, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
.3 Operator: Handwheel.

.3 NPS 2 and under, composition disc, Class 150:
.1 Body and bonnet: union bonnet.
.2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
.3 Operator: Handwheel.

.4 NPS 2 and under, plug disc, Class 150, screwed ends:
.1 Body and bonnet: union bonnet.
.2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem.
.3 Operator: Handwheel.

.5 Angle valve, NPS 2 and under, composition disc, Class 150:
.1 Body and bonnet: union bonnet.
.2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.
.3 Operator: Handwheel.

.6 Check Valves:

.1 Requirements common to check valves, unless specified otherwise:
.1 Standard specification: MSS SP-80.
.2 Connections: screwed with hexagonal shoulders.

.2 NPS 2 and under, swing type, bronze disc, Class 125:
.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.3 NPS 2 and under, swing type, bronze disc:
.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.4 NPS 2 and under, swing type, composition disc, Class 200:
.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
.2 Disc: renewable rotating disc of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.

.5 NPS 2 and under, horizontal lift type, composition disc, Class 150:
.1 Body: with integral seat, union bonnet ring with hex shoulders, cap.
.2 Disc: renewable PTFE rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62.

.6 NPS 2 and under, vertical lift type, bronze disc, Class 125:
.1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.

.7 Silent Check Valves:
.1 NPS 2 and under:
.1 Body: cast high tensile bronze to ASTM B62 with integral seat.
.2 Pressure rating: Class 125.
.3 Connections: screwed ends to ANSI B1.20.1 and with hex shoulders.
.4 Disc and seat: renewable rotating disc.
.5 Stainless steel spring, heavy duty.
.6 Seat: regrindable.

.8 Ball Valves:
.1 NPS 2 and under:
.1 Body and cap: cast high tensile brass to C37700.
.2 Pressure rating: Class 150 WSP/600 WOG.
.3 Connections: Screwed ends to ANSI B1.20.1 and with hexagonal shoulders or solder ends to ANSI.
.4 Stem: tamperproof ball drive.
.5 Stem packing nut: external to body.
.6 Ball and seat: replaceable solid hard chrome full port ball and teflon seals.
.7 Stem seal: TFE with external packing nut.
.8 Operator: removable lever handle.

3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Remove internal parts before soldering.

.3 Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal. Refer to 23 05 05 - Installation of Pipework.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Valves, gate, globe, and check.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B16.1-1998, Cast Iron Pipe Flanges and Flanged Fittings.

.2 American Society for Testing and Materials International (ASTM).
  .1 ASTM A49-01, Specification for Heat-Treated Carbon Steel Joint Bars.
  .2 ASTM A126-95 (2001), Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  .3 ASTM B61-93, Specification for Steam or Valve Bronze Castings.
  .4 ASTM B62-93, Specification for Composition Bronze or Ounce Metal Castings.
  .5 ASTM B85-03, Specification for Aluminum-Alloy Die Castings.
  .6 ASTM B209-04, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  .1 MSS SP-70-1998, Cast Iron Gate Valves, Flanged and Threaded Ends.
  .2 MSS SP-71-1997, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
  .3 MSS SP-82-1992, Valve Pressure Testing Methods.
  .4 MSS SP-85-2002, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
  .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
  .2 Submit data for valves specified in this section.

.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 MATERIAL

.1 Valves:
- .1 Except for specialty valves, to be of single manufacturer.

.2 Standard specifications:
- .1 Gate valves: MSS SP-70.
- .2 Globe valves: MSS SP-85.
- .3 Check valves: MSS SP-71.

.3 Requirements common to valves, unless specified otherwise:
- .1 Body, bonnet: cast iron to ASTM B209 Class B.
- .2 Connections: flanged ends with 2 mm raised face with serrated finish to ANSI B16.1.
- .3 Inspection and pressure testing: to MSS SP-82.
- .4 Bonnet gasket: non-asbestos.
- .5 Stem: to have precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.
- .6 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.
- .7 Gland packing: non-asbestos.
- .8 Handwheel: Die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49. Nut of bronze to ASTM B62.
- .9 Identification tag: with catalogue number, size, other pertinent data.

.4 All products to have CRN registration numbers.

2.2 GATE VALVES

.1 NPS 2 1/2 - 8, non rising stem, inside screw, bronze trim, solid wedge disc:
- .1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly. Class 300.
- .2 Disc: solid offset taper wedge, bronze to ASTM B62.
- .3 Seat rings: renewable bronze to ASTM B62, screwed into body.
- .4 Stem: bronze to ASTM B62.
- .5 Disc: solid offset taper wedge, cast iron to ASTM A126 Class B, secured to wrought steel stem.
- .6 Seat: Integral with body.
- .7 Stem: wrought steel.
- .8 Operator: Handwheel.

.2 NPS 2 1/2-8, outside screw and yoke (OS&Y), bronze trim, solid wedge disc:
- .1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, yoke, yoke hub, yoke sleeve and nut. Class 300.
- .2 Disc: solid offset taper wedge, bronze to ASTM B62 up to NPS 3, cast iron with bronze disc rings on other sizes, secured to stem through integral forged T-head disc-stem connection.
- .3 Seat rings: renewable bronze screwed into body.
- .4 Stem: nickel-plated steel.
- .5 Disc: solid offset taper all-cast iron, secured to stem through integral forged T-head disc-stem connection.

.6 Seat rings: integral with body.
.7 Stem: nickel-plated steel.
.8 Pressure-lubricated operating mechanism.
.9 Operator: Handwheel.
.10 Bypass: complete with union and NPS globe valve as Section 23 05 05 - Installation of Pipework.

2.3 UNDERWRITERS APPROVED GATE VALVE

.1 NPS 2 1/2 - 14, OS&Y:
.1 Approvals: UL and FM approved for fire service.
.2 UL and FM Label: on valve yoke.
.3 Body, Bonnet: cast iron to ASTM A126 Class B. Wall thicknesses to ANSI B16.1 and ULC 262 (B).
.4 Bonnet bushing, yoke sleeve: bronze, to FM requirements.
.5 Packing gland: bronze.
.6 Stem: manganese bronze. Diameter to ULC C-262 (B).
.7 Stuffing box dimensions, gland bolt diameter: to ULC C-262 (B).
.8 Bosses for bypass valve, drain: on NPS 4 and over.
.9 Disc: solid taper wedge. Up to NPS 3: bronze. NPS 4 and over: cast iron with bronze disc rings.
.10 Disc seat ring: self-aligning, Milwood undercut on NPS 3 - 12.
.11 Pressure rating:
.1 NPS 2-1/2 - 12: 1.7 Mpa CWP.
.12 Operator: handwheel.
.13 Bypass: complete with union and NPS globe valve as Section 23 05 23.01 - Valves - Bronze.

2.4 GLOBE VALVES

.1 NPS 2 1/2 - 10, OSY:
.1 Body: with multiple-bolted bonnet, Class 300.
.2 WP: 860 kPa steam, 1.4 MPa CWP.
.3 Bonnet-yoke gasket: non-asbestos.
.4 Disc: bronze to ASTM B62, fully guided from bottom, securely yet freely connected to stem for swivel action and accurate engagement with disc.
.5 Seat ring: renewable, regrindable, screwed into body.
.6 Stem: bronze to ASTM B62.
.7 Operator: Handwheel.

2.5 BYPASSES FOR GATE AND GLOBE VALVES

.1 Locations: on valves as indicated.

.2 Position of bypass valve on main valves.

.3 Size of bypass valve:
.1 Main valve up to NPS 8: NPS 3/4.

.4 Type of bypass valves:
.1 On gate valve: globe, with composition disc, bronze trim, to Section 23 05 23.01 - Valves - Bronze. Pressure rating to match main valve.
.2 On globe valve: globe, with composition disc, bronze trim, to Section 23 05 23.01 - Valves - Bronze. Pressure rating to match main valve.

2.6 VALVE OPERATORS

.1 Install valve operators as follows:
- .1 Handwheel: on valves except as specified.
- .2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in boiler rooms and mechanical equipment rooms.

2.7 CHECK VALVES

.1 Swing check valves, Class 300:
- .1 Body and bolted cover: cast iron to ASTM A126 Class B with tapped and plugged opening on each side for hinge pin.
- .2 Flanged ends: 2 mm raised face with serrated finish.
- .3 Rating: 300 psi steam; 500 psi CWP.
- .4 Disc: rotating for extended life.
  - .1 Up to NPS 3: bronze to ASTM B61.
  - .2 NPS 4 - 8: Iron faced with ASTM B61 bronze.
- .5 Seat rings: renewable bronze to ASTM B61, screwed into body.
- .6 Hinge pin, bushings: renewable, bronze to ASTM B61.
- .7 Hinge: galvanized malleable iron.
- .8 Identification tag: fastened to cover.

3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance and equipment removal. Refer to Section 23 05 05 Installation of Pipework.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Valves Cast Steel, gate, globe, and check.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
- .1 ANSI/ASME B16.5-2003, Pipe Flanges and Flanged Fittings.
- .2 ANSI/ASME B16.10-1992, Face-to-Face and End-to-End Dimensions Valves.
- .3 ANSI/ASME B16.25-1997, Buttwelding Ends.
- .4 ANSI/ASME B16.34-1996, Valves - Flanged, Threaded and Welding End.

.2 American Petroleum Institute (API).
- .1 API 598-1996, Valve Inspection and Testing.

.3 American Society for Testing and Materials International, (ASTM).
- .1 ASTM A49-01, Specification for Heat-Treated Carbon Steel Joint Bars.
- .2 ASTM A193/A193M-04, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
- .3 ASTM A194/A194M-03b, Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
- .4 ASTM A216/A216M-1993 (03), Specification for Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service.
- .5 ASTM B85-03, Specification for Aluminum-Alloy Die Castings.

.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
- .1 MSS SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
- .2 MSS SP-61-2003, Pressure Testing of Steel Valves.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit data for valves specified this section.
- .3 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.3 Closeout Submittals:
- .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 MATERIAL

.1 Valves:
- .1 Except for specialty valves, to be of single manufacturer.
- .2 Valves to be individually tested.

.2 Requirements common to valves, unless specified otherwise:
- .1 Pressure-temperature ratings: to ANSI B16.34.
- .2 Inspections and tests: to API 598.
- .3 Pressure Testing: to MSS SP-61.
- .4 Flanged valves:
  - .1 Face-to-face dimensions: to ANSI B16.10.
  - .2 Flange dimensions: to ANSI B16.5 with 1.6 mm raised face.
- .5 Butt-weld valves:
  - .1 End-to-end dimensions: to ANSI B16.10.
  - .2 End dimensions: to ANSI B16.25 bored for standard pipe schedule.
- .6 Handwheel: non-heating type with raised rim of die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49.
- .7 Markings: to MSS SP-25.
- .8 Identification:
  - .1 Plate showing catalogue number, size, material of body disc, stem seat, fluid, pressure-temperature rating.
  - .2 Body markings: manufacturer, size, primary service rating, material symbol.
- .9 CRN registration number required for all products.

2.2 GATE VALVES

.1 NPS 2 1/2 - 12, rising stem, OS&Y, solid flexible wedge disc, flanged or butt-weld ends, Class 300:
- .1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A216/A216M WCB, with full length disc guides designed to ensure correct re-assembly.
- .2 Body/bonnet joint: Flat face with corrugated metallic gasket.
- .3 Bonnet studs: to ASTM A193/A193M Type B7.
- .4 Bonnet nuts: to ASTM A194/A194M Type 2H.
- .5 Stuffing box: including non-galling two-piece ball jointed packing gland, with swing-type eye bolts and nuts.
- .6 Gland packing: containing corrosion inhibitor to prevent stem pitting.
- .7 Yoke sleeve: Ni-Resist, minimum melting point above 954 degrees C.
- .8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.
- .9 Disc: with disc stem ring to connect to stem, guided throughout its travel.
  - .1 NPS 2 1/2 - 6: Solid corrosion and heat resistant 13% chromium steel with minimum hardness of 350 HB.

.2 NPS 8 and larger: Carbon steel faced with corrosion and heat resistant 13 chromium steel with minimum hardness of 350 HB.

.10 Seat ring: seamless carbon steel with hard-faced cobalt-chromium-tungsten alloy seating surface, slipped in, seal welded, ground to match disc.

.11 Stem: heat treated corrosion and heat resistant 13% chromium steel with accurately-cut precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut, T-head disc-stem connection.

.12 Operator: see elsewhere this section.

2.3 GLOBE VALVES

.1 NPS 2 1/2 - 12, rising stem, OS&Y, flanged or butt-weld ends, Class 300:

.1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A216/A216M WCB.

.2 Body/bonnet joint: Flat face with corrugated metallic gasket.

.3 Bonnet studs: to ASTM A193/A193M Type B7.

.4 Bonnet nuts: to ASTM A194/A194M Type 2H.

.5 Stuffing box: including non-galling two-piece ball-jointed packing gland, with swing-type eye bolts and nuts.

.6 Gland packing: containing corrosion inhibitor to prevent stem pitting.

.7 Yoke bushing: Ni-Resist, minimum melting point above 954 degrees C.

.8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.

.9 Disc: Plug type with 15 degrees taper seat and bottom guide or ball type with 35 degrees taper seat.

.10 Seat rings: with 1.6 mm thick cobalt-chromium-tungsten alloy facings with minimum hardness of 375 HB (cold), slipped in, seal welded, ground to match disc.

.11 Stem: heat treated corrosion and heat resistant 13% chromium steel with bonnet bushing, long engagement with yoke bushing for accurate seating, accurately-cut precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.

.12 Operator: see elsewhere this section.

2.4 VALVE OPERATORS

.1 Handwheel: on all valves except as specified.

.2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in Boiler Rooms and Mechanical Equipment Rooms.

2.5 BYPASSES FOR GATE AND GLOBE VALVES

.1 Locations: on valves as indicated.

.2 Position of bypass valve on main valves.

.3 Size of bypass valve:

.1 Main valve up to NPS 8: NPS 3/4.

.4 Type of bypass valves:

.1 On gate valve: globe, with composition disc, bronze trim, to Section 23 05 22 - Valves - Bronze.

.2 On globe valve: globe, with composition disc, bronze trim, to Section 23 05 22 - Valves - Bronze.

2.6 CHECK VALVES

.1 NPS 2 1/2 and over, flanged or butt-weld ends, Class 300: swing check.
- .1 Body and multiple-bolted cap: cast steel to ASTM A216/A216M WCB.
- .2 Cap studs: to ASTM A193/A193M Type B7.
- .3 Cap nuts: to ASTM A194/A194M Type 2H.
- .4 Body/cap joint: male-female face with corrugated metallic gasket.
- .5 Disc: heat treated corrosion and heat resistant 13% chromium steel.
- .6 Seat rings: heat treated corrosion and heat resistant 13% chromium steel, slipped in, seal welded, ground to match disc.
- .7 Hinge: cast carbon steel.
- .8 Hinge pin: stainless steel (410).

2.7 SILENT CHECK VALVES

.1 Construction:
- .1 Body: Cast steel to ASTM A216 WCB with integral seat.
- .2 Pressure rating: Class 300.
- .3 Connections: Flanged or Wafer ends.
- .4 Double bronze disc with SS seat and stem. Renewable disc, seat, stem and spring. Spring rating must match system design for silent operation and installation.
- .5 Stainless steel spring, heavy duty.
- .6 Seat: regrindable.

3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's recommendations in upright position with stem above horizontal.

.2 Install valves with unions or flanges to each piece of equipment arranged to allow servicing, maintenance, and equipment removal. Refer to Section 23 05 05 Installation of Pipework.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Plug Valves - Lubricated plug valves, Eccentric plug valves.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B1.20.1-1983 (R2001), Pipe Threads, General Purpose (Inch).
  .2 ANSI/ASME B16.1-1998, Cast Iron Pipe Flanges and Flanged Fittings.
  .3 ANSI/ASME B16.11-2001, Forged Fittings, Socket-Welding and Threaded.
  .4 ANSI/ASME B16.25-1997, Buttwelding Ends.
  .5 ANSI/ASME B16.34-1996, Valves - Flanged, Threaded and Welding End.
  .6 ANSI/ASME B16.10-2000, Face to Face and End to End Dimensions of Valves.

.2 American Society for Testing and Materials International (ASTM).
  .1 ASTM A126-95 (2000), Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.
  .3 ASTM B209-04, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.3 Manufacturer's Standardization Society of the Valves and Fittings Industry Inc. (MSS).
  .1 MSS SP-78-1998, Cast Iron Plug Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
  .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
  .2 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
  .3 Submit data for valves specified this Section.

.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 MATERIAL

.1 Valves:
  .1 Except for specialty valves, to be of single manufacturer.
  .2 Products to have CRN registration number.

2.2 ECCENTRIC PLUG VALVES

.1 General:
- .1 Dead-tight shut-off on liquids and gases at pressure differentials up to 1.2 MPa in forward direction, 520 kPa in reverse direction.

.2 Up to NPS 2, screwed ends:
- .1 Body: cast iron to ASTM B209 Class B.
- .2 Plug:
  - .1 NPS 1/2 and 3/4: bronze to ASTM B62.
  - .2 NPS 1 to NPS 2: bronze to ASTM B62.
- .3 Bearings: permanently lubricated, bronze to ASTM B62 in upper and lower journals.
- .4 Seals: double-seal consisting of:
  - .1 Plastic seat coating between plug and body.
  - .2 Resilient seal moulded into groove in plug face.
  - .3 Seal materials: BUNA Stem seals with Neoprene (gas service) plug seals.
  - .4 VITON stem seals with Fluorinated hydrocarbon plug seals (over 149 deg.C).
  - .5 Isobutene Isoprene stem seal with isobutene-isoprene plug seals (up to 121 deg.C)
- .5 End connections: screwed.
- .6 Operators: lever with adjustable memory stop.

.3 NPS 2 1/2 to NPS 4, flanged ends:
- .1 Body: cast iron to ASTM B209 Class B.
- .2 Plug: nickel-plated cast iron to ANSI.
- .3 Bearings: permanently lubricated, bronze to ASTM B62 in upper and lower journals.
- .4 Seals: double-seal consisting of:
  - .1 Plastic seat coating between plug and body.
  - .2 Resilient seal moulded into groove in plug face.
  - .3 Seal materials: BUNA Stem seals with Neoprene plug seals (gas service)
  - .4 VITON stem seals with Fluorinated hydrocarbon plug seals (over 149 deg.C).
  - .5 Isobutene Isoprene stem seal with isobutene-isoprene plug seals (up to 121 deg.C)
- .5 End connections: flanged to ANSI B16.1 or roll grooved.
- .6 Operators: lever.

2.3 LUBRICATED PLUG VALVES

.1 Principle of operation:
- .1 Special sealing compound used to effect tight seal. When line pressure applied to valve in closed position, parallel plug forced against downstream side of valve. The metal-to-metal contact and sealing compound ensures leak-tight seal.

.2 Testing to specifications: MSS SP-78 for non-shock pressure at specified temperature.

.3 End connections:
- .1 NPS 1/2 to 2: screwed ends.
- .2 NPS 2½ to 12: flanged ends.

.4 Valve:
- .1 Body: cast iron to ASTM A126 Class B semi-steel.
- .2 Pressure rating: NPS 1/2 to 12:
  - .1 Screwed end valves: screwed to NPT standards.

.2 Flanged end valves: flanged to ANSI B16.1 Class 300. Flanged valves NPS 2-8 face dimensions in accordance with ANSI B16.10 short pattern, making them interchangeable with Class 300 flanged cast iron gate valves.

.3 Hydrostatic tests: body 300 psig. Seat: 100 psig.

.3 Plug: tapered, with regular pattern port - 90 degrees from full open to fully closed, complete with PFTE thrust ring: 100% full port.

.4 Number of ports: as required.

.5 Ends: with ends screwed to ANSI B1.20.1, butt welding to ANSI B16.25, socket-welding to ANSI B16.11.

.6 Lubrication system, nickel-plated.

.7 Lubricant: to suit type, temperature and pressure of contained fluid.

.8 Provide sealing compound injection gun designed for use with pre-packed sealing compound cartridges and valve fitted with button head nipples and combination sealing screws.

.9 Feeding system: lubricant forced into lubrication grooves between seating surfaces of plug and body to form positive seal, leakproof operation, and corrosion preventing film. Lubricant receptacle to hold additional lubricant. Lubricant screw for lubrication. Check valve to prevent reverse flow of lubricant. O-rings between body and plug.

.5 Operator:

.1 Up to NPS 5: manual lever.

.6 3 port and 4 port valves:

.1 To be supplied transflow pattern, to allow reduced flow through ports during rotation of plug from one position to another.

.2 Limit stops: to be provided.

.7 Accessories: lubricant gun.

3 Execution

3.1 INSTALLATION OF LUBRICATED PLUG VALVES

.1 Install with line pressure acting to hold plug against body ports which are to be cut-off from higher pressure.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Butterfly Valves.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B1.20.1-1983 (R2001), Pipe Threads, General Purpose (Inch).
  .2 ANSI/ASME B16.1-1998, Cast Iron Pipe Flanges and Flanged Fittings.
  .3 ANSI/ASME B16.5-03, Pipe Flanges and Flanged Fittings.
  .4 ANSI/ASME B16.11-01, Forged Fittings, Socket-Welding and Threaded.
  .5 ANSI/ASME B16.25-1997, Buttwelding Ends.
  .6 ANSI/ASME B16.34-1996, Valves - Flanged, Threaded and Welding Ends.

.2 American National Standards Institute (ANSI)/American Petroleum Institute (API).
  .1 ANSI/API 609-1997, Lug- and Water-Type Butterfly Valves.

.3 American Society for Testing and Materials International, (ASTM).
  .1 ASTM A126-95 (01), Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.
  .3 ASTM B209M-04, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  .1 MSS SP-67-02, Butterfly Valves.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
  .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
  .2 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
  .3 Submit data for valves specified this section.

.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 BUTTERFLY VALVES - RESILIENT SEAT - 300 PSIG

.1 Sizes: Lug type: NPS 2 to 48.

.2 Pressure rating: 300 psig at 135 degrees C.

.3 Lug body: 300 ANSI bolt pattern.

.4 Full lug body (threaded).

.5 Application: for on-off service.

.6 Operators:
- .1 NPS 2 - 6: Handles capable of locking in any of ten (10) positions - 0 degrees to 90 degrees. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latch plate and mounting hardware: cadmium plated carbon steel.
- .2 Install parallel or perpendicular to pipeline.

.7 Designed to comply with MSS SP-67 and API 609.

.8 Compatible with ANSI B16.1 Class 250 (iron) and ANSI B16.5 Class 300 (steel) flanges.

.9 Construction:
- .1 Body: ductile iron.
- .2 Disc: aluminum bronze.
- .3 Seat: EPDM.
- .4 Shaft: NPS 2 - 12: 416 stainless steel.
- .5 Taper pin: 316 SS.
- .6 Blowout proof stem.
- .7 O-Ring: Buna-N.
- .8 Bushings: teflon.
- .9 Disc shall not be pinned to shaft.
- .10 Bubble tight shutoff with downstream flanges removed, class 6 shutoff.

2.2 MOUNTING FLANGES

.1 Class 300 steel to B16.5 pipe flanges.

2.3 ELECTRIC ACTUATORS

.1 Operation: designed to provide precise quarter turn electric operation.
- .1 Torque range: up to 1.130 N-m and speed ranges from 10 seconds to 30 seconds to move from fully open to fully closed.
- .2 Gear train within actuator to provide smooth continuous rotary power stroke for accurate automatic valve positioning. Factory-set, field adjustable cam-actuated travel limit switches to provide precise control of shaft rotation.

.2 Construction:
- .1 Castings: heavy duty industrial grade for rugged use.
- .2 Actuators: continuous duty with high efficiency single phase reversing capacitor motor with thermal overload protection.
- .3 Gears and pinions constructed from hardened steel.
- .4 Gear train to be permanently lubricated.
- .5 Mechanical brake to ensure that gear is locked in precise position.

.3 Electrical:
.1 Standard voltage: 120 VAC. 60 Hz.
.2 Control options: 4-20 Ma DC or 0-10 V DC.
.3 CSA approved.
.4 Electrical rating: NEMA IV.

3 Execution

3.1 PREPARATION

.1 Valve and mating flange preparation.
.1 Inspect adjacent pipeline, remove rust, scale, welding slag, other foreign material.
.2 Ensure that valve seats and pipe flange faces are free of dirt or surface irregularities which may disrupt flange seating and cause external leakage.
.3 Install butterfly valves with disc in almost closed position.
.4 Inspect valve disc seating surfaces and waterway and eliminate dirt or foreign material.

3.2 INSTALLATION OF VALVES

.1 Install in accordance with manufacturer's instructions.

.2 Do not use gaskets between pipe flanges and valves unless instructed otherwise by valve manufacturer.

.3 Verify suitability of valve for application by inspection of identification tag.

.4 Mount actuator on to valve prior to installation.

.5 Handle valve with care so as to prevent damage to disc and seat faces.

.6 Valves in horizontal pipe lines should be installed with stem in horizontal position to minimize liner and seal wear.

.7 Ensure that valves are centered between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.

3.3 ACTUATOR INSTALLATION

.1 Electrical connections to be made by actuator manufacturer.

.2 Cycle valve operation from fully closed to fully open then back to fully closed.

.3 At same time, check travel stop settings for proper disc alignment.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 hangers and supports for mechanical piping, ducting and equipment.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
  .1 ANSI/ASME B31.1-04, Power Piping.

.2 American Society for Testing and Materials International (ASTM)
  .1 ASTM A125-1996 (R2001), Specification for Steel Springs, Helical, Heat-Treated.
  .2 ASTM A307-04, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  .3 ASTM A563-04a, Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

.5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  .1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
  .2 ANSI/MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
  .3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.6 Underwriter's Laboratories of Canada (ULC)

1.3 SYSTEM DESCRIPTION

.1 Design Requirements:
  .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
  .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
  .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
  .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment and prevent vibration.
  .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.
  .6 Pipe supports shall meet the requirements of ASME B31.1 Power Piping and ASME B31.9 Building Services Piping.

.7 Automatic sprinkler pipe supports shall meet the requirements of NFPA No. 13, Standard for Installation of Sprinkler Systems.
.8 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.
.9 Select hangers and supports for the service and in accordance with the manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.
.10 Fasten hangers and supports to building steel or structural wood in accordance with the requirements of Structural. Equipment, piping and ductwork shall be supported from the top chords of trusses/beams, supporting off bottom is not permitted, except where specifically noted.
.11 Provide and set sleeves required for equipment, including openings required for placing equipment.
.12 Obtain approval prior to drilling for inserts and supports for piping systems.
.13 Obtain approval prior to using percussion type fastenings.
.14 Use of other piping or equipment for hanger supports is not permitted.
.15 Use of perforated band iron, wire or chain as hangers is not permitted.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ASME B31.1, ASME B31.9 and MSS SP58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

.3 Design hangers so they cannot become disengaged by movements of supported pipe.

2.2 PIPE HANGERS

.1 Finishes:
.1 Pipe hangers and supports: galvanized after manufacture.
.2 Use electro-plating galvanizing process or hot dipped galvanizing process.
.3 Ensure steel hangers in contact with copper piping are copper plated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:
.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
.1 Rod: to be UL listed.
.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS-SP58 and MSS-SP69.

.3 Upper attachment structural: suspension from upper flange of I-Beam:
- .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP69.
- .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.

.4 Upper attachment to concrete:
- .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
- .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS SP69.

.5 Shop and field-fabricated assemblies:
- .1 Trapeze hanger assemblies: Steel channels with welded spacers and hanger rods.
- .2 Steel brackets: Welded and wrought steel clamp.

.6 Hanger rods: threaded rod material to MSS SP58:
- .1 Ensure that hanger rods are subject to tensile loading only.
- .2 Provide linkages where lateral or axial movement of pipework is anticipated.
- .3 Threaded both ends, one end or continuous.

.7 Pipe attachments: material to MSS SP58:
- .1 Attachments for steel piping: carbon steel black.
- .2 Attachments for copper piping: copper plated black steel.
- .3 Use insulation shields for hot pipework.
- .4 Oversize pipe hangers and supports.

.8 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
- .1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.

.10 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
- .1 Finishes for steel pipework: black.
- .2 Finishes for copper, glass, brass or aluminum pipework: black, with formed portion plastic coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

.12 Wall Support:
- .1 Up to 75 mm: Cast iron hook.
- .2 100 mm and over: Welded steel bracket and wrought steel clamp.

.13 Floor Support:
- .1 Pipe sizes up to 100 mm and all cold pipe sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier to steel support.

.14 Insulation:

.1 Supports shall be coordinated with requirements of insulation. Oversized hangars are required for all pipe systems that require insulation with a vapour barrier to maintain integrity of vapour barrier.

.2 Oversized hangars shall also be required for steam pipe systems.

.15 PEX pipe mains and branches running in service spaces (crawlspace, ceiling plenum, etc.) shall be installed in a suitable channel to ensure pipes remain plumb. Channel shall be large enough to house pipe and insulation. Pipe shall be secured to channel.

2.3 WIRE ROPE PIPE AND DUCT HANGERS

.1 Wire Rope Suspension Systems:

.1 Wire rope suspension systems shall be ULC, CSA and SMACNA approved and tested.

.2 Wire suspensions systems shall consist of a pre-formed wire rope sling with either a ferruled loop, permanently fixed threaded ¼" (or 3/8") stud, or permanently fixed nipple end with toggle, at one end or hook or eyelet. The end fixings and the wire must be of the same manufacturer. The system is secured and tensioned with a hanger self-locking grip at the other end. System shall incorporate pipe hangars. Pipe hangars shall not penetrate vapour barrier of chilled water pipe insulation.

.3 Only wire and or supports supplied and or approved, shall be used with the system installed.

.4 The Contractor shall select the correct specification of wire hanger to use for supporting each particular service from table 1 below. Each size is designated with a maximum Safe Working Load Limit (which incorporates a 5:1 safety factor). The correct specification of wire hanger required is determined using the following formula:

Weight per metre of object suspended (kg) x Distance between suspension points (m) = Weight loading per hanger suspension point (kg)

Table 1 Wire Hanger Safe Working Loads

Size	Working Load Limit (kg)	Working Load Limit (lbs)
No. 1	0 - 10 kg	0 - 22 lbs
No. 2	10.5 - 45.5 kg	23 - 100 lbs
No. 3	46 - 91 kg	101 - 200 lbs
No. 4	95.5 - 225 kg	210 - 495 lbs
No. 5	225.5 - 325 kg	496 - 715 lbs

.5 Where the installed wire rope is not vertical then the working load limit shall be reduced in accordance with the recommendations given in the manufacturer's handbook.

.6 The Contractor shall select and use the correct length of wire rope required to support the service.

.7 No in-line joins shall be permitted in the rope.

.8 Solid trapeze hangars may be used to suspend piping routed together, where wire support can be coordinated with ceiling and still ensure pipes are routed at highest point possible (tight to beams).

2.4 RISER CLAMPS

.1 Steel or cast iron pipe: black carbon steel to MSS SP58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.5 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:
  .1 64 kg/m^3 density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:
  .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

2.6 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).

.2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.7 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.8 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 50 00 - Metal Fabrications.

2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.10 HOUSEKEEPING PADS

.1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.

.2 Concrete: to Section 03 30 00 - Cast-in-place Concrete.

2.11 SLEEVES

.1 Pipes through floors: Form with 18 gauge galvanized steel.

.2 Pipes through beams, walls, fire proofing, footings, potentially wet floor: Form with steel pipe or 18 gauge galvanized steel.

.3 Size large enough to allow for movement due to expansion and to provide for continuous insulation.

2.12 OTHER EQUIPMENT SUPPORTS

.1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 50 00 - Metal Fabrications.

.2 Submit structural calculations with shop drawings.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with:
- .1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:
- .1 Install on piping systems at pumps, at all vibration isolated equipment and as indicated.

.3 Clamps on riser piping:
- .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
- .2 Bolt-tightening torques to industry standards.
- .3 Steel pipes: install below coupling or shear lugs welded to pipe.
- .4 Cast iron pipes: install below joint.

.4 Clevis plates:
.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:
.1 Vertical movement of pipework is 13 mm or more,
.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:
.1 Transfer of load to adjacent piping or to connected equipment is not critical.
.2 Variation in supporting effect does not exceed 25% of total load.

.8 Installation of Exposed Pipe and Duct Hangers:
.1 Exposed pipe and duct shall be any pipe/duct visible to the occupants. This does not include piping and ductwork routing above dropped ceilings.
.2 Exposed Pipe and Duct hangers shall be a Wire Rope Suspension System.

3.3 INSERTS

.1 Use inserts for suspending hangers for reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over 100 mm.

.3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

3.4 HANGER SPACING

.1 Plumbing piping: to Canadian Plumbing Code, Provincial Code, authority having jurisdiction.

.2 Fire protection: to applicable Fire Code.

.3 Copper piping: up to NPS 1/2: every 1.5 m.

.4 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.5 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper	Rod Diameter
up to 32 mm	1.8 m	1.8 m	9.5 mm
38 mm	1.8 m	1.8 m	9.5 mm

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper	Rod Diameter
50 mm and 63 mm	3.0 m	3.0 m	9.5 mm
75 mm - 100 mm	3.6 m	3.0 m	15.8 mm
150 mm - 200 mm	4.3 m	4.3 m	22.2 mm

.6 Install hangers to provide a minimum 12 mm clear space between finished covering and adjacent work.

3.5 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

.4 Use hangers which are vertically adjustable 38 mm minimum after piping is erected.

.5 Support horizontal soil pipe near each hub, with 1.5 m maximum spacing between hangers.

.6 Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.

.7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.8 Where practical, support riser piping independently of connected horizontal piping.

.9 Hangers: Pipe sizes 12 mm to 38 mm: Adjustable wrought steel ring.

.10 Hangers: Pipe sizes 50 mm to 100 mm and Cold Pipe Sizes: Adjustable wrought steel clevis.

3.6 SLEEVES

.1 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

.2 Extend sleeves through potentially wet floors 25 mm above finished floor level. Caulk sleeves full depth and provide floor plate.

.3 Where piping passes through floor, ceiling or wall close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

.4 Install chrome plated escutcheons where piping passes through finished surfaces.

.5 All penetrations through fire rated walls, floors or partition assemblies shall be sealed/fire stopped with fire stop materials that will remain in place and prevent the passage of smoke, toxic gases, flame, etc., when subjected to the standard test method Can 4-S115, "Standard Method of Fire Tests for Firestop Systems" for a period of time equal to fire protection rating required for the grade of fire separation of the penetrated wall or floor.

.6 Acceptable Product: According to instructions provided, all penetrations in fire rated walls, floors, or partition assemblies shall be sealed/fire stopped with:
- .1 3M Brand Intumescent, "Fire Barrier" Caulk CP-25, Putty 303, Penetration Sealing Systems 7902 or 7904 Series, Composite Sheet CS-195, or Wrap Strip FS-195.
- .2 Tremco Firestop Systems: Fyresil, Fyreshield for penetrations and perimeters. Dymeric ULC, THC 900 ULC

3.7 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.8 FINAL ADJUSTMENT

.1 Adjust hangers and supports:
- .1 Ensure that rod is vertical under operating conditions.
- .2 Equalize loads.

.2 Adjustable clevis:
- .1 Tighten hanger load nut securely to ensure proper hanger performance.
- .2 Tighten upper nut after adjustment.

.3 C-clamps:
- .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:
- .1 Hammer jaw firmly against underside of beam.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Vibration isolation.

1.2 PERFORMANCE REQUIREMENTS

.1 Provide vibration isolation on all mechanical motor driven equipment plus connected piping and ductwork.

.2 Supply vibration isolation equipment and materials by one supplier. Consider side loading of equipment and inertia bases when calculating maximum loads on isolators.

.3 Ensure equipment is sufficiently rigid for isolator point loading.

.4 Provide and install mechanical equipment so that Average Noise Criteria Curves, as outlined in ASHRAE Guide, are not exceeded.

.5 Consider upper floor locations critical unless otherwise indicated.

1.3 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each.

.3 Product Data: Provide schedule of vibration isolator type with location and load on each.

.4 Manufacturer's Installation Instructions: Indicate special procedures and setting dimensions.

.5 Manufacturer's Certificate: Certify that isolators are properly installed and adjusted to meet or exceed specified requirements.

1.4 PROJECT RECORD DOCUMENTS

.1 Section 01 78 00: Submittals for project closeout.

.2 Record actual locations of isolation including attachment points.

2 Products

2.1 VIBRATION ISOLATORS

.1 Open Spring Isolators:
- .1 Spring Isolators:
  - .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
  - .2 Code: Colour code springs for load carrying capacity.
- .2 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

.3 Spring Mounts: Provide with levelling devices, minimum 6 mm thick neoprene sound pads, and zinc chromate plated hardware.

.4 Sound Pads: Size for minimum deflection of 1.2 mm; meet requirements for neoprene pad isolators.

.2 Restrained Spring Isolators:

.1 Spring Isolators:

.1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.

.2 Code: Colour code springs for load carrying capacity.

.2 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

.3 Spring Mounts: Provide with levelling devices, minimum 6 mm thick neoprene sound pads, and zinc chromate plated hardware.

.4 Sound Pads: Size for minimum deflection of 1.2 mm; meet requirements for neoprene pad isolators.

.5 Restraint: Provide heavy mounting frame and limit stops.

.3 Closed Spring Isolators:

.1 Spring Isolators:

.1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.

.2 Code: Colour code springs for load carrying capacity.

.2 Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.

.3 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

.4 Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 7 mm clearance.

.4 Restrained Closed Spring Isolators:

.1 Spring Isolators:

.1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.

.2 Code: Colour code springs for load carrying capacity.

.2 Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.

.3 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

.4 Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 7 mm clearance and limit stops.

.5 Spring Hanger:

.1 Spring Isolators:

.1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.

.2 Code: Colour code springs for load carrying capacity.

.2 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

.3 Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators.

.4 Misalignment: Capable of 20 degree hanger rod misalignment.

.6 Neoprene Pad Isolators:
- .1 Rubber or neoprene waffle pads.
  - .1 30 durometer.
  - .2 Minimum 13 mm thick.
  - .3 Maximum loading 275 kPa.
  - .4 Height of ribs: maximum 0.7 times width.
- .2 Configuration: Single layer.

.7 Rubber Mount or Hanger: Moulded rubber designed for 13 mm deflection with threaded insert.

.8 Glass Fibre Pads: Neoprene jacketed pre-compressed moulded glass fibre.

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Install isolation for mechanical motor driven equipment throughout, unless specifically noted otherwise

.3 Install spring hangers without binding.

.4 On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

.5 Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

.6 Provide pairs of horizontal limit springs on fans with more than 1.5 kPa static pressure, and on hanger supported, horizontally mounted axial fans.

.7 Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers. Provide each inertia base with minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 1.5 mm maximum clearance. Provide other snubbers with clearance between 4 mm and 7 mm.

.8 Support piping connections to isolated equipment resiliently for scheduled distance.
- .1 Up to 100 mm Diameter: First three points of support.
- .2 125 to 200 mm Diameter: First four points of support.
- .3 250 mm Diameter and Over: First six points of support.
- .4 Static deflection of first point shall be twice deflection of equipment. The next two hangers closest to vibration source shall have the greater deflection of 25 mm static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 25 mm static deflection or 1/2 static deflection of isolated equipment.

.9 Connect wiring to isolated equipment with flexible hanging loop.

3.2 MANUFACTURER'S FIELD SERVICES

.1 Examine systems to Section 01 45 00.

.2 Inspect isolated equipment after installation and submit report. Include static deflections.

3.3 EQUIPMENT ISOLATION SCHEDULE

	ISOLATED EQUIPMENT	BASE Thickness	ISOLATOR Type	Deflection
.1	Outdoor Condensing Units	On concrete pad	Rubber	
.2	Fans	Suspended	Spring	2"

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems

1.2 REFERENCES

.1 ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Submit list of wording, symbols, letter size, and colour coding for mechanical identification.

.3 Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

.4 Product Data: Provide manufacturers catalogue literature for each product required.

1.4 PROJECT RECORD DOCUMENTS

.1 Section 01 78 00: Submittals for project closeout.

.2 Record actual locations of tagged valves.

2 Products

2.1 LANGUAGE

.1 Identification in English.

2.2 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification of Natural gas: to CSA/CGA B149.1 and authority having jurisdiction.

.2 Identification of Sprinkler System: to NFPA 13

2.3 NAMEPLATES

.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.2 Colours:
- .1 Hazardous: red letters, white background
- .2 Elsewhere: black letters, white background (except where required otherwise by applicable Codes)

.3 Sizes: Conform to following table using a maximum of 25 characters per line.

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

Description: Laminated three-layer plastic with engraved black letters on light contrasting background colour.

2.4 TAGS

.1 Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background colour. Tag size minimum 40 mm diameter.

.2 Control Tag: Laminated plastic card with black letters on light contrasting background colour in multiple lines. Tag size minimum 85mm x 55mm. Inscriptions to include function and (where appropriate) fail-safe position

.3 Metal Tags: Brass with stamped letters; tag size minimum 40 mm diameter with smooth edges.

.4 Chart: Typewritten letter size list in anodized aluminum frame.

2.5 STENCILS

.1 Stencils: With clean cut symbols and letters of following size:

.1 20-30 mm Outside Diameter of Insulation or Pipe: 200 mm long colour field, 15 mm high letters.

.2 40-50 mm Outside Diameter of Insulation or Pipe: 200 mm long colour field, 20 mm high letters.

.3 65-150 mm Outside Diameter of Insulation or Pipe: 300 mm long colour field, 30 mm high letters.

.4 200-250 mm Outside Diameter of Insulation or Pipe: 600 mm long colour field, 65 mm high letters.

.5 Over 250 mm Outside Diameter of Insulation or Pipe: 800 mm long colour field, 90 mm high letters.

.6 Ductwork and Equipment: 65 mm high letters.

.2 Stencil Paint: As specified in Section 09 91 23.

2.6 PIPE MARKERS

.1 Colour: Conform to ASME A13.1.

.2 Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

.3 Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

.4 Underground Plastic Pipe Markers: Bright coloured continuously printed plastic ribbon tape, minimum 150 mm wide by 0.10 mm thick, manufactured for direct burial service.

2.7 CEILING TACKS

.1 Description: Steel with 20 mm diameter colour coded head.

.2 Colour code as follows:
- .1 Yellow - HVAC equipment
- .2 Red - Fire dampers/smoke dampers
- .3 Green - Plumbing valves
- .4 Blue - Heating/cooling valves

2.8 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms: where required to Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend: Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.4 Arrows showing direction of flow:
- .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
- .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
- .3 Use double-headed arrows where flow is reversible

.5 Extent of background colour marking.
- .1 To full circumference of pipe or insulation.
- .2 Length to accommodate pictogram, full length of legend and arrows.

.6 Extent of background colour marking.

.7 Materials for background colour marking, legend, arrows:
- .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
- .2 Other pipes: pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C

.8 Colours and Legends:
- .1 Where not listed, obtain direction from Departmental Representative.

.2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
City water	Green	CITY WATER
Domestic hot hard water	Green	DOM. HHW
Dom. Hot water recirculation	Green	DOM. HW CIRC
Domestic cold hard water supply	Green	DOM. CHW
Heating water Supply	Yellow	HEATING SUPPLY
Heating water Return	Yellow	HEATING RETURN
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Natural gas	to Codes	
Gas regulator vents	to Codes	
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS

2.9 IDENTIFICATION OF DUCTING SYSTEMS

.1 50 mm high stenciled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: back, or coordinated with base colour to ensure strong contrast

2.10 VALVES AND CONTROLLERS

.1 Valves to be complete with brass tags with 12 mm stamped identification data filled with black paint coordinated with Valve Tag List.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

.3 Controllers to be complete with controls laminated identification tag.

.4 Identify all control systems components including but not limited to equipment, components, controls, sensors with control tags specified in this section.

2.11 FIRE DAMPERS

.1 All new fire dampers shall be tagged with unique tag (FD-1, FD-2 etc.), 12 mm stamped identification data filled with black paint. Contractor shall compile a Fire Damper Tag List and include in O&M. List to identify fire damper tag and location in building.

2.12 EQUIPMENT WITHIN CEILING SPACE

.1 Provide identification (equipment labels and colour coded dots) on the ceiling for all equipment concealed within a ceiling space in addition to identification on equipment.

.2 Equipment Labels:
- .1 Colours: Black lettering on transparent background.
- .2 Height of letter: 5 mm.
- .3 T-bar ceilings: Label shall be located on the metal ceiling grid beside the ceiling tile that provides service access to the equipment. The label shall include the equipment tag and an arrow indicating the ceiling tile to remove for servicing and access to the equipment.
- .4 Solid ceilings: Label shall be located on the trim of the access panel used for servicing the equipment and include the equipment tag.

.3 Colour Coded Dots:
- .1 Confirm site standard colour coding with the Departmental Representative prior to commencing work. Coordinate with all trades.
- .2 Provide a Legend in the operating and maintenance manual identifying the colour coding utilized on site.
- .3 T-bar ceilings: Dot shall be located on the metal ceiling grid beside the ceiling tile that provides service access to the equipment.
- .4 Solid ceilings: Dot shall be located on the trim of the access panel used for servicing the equipment.

3 Execution

3.1 PREPARATION

.1 Degrease and clean surfaces to receive adhesive for identification materials.

.2 Prepare surfaces to Section 09 91 23 for stencil painting.

3.2 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

.3 Install tags with corrosion resistant chain.

.4 Apply stencil painting to Section 09 91 23.

.5 Install plastic pipe markers to manufacturer's written instructions.

.6 Install plastic tape pipe markers complete around pipe to manufacturer's written instructions.

.7 Install underground plastic pipe markers 150 to 200 mm below finished grade, directly above buried pipe.

.8 Identify equipment including air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as small in-line pumps, may be identified with tags.

.9 Identify control panels and major control components outside panels with control tags.

.10 Identify thermostats relating to equipment with nameplates.

.11 Identify valves in main and branch piping with tags.

.12 Identify air terminal units with numbered tags.

.13 Tag automatic controls, instruments, and relays. Key to control schematic.

.14 Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Location of identification not to exceed 6 m on straight runs including risers and drops, adjacent to each valve and Tee, adjacent to each change in direction, at each side of penetration of structure or enclosure, and at each obstruction. Provide additional identification at point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side

.15 Identify ductwork with stencilled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

.16 Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

.17 Identify electric starting switches and remote push button stations with nametags.

.18 Provide identification on the ceiling for all equipment concealed within a ceiling space in addition to identification on the equipment.

.19 Tag fire dampers sequentially and record on Fire Damper Tag List. Provide copy of list in O&M Manual.

3.3 VALVE, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Owner. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Testing, adjustment and balance of air systems.
.2 Testing, adjustment and balance of water systems.

1.2 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.3 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Consultant within 90 days of award of contract.

.2 Personnel performing TAB shall be qualified to standards of AABC and/or NEBB

.3 Provide documentation confirming qualifications, successful experience.

.4 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
  .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
  .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
  .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.

.5 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.6 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.7 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.8 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.9 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
  .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
  .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.4 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.7 PRE-TAB REVIEW

.1 Review contract documents before project construction is started confirm in writing to Consultant adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Consultant in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.8 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.9 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Consultant for verification of TAB reports.

1.10 START OF TAB

.1 Notify Consultant 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, and caulking.

.5 Pressure, leakage, other tests specified elsewhere Division 23.

.6 Provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
- .1 Proper thermal overload protection in place for electrical equipment.
- .2 Air systems:
  - .1 Filters in place, clean.
  - .2 Duct systems clean.
  - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
  - .4 Correct fan rotation.
  - .5 Fire, smoke, volume control dampers installed and open.
  - .6 Coil fins combed, clean.
  - .7 Access doors, installed, closed.
  - .8 Outlets installed, volume control dampers open.
- .3 Liquid systems:
  - .1 Flushed, filled, vented.
  - .2 Correct pump rotation.
  - .3 Strainers in place, baskets clean.
  - .4 Isolating and balancing valves installed, open.
  - .5 Calibrated balancing valves installed, at factory settings.
  - .6 Chemical treatment systems complete, operational.

1.11 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:
- .1 HVAC systems: plus 5 %, minus 5 %.
- .2 Hydronic systems: plus or minus 10 %.

1.12 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 2 % of actual values.

1.13 INSTRUMENTS

.1 Use accurate instruments for measurements. Prior to TAB, submit to Consultant list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Consultant.

.4 Provide calibration histories for each instrument. Re-calibration or use of other instruments may be requested when accuracy of readings is questionable.

1.14 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Submit proposed methodology and procedures for performing TAB if different from referenced standard.

1.15 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
- .1 Details of instruments used.
- .2 Details of TAB procedures employed.
- .3 Calculations procedures.
- .4 Summaries.

1.16 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:
- .1 Project record drawings.
- .2 System schematics.

.3 Submit 4 copies of TAB Report to Consultant for verification and approval, in English in D-ring binders, complete with index tabs.

1.17 VERIFICATION

.1 Reported results subject to verification by Consultant.

.2 Provide personnel and instrumentation to verify up to 30 % of reported results.

.3 Number and location of verified results as directed by Consultant.

.4 Pay costs to repeat TAB as required to satisfaction of Consultant.

1.18 SETTINGS

.1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.19 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Consultant.

1.20 AIR SYSTEMS

.1 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.2 Locations of equipment measurements: to include as appropriate:
- .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
- .2 At controllers, controlled device.

.3 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.21 OTHER TAB REQUIREMENTS

.1 Measurement of noise from equipment specified in Division 23.
- .1 As specified elsewhere or as required to prove Noise Performance when operating performance is questioned.

1.22 CLOSEOUT SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Provide copies of complete final TAB report for Operation and Maintenance manual

1.23 BALANCE REPORTS

.1 Balance reports to include the following at minimum (data shall always include design and actual measured data):
- .1 Title Page: Company Name, Address, and Telephone Number; Project Name, Location, Architect, Engineer, and Project Contractor.
- .2 Include types, serial number and dates of calibration of instruments used.
- .3 Air Handling Units (including Roof Top Units): Location, Local Identification, Manufacturer, Model, Size, Arrangement, discharge and class, Supply Air Flow, Return/Exhaust Air Flow, Outside Air Flow, Static Pressures, Fan RPM, inlet and outlet dry bulb and wet bulb temperatures.
- .4 Duct air quantities: Mains, Branches, Outside Air and Exhausts (Maximum and Minimum), Duct sizes; Number of pressure readings; Sum of velocity measurements; Average velocity; duct air flow rate.
- .5 Exhaust Fan Data: Location, Manufacturer, Model, Specified and Actual Air Flow, Static Pressure, and Fan RPM.
- .6 Electric Motors: Manufacturer, HP/BHP, Phase, Voltage, Amperage (maximum operating and full load), RPM, Service Factor, Starter Heater Elements.
- .7 V-Belt Drive: Identification/Location, Driven Sheave Diameter and RPM belt Size and Quantity, Motor Sheave Diameter and RPM.
- .8 Air Inlets and Outlets: Outlet identification location and Designation; Manufacturer's catalogue identification and type; Application factors; air velocities; air flow rates; Deflector vane or diffuser cone settings.
- .9 Pump Data: Location, Identification/Number, Manufacturer, Size/Model, Drive type, Motor type, Flow Rate, Head, BHP, Discharge and Suction Pressure (full flow and no flow).
- .10 Coil Data: Location, Identification/Number, Service, Manufacturer, Element type, Air Flow Rate, Entering Air and Leaving Air Temperatures (dry bulb and wet bulb), Water Flow rate and Pressure Drop, Entering and Leaving Water Temperatures, energy transfer rate.
- .11 Terminal Heating/Cooling Equipment with fans (unit heaters, force flows, unit ventilators, fan coils etc.): Location, Identification/Number, Manufacturer, Model, Heat transfer rate, Entering and Leaving Water Temperatures, Water Pressure drops, Water Flow Rates, air flow. If a steam system include steam pressure, temperature and condensate temperature. If a heating/cooling system provide data for both modes of operation.
- .12 Terminal Heating/Cooling Equipment (radiation, panels, in-floor etc.): Location, Element Type, Designation, Manufacturer, Entering and Leaving Water Temperatures, Length of Fin, Water Pressure drops, Water Flow Rates. If a steam system include steam pressure, temperature and condensate temperature. If a heating/cooling system provide data for both modes of operation. Provide total flow for in-floor manifold.

2 Products

2.1 NOT USED

3 Execution

3.1 PREPARATION

.1 Before adjusting and balancing, verify that systems are complete and operable. Ensure temperature control systems are complete and operable, thermal overload protection is in place, final filters installed, hydronic systems, flushed, filled, and vented.

.2 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Consultant to facilitate spot checks during testing.

.3 Recorded data shall represent actually measured, or observed condition.

3.2 GENERAL PROCEDURES

.1 Balance to maximum measured flow, allowable deviation as specified.

.2 Permanently mark settings on valves, splitters, dampers, and other adjustment devices.

.3 Subsequent to correctional work, take measurements to verify balance has not been disrupted or that any such disruption has been rectified.

.4 At final inspection, re-check random selections of data recorded in report. Re-check points of areas as selected and witnessed by the Owner.

.5 Check and adjust systems approximately six (6) months after final acceptance and submit report.

.6 The Balancing Contractor shall include the cost of sheave changes necessary to achieve specified air flow within limits specified.

3.3 AIR SYSTEM PROCEDURES

.1 Adjust air handling and distribution systems to provide required or design supply, return and exhaust air quantities. Permanently mark settings of damper and other adjustment devices allowing settings to be restored.

.2 Make air quantity measurements in ducts by Pitot tube traverse of entire cross-sectional area of duct.

.3 Measure air quantities at each air inlet and outlet. Use volume control devices to regulate air quantities.

.4 Vary total system air quantities by adjustment of fan speeds. Where Variable Frequency Drives (VFDs) are installed, utilize VFDs to adjust fan speed. Provide drive changes where required.

.5 Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate - full cooling, and at minimum air flow rate - full heating.

.6 Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

.7 Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

3.4 WATER SYSTEM PROCEDURE

.1 Adjust water systems to provide required or design quantities. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops.

.2 Use calibrated venturi tubes, orifices, or other metered fittings and pressure gauges in conjunction with permanent and portable type flow meters to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

.3 Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

.4 Effect system balance with automatic control valves fully open to heat transfer elements.

.5 Effect adjustment of water distribution systems by means of balancing cocks, valves and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

.6 Where pump capacity available is less than total flow requirements or individual system parts, full flow in any part may be simulated by temporary restriction of flow to other parts.

.7 Where flow restrictors are used provide record data of air and water inlet and outlet temperatures at design conditions.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Materials and methods for pressure testing ducts over 5 m in length, forming part of a supply, return or exhaust ductwork system directly or indirectly connected to air handling equipment.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.2 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
- .1 SMACNA HVAC Air Duct Leakage Test Manual, 1985.

1.3 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Test Reports: submit test reports indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:
- .1 Submit proposed report form and test report format to Departmental Representative for approval at least three months before proposed date of first series of tests. Do not start tests until approval received in writing from Departmental Representative.
- .2 Prepare report of results and submit to Departmental Representative within 7 days of completion of tests. Include:
  - .1 Schematic of entire system.
  - .2 Schematic of section under test showing test site.
  - .3 Required and achieved static pressures.
  - .4 Orifice differential pressure at test sites.
  - .5 Permissible and actual leakage flow rate (L/s) for test sites.
  - .6 Witnessed certification of results.
- .3 Include test reports in final TAB report.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturer's field reports specified.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings:
- .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Chart.
  - .1 Verify project requirements.
  - .2 Review installation conditions.
  - .3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 TEST INSTRUMENTS

.1 Test apparatus to include:

.1 Fan capable of producing required static pressure.

.2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.

.3 Flow measuring instrument compatible with the orifice plate.

.4 Calibration curves for orifice plates used.

.5 Flexible duct for connecting to ductwork under test.

.6 Smoke bombs for visual inspections.

.2 Test apparatus: accurate to within +/- 3 % of flow rate and pressure.

.3 Submit details of test instruments to be used to Departmental Representative at least one month before anticipated start date.

.4 Test instruments: calibrated and certificate of calibration deposited with Departmental Representative no more than 28 days before start of tests.

.5 Re-calibrated every six months thereafter.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PREPARATION

.1 Do not conceal or cover ductwork or equipment until inspected by consultant and tested.

.2 Provide equipment, materials and labour for tests and pay expenses. Use test instruments by approved laboratory or manufacturer and furnish certificate showing degree of accuracy.

.3 Test instruments shall have been calibrated within one year.

.4 Install permanent gauges and thermometers just prior to tests to avoid changes in calibration.

.5 Before adjusting and balancing, verify that systems are complete and operable. Ensure temperature control systems are complete and operable, thermal overload protection is in place, final filters installed, hydronic systems, flushed, filled, and vented.

.6 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Consultant to facilitate spot checks during testing.

.7 Recorded data shall represent actually measured, or observed condition. And shall be included in O&M Manual

3.3 TEST PROCEDURES

.1 Maximum lengths of ducts to be tested consistent with capacity of test equipment.

.2 Section of duct to be tested to include:
.1 Fittings, branch ducts, tap-ins, fire dampers.

.3 Repeat tests until specified leakage at test pressures are attained. Bear costs for repairs and repetition to tests.

.4 Base partial system leakage calculations on SMACNA HVAC Air Duct Leakage Test Manual.

.5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

3.4 SITE TOLERANCES

.1 Allowable system leakage tolerances are to follow SMACNA Leakage standards as specified under ductwork.

.2 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.5 TESTING

.1 Test ducts before installation of insulation or other forms of concealment.

.2 Test after seals have cured.

.3 Test when ambient temperature will not affect effectiveness of seals and gaskets.

.4 Low Pressure Ducts: Test for tightness such that leakage is inaudible and not detectable by feel. Check for audible leaks at 250 Pa above duct design operating pressure.

.5 Medium and High Pressure Ductwork: Check for audible leaks. Test for tightness as specified by the SMACNA Manuals at a duct leakage classification of 3 with a static pressure equal to 2 times the external static pressure of the associated air system.

3.6 FIELD QUALITY CONTROL

.1 Performance Verification:
.1 Departmental Representative to witness tests and to verify reported results.
.2 To be certified by same TAB agency approved by Departmental Representative to undertake TAB on this project.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .1 ANSI/ASHRAE/IESNA 90.1-01, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials International, (ASTM)
- .1 ASTM B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
- .2 ASTM C335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .3 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .4 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C547, Specification for Mineral Fiber Pipe Insulation.
- .6 ASTM C553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .7 ASTM C612, Specification for Mineral Fiber Block and Board Thermal Insulation.
- .8 ASTM C795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
- .9 ASTM C921-(1998)e1, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.3 Canadian General Standards Board (CGSB)
- .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (R1999).

.5 Underwriters Laboratories of Canada (ULC)
- .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC-S701, Thermal Insulation Polyotrene, Boards and Pipe Covering.

1.2 DEFINITIONS

.1 For purposes of this section:
- .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
- .2 "EXPOSED" - will mean "not concealed" as defined herein.
- .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:
- .1 CRD: Code Round Ductwork,
- .2 CRF: Code Rectangular Finish.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.4 MANUFACTURERS' INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

.2 Installation instructions to include procedures used, and installation standards achieved.

1.5 QUALITY ASSURANCE

.1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

.2 Materials: UL listed; flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.

.3 Do work to TIAC standards.

.4 Deliver material to job site in original non-broken factory packaging, labelled with manufacturer's density and thickness.

.5 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:
- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 deg.C mean temperature when tested in accordance with ASTM C335. Maximum “K” factor to be 0.035 W/m. deg.K (0.24 BTU in/hr/sq.ft. Deg.K) to ASTM C5553.

.3 TIAC Class C-1: Rigid mineral fibre board to ASTM C612, unfaced or faced with vapour retarder jacket; ksi value of 0.035 at 24 degrees C.

.4 TIAC Code C-2: mineral fibre blanket to ASTM C553 with or without factory applied vapour retarder jacket; ksi value of 0.035 at 24 degrees C

.5 Flexible Duct Liner: Flexible non-combustible mineral fiber blanket to ASTM C 1071 Type 1; ksi value of 0.035 at 24 degrees C, 24 kg/cu m minimum density; coated air side for maximum 20.3 m/s air velocity. Minimum NRC value of 0.65 at 25mm to ASTM 423.

.6 Rigid Duct Liner: semi-rigid non-combustible mineral fiber to ASTM C 1071 Type 2; ksi value of 0.035 at 24 degrees C, 48 kg/cu m minimum density; coated air side for maximum 20.3 m/s air velocity. Minimum NRC value of 0.7 at 25mm to ASTM 423.

2.3 JACKETS

.1 Interior Applications:
- .1 Vapour Barrier Jackets: to CGSB 51-GP-52Ma.
- .2 PVC Jackets: One piece, high-gloss pre-moulded type, 0.8 mm (30mls) thick. Jackets exposed to outdoor use or flourescent lighting shall be ultra-violet ray resistant.
- .3 Canvas Jackets: ULC listed treated cotton fabric, 220 g/sq.m. to ASTM C 921
- .4 Aluminum Jackets: 0.51 mm thick; stucco embossed.

.2 Exterior Applications:
- .1 Aluminum Jackets: 0.51 mm thick; stucco embossed.
- .2 Stainless Steel Jackets: Type 304 stainless steel; 0.25 mm thick, stucco embossed
- .3 Outdoor Jacket: Coated glass fibre sheet, 16 kg/sq m.

2.4 ACCESSORIES

.1 Bands: 20 mm wide; 0.38 mm thick stainless steel.

.2 Insulating Cement: Hydraulic setting on mineral wool.

.3 Fibrous Glass Cloth: Untreated; 305 g/sq m weight.

.4 Adhesives: Compatible with insulation, waterproof, fire-retardant type.

.5 Impale Anchors: Galvanized steel, 2 mm diameter with 35mm diameter head, length as required for insulation.

.6 Joint Tape: self adhesive reinforced aluminum, minimum 50mm wide

.7 Tie Wire: stainless steel, 1.5 mm.

.8 Outdoor vapour retarder mastic:
- .1 Vinyl emulsion type acrylic, compatible with insulation
- .2 Fibrous glass cloth

3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of ductwork systems complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards

.2 Apply materials in accordance with manufacturer's instructions and as indicated.

.3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
- .1 Ensure hangers, and supports are outside vapour retarder jacket.

.5 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

.6 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.7 Locate insulation or cover seams in least visible location.

.8 Provide recovering jackets on exposed insulation throughout, including equipment room. Insulation located in crawl spaces, shafts and suspended ceiling spaces is not considered exposed. Use pre-sized paper under recovering at uneven insulated surfaces.

.9 External Duct Insulation:
- .1 Secure insulation with vapour barrier with wires and seal jacket joints with vapour barrier adhesive or tape to match jacket.
- .2 Secure insulation without vapour barrier with staples, tape, or wires.
- .3 Install without sag on underside of duct work. Use adhesive or mechanical fasteners to prevent sagging. Seal vapour barrier penetrations with vapour barrier adhesive. Stop and point insulation around access doors and damper operators.

.10 Exposed Rectangular: Secure rigid insulation with 50% coverage of adhesive and 12 gauge galvanized impale anchor tabs on 400 mm (16") centres. Seal joints and breaks with 250 mm (10") wide strips of open mesh glass cloth or tape imbedded between 2 coats of vapour barrier sealant. Point up other joints and breaks with hydraulic setting cement.

.11 Round Duct and Concealed Rectangular Duct: Adhere flexible insulation to ductwork with adhesive applied in 150 mm (6") wide strips on 400 mm (16") centres. Provide 16 gauge annealed tie wire tied, spiral wound or half hitched at 200 mm (8") centres for securing duct insulation until adhesive sets. Butt insulation and seal joints and breaks with 50 mm (2") lap of foil adhered over joint.

.12 Acoustic lining: Apply to interior of ducts where shown.
- .1 Adhere insulation with adhesive for 100 percent coverage. Secure insulation with mechanical fasteners on 375 mm centres maximum on top and side of duct work with dimension exceeding 500 mm. Seal and smooth joints. Seal vapour barrier penetrations with vapour barrier adhesive. Cut off excess fastener length and cover with brush coat of mastic.
- .2 Use 25 mm (1") thick insulation unless otherwise noted.

.3 Provide vapour barrier located on the warm side for outside air intakes.
.4 Ducts with acoustic insulation do not require external thermal insulation
.5 Ductwork dimensions indicated on drawings include insulation thickness.

3.3 INSTALLATION – JACKETS

.1 Install in accordance with TIAC standards and manufacturers written requirements.

.2 Provide recovering jackets on exposed insulation throughout, including equipment room. Insulation located in crawl spaces, shafts and suspended ceiling spaces is not considered exposed. Use pre-sized paper under recovering at uneven insulated surfaces.

3.4 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

System	TIAC Code	Vapour Retarder	Thickness (mm)	
Rectangular cold and dual temperature supply air ducts	C-1	yes	50	
Round cold and dual temperature supply air ducts	C-2	yes	50	
Supply, return and exhaust ducts exposed in space being served	none, unless indicated otherwise on drawings			
Mixing plenums	C-1	yes	50	
Exhaust duct between fan and louvre/discharge	C-1	Yes	50	
Ducts outside building	C-1	Yes	special as required to achieve RSI 4.76 (R-20) to match walls in accordance with NECB requirements.	
Acoustically lining	none		25	
Domestic Kitchen Range Hood Exhaust	C-1	yes	50	

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:
.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.
.1 Finishes: conform to following TIAC codes noted in table:

	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

END OF SECTION

1. General

1.1 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .1 ANSI/ASHRAE/IESNA 90.1-01-SI, Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials (ASTM International)
- .1 ASTM B209M-01, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
- .2 ASTM C335-95, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .3 ASTM C411-97, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .4 ASTM C449/C449M-00, Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C533-95 (2001), Specification for Calcium Silicate Block and Pipe Thermal Insulation.
- .6 ASTM C547-00, Specification for Mineral Fiber Pipe Insulation.
- .7 ASTM C553-00, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .8 ASTM C612-00a, Specification for Mineral Fiber Block and Board Thermal Insulation.
- .9 ASTM C795-92 (1998)e1, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .10 ASTM C921-89 (R1996), Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)
- .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .2 CGSB 51-GP-53M-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.

.4 Thermal Insulation Association of Canada (TIAC)
- .1 National Insulation Standards 1992(R1999).

.5 Underwriters Laboratories of Canada (ULC)
- .1 CAN/ULC-S102-M88 (R2000), Surface Burning Characteristics of Building Materials and Assemblies.

1.2 PRODUCT DATA

.1 Submit Product Data in accordance with Section 01 33 00 - Submittal Procedures.

1.3 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.4 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with 01 33 00 - Submittal Procedures.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.5 QUALITY ASSURANCE

.1 Applicator: Company specializing in mechanical insulation application with three years minimum experience.

.2 Materials: UL listed; flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.

.3 Do work to TIAC standards.

.4 Deliver material to job site in original non-broken factory packaging, labelled with manufacturer's density and thickness.

.5 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

2. Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:
- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: includes glass fibre and rock wool. Insulation on steam equipment to be rock wool only, glass fibre is not permitted.

.2 Rock wool shall be utilized on steam systems.
- .1 TIAC Code A-1; rigid pre-moulded mineral fibre to ASTM C 547 with or without factory applied vapour retarder jacket; ksi value of 0.035 at 24 deg.C
- .2 TIAC Code A-2: rigid moulded calcium silicate to ASTM C533 in sections and blocks, and with special shapes to suit project requirements, asbestos free; ksi value of 0.060 at 147 degrees C

.3 TIAC Code A-3: rigid pre-moulded mineral fibre to ASTM C 547 with or without factory applied vapour retarder jacket for high temperature applications; ksi value of 0.072 at 260 degrees C

.4 TIAC Code A-6: flexible unicellular tubular elastomer to ASTM C534; ksi value of 0.04 at 24 degrees C

.5 TIAC Class C-1: Rigid mineral fibre board to ASTM C612, unfaced or faced with CGSB 51-GP-52Ma vapour retarder jacket; ksi value of 0.035 at 24 deg.C.

.6 TIAC Code C-2: mineral fibre blanket to ASTM C553 with or without factory applied vapour retarder jacket. Thermal conductivity; ksi value of 0.04 at 24 degrees C.

2.3 CEMENT

.1 Thermal insulating and finish

.1 To: ASTM C449/C449M.

.2 Hydraulic setting or Air drying on mineral wool, to ASTM C449.

2.4 INSULATION SECUREMENTS

.1 Tape: Self-adhesive, aluminum, plain, reinforced, 50 mm wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

.6 Fasteners: 2 mm diameter pins with 35 mm diameter clips. Length of pin to suit thickness of insulation.

2.5 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

3. Execution

3.1 PRE- INSTALLATION REQUIREMENTS

.1 Pressure testing of equipment and adjacent piping systems complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install materials in accordance with manufacturer's instructions and TIAC National standards.

.2 In exposed equipment in finished areas, locate insulation and cover seams in least visible locations.

.3 Provide insulation with vapour barrier when medium may be below ambient temperature and as noted on schedules.

.4 Neatly finish insulation at supports, protrusions, and interruptions.

.5 Apply insulation with edges tightly butted, joints staggered and secured in place by steel bands. Where necessary weld on suitable anchors.

.6 Provide sufficient clearance around openings for normal operation of equipment.

.7 Finish hot surface insulation with 25 mm galvanized hexagonal mesh and coat with hydraulic setting insulation cement.

.8 Finish cold surface insulation joints with 100 mm wide strips of vapour barrier sealed with vapour barrier adhesive finish insulation with heavy coat of vapour barrier mastic applied over whole body. Finish with a final coat of cement containing 25% by weight of Portland Cement. Recover and provide an extra coat of lagging adhesive.

.9 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
- .1 Hangers, supports outside vapour retarder jacket.

.10 Supports, Hangers:
- .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.3 INSULATION SCHEDULES

.1 Insulation for equipment to match requirements for associated piping or ductwork serving equipment unless otherwise specified.

.2 Thickness of insulation, refer to Section 23 07 15 Thermal Insulation for Piping and 23 07 13 Duct Insulation.

.3 Finishes:
- .1 Exposed indoors: canvas
- .2 Exposed in mechanical rooms: Aluminum jacket.
- .3 Concealed, indoors: canvas on valves, fittings. No further finish.
- .4 Use vapour retarder jacket on TIAC code A-3, A-6 and C-2 insulation compatible with insulation.
- .5 Outdoors: water-proof aluminum jacket.
- .6 Finish attachments: SS screws, at 150 mm on centre. Seals: wing.
- .7 Installation: to appropriate TIAC code.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Thermal insulation for piping and piping accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .1 ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
- .2 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .3 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.
- .6 ASTM C547-2003, Mineral Fiber Pipe Insulation.
- .7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .8 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)
- .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts

.4 Department of Justice Canada (Jus)
- .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
- .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.6 Manufacturer's Trade Associations
- .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).

.7 Underwriters' Laboratories of Canada (ULC)
- .1 CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .3 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings
- .4 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

.1 For purposes of this section:
- .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
- .2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC ss:
- .1 CRF: Code Rectangular Finish.
- .2 CPF: Code Piping Finish.

1.4 QUALITY ASSURANCE

.1 Applicator: Company specializing in mechanical insulation application with three years minimum experience.

.2 Materials: UL listed; flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.

.3 Do work to TIAC standards.

.4 Deliver material to job site in original non-broken factory packaging, labelled with manufacturer's density and thickness.

.5 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.
- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre and rock wool.
- .1 TIAC Code A-1; rigid pre-moulded mineral fibre to ASTM C 547 with or without factory applied vapour retarder jacket; ksi value of 0.035 at 24 degrees.

.2 TIAC Code A-2: rigid moulded calcium silicate to ASTM C533 in sections and blocks, and with special shapes to suit project requirements, asbestos free; ksi value of 0.060 at 147 deg.C.

.3 TIAC Code A-3: rigid pre-moulded mineral fibre to ASTM C 547 with or without factory applied vapour retarder jacket for high temperature applications; ksi value of 0.072 at 260 degrees C

.4 TIAC Code A-6: flexible unicellular tubular elastomer to ASTM C534; ksi value of 0.04 at 24 degrees C

.5 TIAC Class C-1: Rigid mineral fibre board to ASTM C612, unfaced or faced with CGSB 51-GP-52Ma vapour retarder jacket; ksi value of 0.035 at 24 deg.C.

.6 TIAC Code C-2: mineral fibre blanket to ASTM C553 with or without factory applied vapour retarder jacket. Thermal conductivity; ksi value of 0.04 at 24 deg.C

2.3 REMOVABLE, PRE-FABRICATED INSULATING ENCLOSURES

.1 Use of insulating materials other than those stated in this specification requires Departmental Representative's approval. Standard of acceptance for re-usable insulation blankets shall be Reflex Re-usable flexible insulation covers.

.2 All materials shall be of flame resistant materials.

.3 Re-usable flexible insulation blanket outer jacket material shall be 0.26 kg/m2. Teflon coated fibreglass cloth.

.4 Material used to secure seams and attachments on re-usable flexible insulation blankets shall be 10 strand stainless steel thread with polyester wrap.

.5 Re-usable flexible insulation blanket liner material shall be 560 grams/m2 Teflon coated fibreglass cloth for operating temperatures up to 232 deg.C.

.6 Minimum insulation thickness shall be 25 mm insulation for operating temperatures up to 232 deg.C.

.7 Insulation materials shall be Type E needled fibreglass mat containing no organic binders and no less than 11 pound density for operating temperatures up to 538 deg.C.

.8 Fasteners shall be velcro closures incorporated with seam flaps in conjunction with sewn on straps and stainless steel D rings.

.9 Flaps shall be used to cover all closing seams and cover slots. The flaps shall be 50 mm wide plain flaps for operating temperatures up to 232 deg.C.

.10 6 mm matrix braded Nomex draw-cord closures shall be used on cover openings over 50 mm in diameter. Close the ends of covers over adjacent insulation or piping.

.11 Quilting fasteners shall be 14 gauge stainless steel quilt pins and locking washers.

.12 A stainless steel drain grommet, 11 mm in diameter, shall be installed at the low point on the cover.

.13 A permanent stainless steel or aluminum identification tag shall be attached to each blanket. Tags shall be secured to the re-usable blanket with aluminum rivets and shall be installed in the most visible location on the blanket.

2.4 ACCESSORIES

.1 Bands: 20 mm wide; 0.38 mm thick stainless steel.

.2 Insulating Cement: Hydraulic setting on mineral wool.

.3 Fibrous Glass Cloth: Untreated; 305 g/sq m weight.

.4 Adhesives: Compatible with insulation, waterproof, fire-retardant type.

.5 Impale Anchors: Galvanized steel, 2 mm diameter with 35mm diameter head, length as required for insulation.

.6 Joint Tape: self adhesive reinforced aluminum, minimum 50mm wide

.7 Tie Wire: stainless steel, 1.5 mm.

.8 Outdoor vapour retarder mastic:
- .1 Vinyl emulsion type acrylic, compatible with insulation
- .2 Fibrous glass cloth

2.5 JACKETS

.1 Interior Applications:
- .1 Vapour Barrier Jackets: to CGSB 51-GP-52Ma.
- .2 PVC Jackets: One piece, high-gloss pre-moulded type, 0.8 mm (30mls) thick. Jackets exposed to outdoor use or flourescent lighting shall be ultra-violet ray resistant.
- .3 Canvas Jackets: ULC listed treated cotton fabric, 220 g/sq.m. to ASTM C 921
- .4 Aluminum Jackets: 0.51 mm thick; stucco embossed.

.2 Exterior Applications:
- .1 Aluminum Jackets: 0.51 mm thick; stucco embossed.
- .2 Stainless Steel Jackets: Type 304 stainless steel; 0.25 mm thick, stucco embossed
- .3 Outdoor Jacket: Coated glass fibre sheet, 16 kg/sq m.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION ON PIPING

.1 Install materials in accordance with manufacturer's instructions and TIAC National standards.

.2 Continue insulation with vapour barrier through penetrations. pack around pipes with fire proof self-supporting insulation material, properly sealed.

.3 In exposed piping, locate insulation and cover seams in least visible locations.

.4 Provide insulation with vapour barrier when medium conveyed may be below ambient temperature and as noted on schedules.

.5 Insulate fittings and valves on pipe systems.

.6 On insulated piping with vapour barrier, insulate fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints. Cover with open mesh glass cloth sealed with vapour barrier sealant.

.7 On insulated piping without vapour barrier and piping conveying fluids 60 degrees C or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation at such locations.

.8 Provide an insert of cork or other heavy density material not less than 150 mm long, of same thickness and contour as adjoining insulation, between support shield and piping, but under the finish jacket, on piping 50 mm diameter or larger.

.9 Neatly finish insulation at supports, protrusions, and interruptions.

.10 Handicap Plumbing Fixtures: Insulate trap and drain with 25 mm (1") fibreglass insulation complete with high gloss white PVC jacket. Refer to Plumbing specifications.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Removable insulation bags must be provided for the following: control valves, unions or flanges at equipment, steam traps and flanged valves.

.2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.3 Blankets on flanged valves and equipment shall be designed to cover adjacent mating flanges and overlap line insulation by a minimum of 50 mm. Allowance of stud length plus 25 mm from the back of the mating flange shall be used to calculate the cut back distance of line insulation. Draw-cold flaps shall not be considered as part of the overlap.

.4 Blankets on valves shall be designed to cover the valve body and the bonnet flange of the valve.

.5 Blankets for pressure gauges include block and bleed valve.

.6 Blankets for PSV's shall include the outlet flange. Blanket shall cover entire spring chamber.

.7 All blankets shall be fitted with an identification tag clearly marked with the following information:

.1	Equipment size and type	i.e. 6" 300# Control Valve
.2	Equipment location and tag number	i.e. 21-PV-129
.3	Manufacturer's Serial Number	i.e SN01010

.8 All equipment shall be field measured by blanket supplier. Measurements shall be performed after equipment is installed. All necessary allowances for the blankets shall be coordinated between the blanket supplier and the mechanical, electrical and insulation Contractors.

.9 Re-usable flexible insulation blanket construction:

.1 Blankets up to 25 mm thick shall be inside seam construction with double stitching, with the liner and jacket material sewn together to form the insulation pocket.

.1 Perimeter flaps shall be formed as an extension of the liner and jacket, and shall not be attached to blanket as separate pieces.

.2 All blankets up to 25 mm thick must be double stitched. First stitch will be performed with cloth layers sewn together inside out. Blanket will then be turned right side out and top stitched around all penetrations and around the perimeter of the insulation pocket to create a separation between the insulation pocket and the perimeter flaps.

.3 All draw-cord and closure flaps, required inside the perimeter of the blanket shall be attached inside the seam, between the liner and jacket layers of the blanket.

.2 Blankets over 25 mm thick shall be constructed using boxed corners and gussets in order to maintain consistent thickness across the entire area of the blanket.

.1 Perimeter flaps shall be formed as an extension of the outer jacket, and shall not be attached to the blanket as separate pieces.

.2 All draw-cord and closure flaps, required inside the perimeter of the blanket, shall be attached inside the seam, between the liner and jacket layers of the blanket.

3.5 INSTALLATION - JACKETS

.1 Install in accordance with TIAC standards and manufacturers written requirements.

.2 Indoor, Concealed Pipes: Apply pipe insulation with an integral all-service jacket complete with vapour barrier if specified. Secure jacketing using appropriate fastenings on approximately 100mm centres. Cover longitudinal and circumferential joints with jacket finishing tape neatly applied. Alternately secure jacketing using integral self-sealing lap and self-sealing circumferential joint strips. Fittings, (valves and strainers if

specified) not finished with PVC covers shall be covered with a hard coat cement and finish with treated fitting fabric applied with fabric adhesive. Finish jackets as scheduled.

.3 Indoor, Exposed Applications: Insulate as for concealed applications. Finish jacket to be as indicated in schedule. Where indicated by Architect to be painted, finish insulation with canvas jacket; size for finish painting.

.4 Exterior Applications: Vapour barrier jacket, covered with aluminum jacket with seams located on bottom side of horizontal piping. insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapour barrier cement. Lap joints 75 mm (3") minimum and seal with compatible waterproof lap cement.

.5 Provide recovering jackets on exposed insulation throughout, including equipment room. Insulation located in crawl spaces, shafts and suspended ceiling spaces is not considered exposed. Use pre-sized paper under recovering at uneven insulated surfaces.

.6 Metal Jackets: Over the pipe insulation apply metal jacketing using necessary fastenings on approximately 150mm centres. Over insulated fittings, (valve bodies, valve bonnets, strainers and flanges etc. as specified) apply metal jacket or preformed metal fitting covers to provide a complete jacket system. Secure with necessary fastenings.

.7 PVC Jackets: Over the pipe insulation apply PVC jacketing using necessary fastenings on approximately 100mm centres. Cover longitudinal and circumferential joints with finishing tape neatly applied. Over insulated fittings, valve bodies, valve bonnets, strainers and flanges if specified) apply PVC jacket or preformed PVC fitting covers to provide a complete jacket system. Secure with appropriate fastenings and jacket finishing tape.

3.6 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges, fittings and all associated equipment unless otherwise specified.

.2 TIAC Code: A-1.
- .1 Seals: lap seal adhesive, lagging adhesive.
- .2 Installation: TIAC Code 1501-H.

.3 TIAC Code: A-3.
- .1 Seals: VR lap seal adhesive, VR lagging adhesive.
- .2 Installation: TIAC Code: 1501-C.

.4 TIAC Code: A-6.
- .1 Seals: lap seal adhesive, lagging adhesive.
- .2 Installation: to TIAC standards.

.5 TIAC Code: C-2 vapour retarder jacket.
- .1 Seals: lap seal adhesive, lagging adhesive.
- .2 Installation: TIAC Code: 1501-C.

.6 TIAC Code: A-2.
.1 Seals: lap seal adhesive, lagging adhesive.
.2 Installation: TIAC Code: 1501-H.

.7 Thickness of insulation as listed in following table.
.1 Run-outs to individual units and equipment not exceeding 4000 mm long.
.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.
.3 Chilled water insulation thicknesses are listed such that a minimum of 25mm is maintained over all fittings, valves and accessories.

Application	Temp deg.C.	TIAC code	Pipe sizes (NPS) & insulation thickness (mm)					
		Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over	
Hot Water	60 - 94	A-1	25	38	38	38	38	38
Hot Water	up to 59	A-1	25	25	25	25	38	38
Hot Water Equipment	All Temp.	A-1	38	38	38	38	38	38
Cold Water		A-3	25	25	25	25	25	25
Refrigerant	4 - 13	A-6	25	25	25	25	25	25
Refrigerant	below 4	A-6	25	25	38	38	38	38
Cooling Coil cond. drain and pan		C-2	25	25	25	25	25	25

.8 Finishes:
.1 Exposed indoors: canvas or PVC
.2 Exposed in mechanical rooms: PVC jacket.
.3 Concealed, indoors: canvas on valves, fittings. No further finish.
.4 Use vapour retarder jacket on TIAC code A-3, A-6 and C-2 insulation compatible with insulation.
.5 Outdoors: water-proof aluminum jacket.
.6 Finish attachments: SS screws, at 150 mm on centre. Seals: wing.
.7 Installation: to appropriate TIAC code CRF/1 through CPF

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
  .1 ASTM E202-04, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.2 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 PREPARATION

.1 Do not conceal or cover piping, fixtures or equipment until inspected by consultant and tested.

.2 Provide equipment, materials and labour for tests and pay expenses. Use test instruments by approved laboratory or manufacturer and furnish certificate showing degree of accuracy.

.3 Test instruments shall have been calibrated within one year

.4 Install permanent gauges and thermometers just prior to tests to avoid changes in calibration.

.5 Carry out hydraulic tests for 8 hours and maintain pressure. Where leakage occurs, repair and re-test.

.6 Before adjusting and balancing, verify that systems are complete and operable. Ensure temperature control systems are complete and operable, thermal overload protection is in place, final filters installed, hydronic systems, flushed, filled, and vented.

.7 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Consultant to facilitate spot checks during testing.

.8 Recorded data shall represent actually measured, or observed condition.

3.2 PRESSURE TESTS

.1 Heating Water Piping: Test to 1-1/2 times maximum working pressure or minimum 1034 kPa (150 psi) water pressure.

.2 Domestic Water Piping: Test to 1-1/2 times maximum working pressure or 1034 kPa (150 psi) water pressure measured at system low point.

.3 Drainage Systems: Test by filling with water to produce water pressure of 30 kPa (10') minimum and 75 kPa (25') maximum. Check for proper grade and obstruction by ball test.

.4 Standpipe System: Test to 2070 kPa water pressure at the valve.

.5 Sprinkler System: Test as required by authorities having jurisdiction.

.6 Control Air Piping: Test to 345 kPa air pressure. Maintain pressure 1 hour with maximum 7 kPa pressure drop.

.7 Refrigerant Piping: Test with nitrogen to 2070 kPa on high pressure side and 1035 kPa on low side and refrigerant halide torch test.

.8 Gas Piping: Test as required by authority having jurisdiction.

.9 Check system during application of test pressure including visual check for leakage of water test medium, soap bubble test for air or nitrogen test medium and halide torch for refrigerant medium.

.10 During piping system tests, check linear expansion at elbows, U bends, expansion joints, and offsets for proper clearance.

.11 When using water as test medium for system not using water or steam, evacuate and dehydrate the piping and certify the lines are dry. Use agency specializing in this type of work.

.12 Should tests indicate defective work or variance with specified requirements, make changes immediately to correct the defects. Correct leaks by remaking joints in screwed fittings, cutting out and rewelding welded joints, remaking joints in copper lines. Do not caulk.

.13 Sprinkler system: Test as required by authorities having jurisdiction.

3.3 PERFORMANCE TESTS

.1 Conduct performance tests to demonstrate equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct tests as soon as conditions permit. Make changes, repairs, and adjustments required as tests may indicate prior to operating tests.

.2 Lubricate bearings, adjust and/or replace and set direct and "V" belt drives for proper alignment and tension.

.3 Calibrate and adjust thermostats, thermometers, gauges, linkage and dampers. Control valves shall operate freely.

.4 Operate and test motors and speed switches for correct wiring and sequences. Check overload heaters in motor starters.

.5 Replace disposable filters with new testing filters and remove, clean and reinstall washable filters prior to conducting testing.

.6 Clean fan wheel and coils prior to conducting tests.

.7 Remove, clean, and reinstall strainers prior to conducting tests.

.8 Fasten loose and rattling pieces of equipment. Unit heaters, pumps and other equipment shall operate quietly.

.9 Make operating tests for minimum of 5 days during heating season and cooling season of first year of operation and at times when directed, for proper setting of controls under peak load conditions.

.10 Provide services of mechanics and manufacturer's representatives, ladders, tools and associated equipment required to assist the Owner in final tests.

.11 Conduct final operating tests in presence of the Owner. Vary loads to illustrate start-up and shut-down sequence and simulate emergency Conditions for safety shut-downs, with automatic and manual reset. Repair and test defects until satisfactory. Make final adjustments to suit exact building conditions.

.12 Provide manufacturer’s start-ups and reports as specified under specific equipment. Provide copies reports in the Operation and Maintenance Manuals.

.13 Subject gas fired appliances rated in excess of 117 kW to an operational test established by the authority having jurisdiction and to pass this test before being approved for operation.

3.4 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)

.1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.

.2 When systems are operational, perform following tests:

- .1 Conduct full scale tests at maximum design flow rates, temperatures and pressures for continuous consecutive period of 48 hours to demonstrate compliance with design criteria.
- .2 Verify performance of hydronic system circulating pumps as specified, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.
  - .1 Pump operation.
  - .2 Heating Plant and Chilled Water Plant operation (only as pertains to supplying energy to modified systems in scope).
  - .3 Maximum heating demand.

.4 Maximum cooling demand.

3.5 HYDRONIC SYSTEM CAPACITY TEST

.1 Perform hydronic system capacity tests after:
- .1 TAB has been completed
- .2 Verification of operating, limit, safety controls.
- .3 Verification of primary and secondary pump flow rates.
- .4 Verification of accuracy of temperature and pressure sensors and gauges.

.2 Calculate system capacity at test conditions.

.3 Using manufacturer's published data and calculated capacity at test conditions, extrapolate system capacity at design conditions.

.4 When capacity test is completed, return controls and equipment status to normal operating conditions.

.5 Submit sample of system water to approved testing agency to determine if chemical treatment is correct. Include cost.

.6 Chilled water system capacity test:
- .1 Perform capacity test when ambient temperature is within 10% of design conditions. Simulate design conditions by:
  - .1 Adding heat from building heating system or;
  - .2 Raising space temperature by turning off cooling and air systems for sufficient period of time before starting testing and pre-heating building to summer design space temperature (occupied) or above.
- .2 Test procedures:
  - .1 Open fully cooling coil control valves.
  - .2 Set thermostats on associated AHU's for maximum cooling.
  - .3 Set AHU's for design maximum air flow rates.
  - .4 After system has stabilized, record chilled water flow rates and supply and return temperatures simultaneously.

3.6 POTABLE WATER SYSTEMS

.1 When cleaning is completed and system filled:
- .1 Verify performance of equipment and systems as specified elsewhere in Division 22, 23 or 25.
- .2 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or recharge air chambers. Repeat for each outlet and flush valve.
- .3 Confirm water quality consistent with supply standards, verifying that no residuals remain resulting from flushing and/or cleaning.

3.7 WET AND DRY PIPE SPRINKLER SYSTEM, STANDPIPE AND HOSE SYSTEMS

.1 Cleaning, testing, start-up, performance verification of equipment, systems, components, and devices is specified elsewhere in Division 23.

.2 Verification of controls, detection devices, alarm devices is specified Division 26.

.3 Demonstrate that fire hose will reach to most remote location regardless of partitions, and obstructions.

.4 Verify operation of interlocks between HVAC systems and fire alarm systems as required by Code or specified.

3.8 SANITARY AND STORM DRAINAGE SYSTEMS

.1 Ensure that traps are fully and permanently primed.

.2 Ensure that fixtures are properly anchored, connected to system.

.3 Operate flush valves and operate each fixture to verify drainage and no leakage.

.4 Cleanouts: refer to Section 22 42 03 - Commercial Washroom Fixtures.

.5 Roof drains:
- .1 Refer to Section 22 42 03 - Commercial Washroom Fixtures.
- .2 Remove caps as required.

3.9 REPORTS

.1 Include record of all tests in Operation and Maintenance Manuals.

3.10 TRAINING

.1 In accordance with Section 21 05 01 - Common Work Results Mechanical.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Procedures and cleaning solutions for cleaning mechanical piping systems.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
  .1 ASTM E202-00, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  .1 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 GENERAL REQUIREMENTS

.1 Provide on-site start-up services and support services as required during first year of operation to maintain chemical treatment program.

.2 Materials which may contact finish areas through leakage shall be colourless.

.3 It is the Contractor’s full responsibility for providing suitable working systems especially and in accordance with the requirements of the boiler/chiller manufacturer and equipment construction (copper, aluminum, cast iron, etc.).

2.2 CLOSED HYDRONIC SYSTEM

.1 Cleaning:
  .1 Buffered liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.

.2 Biocide, chlorine release agents such as sodium hypochlorite or calcium hypochlorite, or microbiocides such as quarternary ammonia compounds, tributyl tin oxide, methylene bis (thiocyanate), or isothiazolones.

.2 Glycol:
.1 Refer to equipment schedule for type of glycol and percentage of solution. Contractor shall ensure glycol utilized meets Manufacturers requirements for the installed equipment.

2.3 POT FEEDER

.1 1.9L (2 quart) capacity cast iron or welded steel with quick opening cap for working pressure of 1200 kPa.

2.4 SIDESTREAM FILTER

.1 Refer to Section 23 21 14 Hydronic Specialties.

2.5 WATER METER

.1 Displacement type cold water meter with sealed, tamper-proof magnetic drive, impulse contact register, single pole, double throw dry contact switch.

2.6 SOLENOID VALVES

.1 Forged brass body globe pattern, normally open or closed as required, general purpose solenoid enclosure, and continuous duty coil.

2.7 GLYCOL SYSTEM

.1 Refer to equipment schedule.

.2 Packaged glycol mixing and fill system complete with following standard components:
.1 storage/mixing tank with cover
.2 Power supply: cord and plug for standard 115 VAC plug.
.3 Pressure pump capable of running dry without damage.
.4 Low level pump cut-out.
.5 Pump suction hose with inlet strainer and check valve.
.6 feeder system shall be compatible with glycol solutions up to 50%.
.7 Manual diverter valve for purging air and agitating contents of storage tank.
.8 Unit to be complete with Low Level Alarm Panel c/w Remote Monitoring Dry Contacts and Selectable Audible Alarm

2.8 HEAT TRANSFER FLUID

.1 Refer to equipment schedule for percentage by volume solution of inhibited glycol based heat transfer fluid and type of glycol.

.2 Heating Water Systems: Heat transfer fluid shall be in accordance with the type/construction of the boiler being installed (copper, aluminum, cast iron, stainless steel, etc.) and in accordance with the boiler manufacturer's requirements. The contractor shall ensure that the chemical treatment Agency has all necessary information regarding the boiler system. All chemicals used and system maintenance information shall be provided and included in the maintenance manuals. For boilers with aluminium

heat exchangers, glycol with multi-metal additives such as produced by Rhogard, Brenntag, Ashland or Furnox shall be used according to the boiler manufacturer.

.3 Dilution Water: Glycol supplier shall identify the optimum dilution water quality required to complement the glycol solution. If different than specified below, this shall be submitted to the Consultant for review. In general, water used to dilute the concentration of glycol must be either distilled, de-ionized, and contain less than 25 ppm of chloride and sulfite, and less than 50ppm each of hard water ions (calcium and magnesium as calcium carbonate) with a total hardness not to exceed 100ppm. If good quality water is not available, the glycol supplier shall provide the heat transfer fluid and water to meet the specifications of the system.

2.9 TEST EQUIPMENT

.1 Provide test kits as required to determine proper systems treatment and not limited to the following:
- .1 System Test Kit: P & M Alkalinity, scale inhibitor, nitrite, sulphite, molybdate, Ph and hardness.
- .2 Refractormeter to measure freezing protection of glycol mixture.
- .3 Alkalinity titration test kit.
- .4 Chloride titration test kit.
- .5 Sulphite titration test kit.
- .6 Total hardness titration test kit.
- .7 Low phosphate test kit.
- .8 Conductivity bridge, range 0 - 10,000 microhms.
- .9 Creosol red pH slide complete with reagent.
- .10 High nitrite test kit.

3 Execution

3.1 PREPARATION

.1 Ensure reasonable care is exercised in preventing debris, dirt and other foreign material from entering piping system during construction.

.2 Cleaning procedures:
- .1 Provide detailed report outlining proposed cleaning procedures at least 2 weeks prior to proposed starting date. Report to include:
  - .1 Cleaning procedures, flow rates, elapsed time.
  - .2 Chemicals and concentrations used.
  - .3 Inhibitors and concentrations.
  - .4 Specific requirements for completion of work.
  - .5 Special precautions for protecting piping system materials and components.
  - .6 Complete analysis of water used to ensure water will not damage systems or equipment

.3 Systems to be operational, filled, started, and vented prior to cleaning.

.4 Place terminal control valves in open position during cleaning.

.5 Verify that electric power is available and of the correct characteristics.

.6 Provide adequate drain connections to completely drain systems in one hour. Use water meter to record gallonage (litres) in each system.

.7 Remove strainer screens from system during cleaning. Protect or remove control devices from systems being cleaned. Terminal control valves shall be in open position during cleaning.

.8 System pumps may be used for cleaning provided that new set of seals are provided and installed, and pumps are dismantled and inspected. Replace worn parts, install new gaskets and turnover used seals.

3.2 INSTALLATION

.1 Install equipment to manufacturer's written instructions and as per schematics and drawings.

3.3 CLEANING SEQUENCE

.1 Concentration: As recommended by manufacturer.

.2 Flush velocity in system mains and branches shall be sufficient to ensure removal of debris.

.3 Hot Water Heating Systems:
- .1 Apply heat while circulating, slowly raising temperature to 71 degrees C and maintain for 12 hours minimum.
- .2 Remove heat and circulate to 37.8 degrees C or less; drain systems as quickly as possible and refill with clean water.
- .3 Circulate for 6 hours at design temperatures, then drain.
- .4 Refill with clean water and test. Repeat flush and test until traces of system cleaner is removed to satisfaction of the Departmental Representative.
- .5 Refill system with water or water/glycol solution as specified.

.4 Use neutralizer agents on recommendation of system cleaner supplier and approval of Consultant.

.5 Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

.6 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

3.4 CLOSED SYSTEM TREATMENT

.1 Provide one bypass feeder in conjunction with sidestream filters on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

.2 Introduce closed system treatment through bypass feeder when required or indicated by test.

.3 An analysis of the closed system water shall be taken and recorded by the contractor after completion of work clearly indicating the following: tests proving glycol concentration, tests showing inhibitor strength, tests indicating Ph levels and water quality, Test reports shall identify specified requirements of system and manufacturers requirements for installed equipment and clearly show that water quality, pH, and inhibitor strength all meet identified requirements. This report shall be recorded in the maintenance manual. Refer to ASTM E202.

.1 Perform tests before system is turned over to the Owner.
.2 Provide test prior to end of guarantee and replenish as required.
.3 Provide written test results for review for all tests.

.4 Provide antifreeze solution lost from the systems from any cause other than neglect by the Owner during the first year of operation.

.5 Provide two extra 204 litre (45 gallon) drums of specified glycol following

3.5 START-UP OF HYDRONIC SYSTEMS

.1 After cleaning is completed and system is filled:
.1 Establish circulation and expansion tank level, set pressure controls.
.2 Ensure air is removed.
.3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
.4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.
.5 Clean out strainers repeatedly until system is clean.
.6 Commission water treatment systems as specified.
.7 Check water level / pressure in expansion tank with cold water with circulating pumps OFF and again with pumps ON.
.8 Repeat with water at design temperature.
.9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.
.10 Bring system up to design temperature and pressure slowly.
.11 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
.12 Adjust pipe supports, hangers, springs as necessary.
.13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.
.14 If sliding type expansion joints bind, shut down system, re-align, repeat start-up procedures.
.15 Re-tighten bolts using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.
.16 Check operation of drain valves.
.17 Adjust valve stem packings as systems settle down.
.18 Fully open balancing valves (except those that are factory-set).
.19 Check operation of over-temperature protection devices on circulating pumps.
.20 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission

3.6 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and installation procedures for electric heating and cooling controls.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
    .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  .2 Instructions: submit manufacturer's installation instructions.
    .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.4 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 COORDINATION

.1 All electrical low-voltage control wiring, including interlock wiring, required for the equipment supplied by Mechanical, except where otherwise noted, shall be supplied and installed by Mechanical or their subtrades.

.2 All mechanical control wiring 50 volts or more shall be a minimum of #14 gauge wire. All mechanical control wiring less than 50 volts shall be minimum #18 gauge wire.

.3 All mechanical control wiring installed by mechanical shall conform with the requirements of the local electrical authority and the Division 26 Electrical specifications.

.4 Electrical Contractor: Electrical shall provide the following:
  .1 All power wiring to equipment.
  .2 Wiring of inline control devices on 120 Vac as indicated on drawings (remote solid state speed controllers for fan operation).

2 Products

2.1 THERMOSTAT (LOW VOLTAGE)

.1 Low voltage wall thermostat:
- .1 For use on 24 V circuit at 1.5 A capacity.
- .2 With heat anticipator adjustable 0.1 to 1.2 A.
- .3 Temperature setting range: 10 degrees C to 25 degrees C.
- .4 Without sub-base.

2.2 THERMOSTAT GUARDS

.1 Thermostat guards: lockable,. Slots for air circulation to thermostat.

2.3 LOW LIMIT TEMPERATURE ALARM

.1 Low limit temperature alarm with:
- .1 Rating: 10.2 A at 120 V.
- .2 Sensing bulb and 1.5 m long capillary tube.
- .3 Switching action: manual.
- .4 Temperature setting range: 0 degrees C to 15 degrees C.

2.4 HIGH LIMIT TEMPERATURE ALARM

.1 High limit temperature alarm with:
- .1 Rating 10 A at 120 V.
- .2 Positive lock-out.
- .3 Manual reset only after 14 degrees C drop-in temperature.
- .4 Cutout setting: 50 degrees C.

2.5 ROOF TOP UNIT THERMOSTAT

.1 Programmable low-voltage thermostat/interface to be supplied with RTU, refer to RTU specifications.

2.6 MOTORIZED DAMPER ACTUATOR (Outdoor Air Intake, CO Sensors)

.1 Mechanical to provide line voltage (120V/1ph) actuator matched to damper.

.2 Actuator to be normally closed.

.3 Direct mount proportional type as indicated.

.4 Operator: size to control dampers against maximum pressure and dynamic closing/opening pressure, whichever is greater.

.5 Damper actuator to drive damper from full open to full closed in less than 120 seconds.

.6 Damper motors shall be provided with adjustable metal mounting brackets. Damper motor shall be rigidly attached so as not to deflect when operating damper from 0 to 100% position.

.7 Damper operator arms shall be double yoke linkages with double set screws for fastening to damper shaft.

.8 Damper operators shall be direct drive and equal to those manufactured by Belimo. Provide sufficient quantity of damper operators to provide a minimum of 5 in-lbs of torque for every square foot of damper area.

2.7 DEDICATED ROOM AIR CONDITIONING

.1 Low voltage thermostat to be supplied with Air Conditioner.

2.8 CONTROL VALVES

.1 Valves shall be sized by the control manufacturer and guaranteed to meet the required capacity. Valve shall be sized to achieve reasonable authority at minimum pressure drop. In general, valve shall have pressure drop equal to pressure drop of controlled device. In general valve shall be line size or one size smaller.

.2 Nominal body rating shall be not less than 125 PSI. However, the valve body and packing selected shall be sized to withstand the system static head plus the maximum pump head and the maximum temperature of the control medium.

.3 Two-way modulating valves shall have close-off ratings exceeding the maximum pressure difference, at any load condition, between the outlet and inlet. Each valve shall be equipped with proper packing to assure there will be no leakage at the valve stem.

.4 Terminal unit two-way control valves shall have equal percentage characteristics. Terminal unit three-way control valves shall have linear flow characteristics.

.5 Physical sizes of valves will be such that they will fit within the physical space provided within equipment enclosures. Verify before ordering materials.

.6 NPS 50mm (2") and under:
- .1 Screwed National Pipe Thread (NPT) tapered female connections.
- .2 Valves to ANSI Class 250, valves to bear ANSI mark.
- .3 Rangeability 50:1minimum.

.7 NPS 64mm (2-1/2") and larger:
- .1 Flanged connections.
- .2 Valves to ANSI Class 150 or 250 as indicated, valves to bear ANSI mark.
- .3 Rangeability 100:1minimum.

.8 Valves are to be provided complete with mounting plate for installation of actuators.

.9 Leakage rate ANSI class IV, 0.01% of full open valve capacity.

2.9 ELECTRONIC / ELECTRIC VALVE ACTUATORS

.1 Damper and valve operator shall be electric and be provided for each automatic damper or valve and shall be of sufficient capacity to operate the damper or valve under all conditions and to guarantee tight close-off of valves, as specified, against system pressure encountered.

.2 Each central system damper or valve operator shall be provided with spring-return for normally closed or normally open position for fail safe operation to account for fire, low temperatures, or power interruption as indicated or as appropriate.

.3 Valve Actuator Requirements:
- .1 Construction: steel, cast iron, aluminum.
- .2 Control signal: 0-10V DC.
- .3 Positioning time: to suit application. 90 sec maximum.
- .4 Scale or dial indication of actual control valve position.
- .5 Size actuator to meet requirements and performance of control valve specifications.
- .6 For interior and perimeter terminal heating and cooling applications floating control actuators are acceptable.

2.10 LOCAL FAN CONTROL TIMER (Rooms 133/134, 138/144, 146/150, 151/156))

.1 Timer switch shall be line voltage, low profile push button activation with stainless steel cover. Switch to have preset time delays of 15, 30, 60, or 120 minutes, activated from push button. LED display to indicate time delay and power.

.2 Push button shall be mounted on stainless steel plate, mounted flush to wall.

.3 Plate shall be secured with security screws.

.4 Wiring shall route in conduit within wall from inset service box to crawlspace.

2.11 TEMPERATURE SENSORS

.1 General: except for room sensors to be resistance or thermocouple type to following requirements:
- .1 Thermocouples: limit to temperature range of 200 degrees C and over.
- .2 RTD's: 1000 ohm at 0 degrees C (plus or minus 0.2 ohms) platinum element or better with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.
- .3 Sensing element: hermetically sealed.
- .4 Stem and tip construction: copper or type 304 stainless steel.
- .5 Time constant response: less than 3 seconds to temperature change of 10 deg.C.
- .6 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length 100 mm as indicated.
- .7 Analog temperature sensors shall provide an output signal that varies continuously with the sensed temperature, within a specified range.
- .8 Binary temperature sensors shall provide an output signal that is either on or off depending upon whether the sensed temperature is above or below the setpoint temperature.

.2 Outdoor air temperature sensors:
- .1 Outside air type: complete with probe length 100 - 150 mm long, non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13 mm conduit, weatherproof construction in NEMA 4 enclosure. Transmitter shall be mounted to minimize building film effects.

.3 Pipe / Tank Temperature Transmitter:
- .1 Shall contain an RTD sensing element to monitor water temperature. The Contractor shall provide brass wells of sufficient size for the pipe to be installed. The output shall be compatible with the panel it serves. Transmitter shall be factory calibrated to an accuracy of + 1% over the full range. Immersion element shall be installed complete with heat transfer compound.

2.12 TEMPERATURE TRANSMITTERS

.1 Requirements:
- .1 Input circuit: to accept 3-lead, 1000 ohm at 0 degrees C, platinum resistance detector type sensors.
- .2 Power supply: 24 V DC into load of 575 ohms. Power supply effect less than 0.01 degrees C per volt change.
- .3 Output signal: 4 - 20 mA into500 ohm maximum load.
- .4 Input and output short circuit and open circuit protection.
- .5 Output variation: less than 0.2 % of full scale for supply voltage variation of plus or minus 10 %.
- .6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5 % of full scale output.
- .7 Maximum current to 100 or 1000 ohm RTD sensor: not to exceed 25 mA.
- .8 Integral zero and span adjustments.
- .9 Temperature effects: not to exceed plus or minus 1.0 % of full scale/ 50degrees C.
- .10 Long term output drift: not to exceed 0.25 % of full scale/ 6 months.
- .11 Transmitter ranges: select narrowest range to suit application from following:
  - .1 Minus 50 degrees C to plus 50 degrees C, plus or minus 0.5 degrees C.
  - .2 0 to 100 degrees C, plus or minus 0.5 degrees C.
  - .3 0 to 50 degrees C, plus or minus 0.25 degrees C.
  - .4 0 to 25 degrees C, plus or minus 0.1 degrees C.
  - .5 10 to 35 degrees C, plus or minus 0.25 degrees C.

2.13 BOILER PLANT CONTROLLER

.1 Designed to operate up to four condensing modulating boilers to accurately maintain a target water temperature. Target water temperature shall be based on outdoor temperature reset. System shall provide boiler equal run-time rotation, boiler circulaitn gpump operation, stand-by primary pump operation & pump exercising. Unit shall be capable of communicating with a Building Automation System (BAS) using BACnet® IP or Modbus® for remote monitoring & adjustment capability.

.2 Power Supply: 115V, 60 Hz, 18 VA

.3 Boiler Circ Pump control circuit: 230 V (ac), 5 amp

.3 Primary Pump control circuit: 230 V (ac), 10 amp

.4 Modulating outputs: 4 x 0-10 V (dc) 500 Ω minimum load impedance / 4-20 mA 1 kΩ max load impedance

.5 Outdoor sensor to be supplied with controller and installed on site by mechanical.

.6 Warranty – 3 years

.7 Design based on Tekmar 284.

2.14 CURRENT TRANSDUCERS

.1 Requirements:

.2 Purpose: combined sensor/transducer, to measure line current and produce proportional signal in one of following ranges:
- .1 4-20 mA DC.
- .2 0-1 volt DC.
- .3 0-10 volts DC.
- .4 0-20 volts DC.

.3 Frequency insensitive from 10 - 80 hz.

.4 Accuracy to 0.5% full scale.

.5 Zero and span adjustments. Field adjustable range to suit motor applications.

.6 Adjustable mounting bracket to allow for secure/safe mounting inside MCC.

.7 Current Sensing Transducers shall be self-powered, solid state with adjustable trip current. Each transducer shall be selected to match the current and voltage of the application. The output shall be compatible with the panel it serves. Each transducer shall include an LED to indicate output status.

2.15 CURRENT SENSING RELAYS

.1 Requirements:
- .1 Suitable to detect belt loss or motor failure.
- .2 Trip point adjustment, output status LED.
- .3 Split core for easy mounting.
- .4 Induced sensor power.
- .5 Relay contacts: capable of handling 0.5 amps at 30 VAC / DC. Output to be NO solid state.
- .6 Suitable for single or 3 phase monitoring. For 3-Phase applications: provide for discrimination between phases.
- .7 Adjustable latch level.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install control devices and wire to equipment.

.2 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.

.3 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

.4 Install and wire thermostats supplied with mechanical equipment, refer to respective equipment sections.

3.3 ROOF TOP UNIT THERMOSTATS

.1 Thermostats supplied with RTUs to be installed at locations shown on drawings.

.2 Wire from thermostat to roof top unit.

.3 Commission RTU operation and establish programmed schedule for each RTU.

3.4 EXHAUST FAN CONTROL

.1 Local Switch – Line Voltage
- .1 Local line voltage timed switch to be supplied by mechanical and wired by Electrical.
- .2 Local on/off switch control to be supplied and wired by electrical.

.2 CO Monitor – Line Voltage
- .1 CO Monitor to be supplied by mechanical and wired by electrical.
- .2 Wire relay from monitor to Purge Exhaust fan.

.3 24/7 Control
- .1 Fan to operate 24/7, no control required.

3.5 HYDRONIC HEATER LOW VOLTAGE THERMOSTATS

.1 Install wall mounted adjustable low voltage thermostat matched to heating valve.
- .1 Sensor to be installed in accordance with manufacturers requirements
- .2 Wire from thermostat to heating valve.
- .3 Commission thermostat and valve operation.

3.6 MOTORIZED DAMPER ACTUATOR – EF-05 and EF-06

.1 Mechanical to supply and install damper in ductwork complete with actuator.

.2 Electrical to wire actuator from exhaust circuit (s).

.3 Damper to open when either or both EF-05 and EF-06 is on.

.4 Damper to be closed when both EF-05 and EF-06 are off.

3.7 MOTORIZED DAMPER ACTUATOR – EF-07

.1 Mechanical to supply and install damper in ductwork complete with actuator.

.2 Electrical to wire actuator from exhaust circuit (s).

.3 Damper to open when EF-07 is on.

.4 Damper to be closed when EF-07 is off.

3.8 DEDICATED ROOM AIR CONDITIONER

.1 Install wall mounted adjustable low voltage thermostat supplied with room air conditioner in locations shown on drawings.
- .1 Sensor to be installed in accordance with manufacturers requirements

.2 Wire from thermostat to AC unit.
.3 Commission air conditioning system.

3.9 BOILER PLANT CONTROL

.1 Install boiler plant controller and connect to boilers, pumps and remote sensors.
.1 Sensor to be installed in accordance with manufacturers requirements
.2 Wire from sensors to controller.
.3 Commission entire system.

.2 The new Boiler Controller shall sequence the two modulating boilers and their associated circ pumps (P-1 & P-2), control and sequence the main heating pumps (P-3 & P-4) and be complete with outdoor reset to control water temperature. After a boiler de-energizes, the associated pump shall delay de-energizing for five minutes. The controller sequencer shall lead/lag and rotate the main heating pumps (P-3 & P-4).

.3 Installation to be complete with flow switches.

.4 Installation to be complete with current sensors for each pump.

3.10 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Copper piping valves and fittings for hydronic systems.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Welding Society (AWS)
  .1 ANSI/AWS A5.8/A5.8M-04, Specification Filler Metals for Brazing and Bronze Welding.

.2 American Society of Mechanical Engineers (ASME)
  .1 ANSI/ASME B16.4-98, Gray-Iron Threaded Fittings.
  .2 ANSI/ASME B16.15-1985 (2004), Cast Bronze Threaded Fittings.
  .3 ANSI B16.18-2001, Cast Copper Alloy, Solder Joint Pressure Fittings.
  .4 ANSI/ASME B16.22-2001, Wrought Copper and Copper-Alloy Solder Joint Pressure Fittings.

.3 American Society for Testing and Materials International (ASTM)
  .1 ASTM B32-04, Standard Specification for Solder Metal.
  .2 ASTM B61-02, Standard Specification for Steam or Valve Bronze Castings.
  .3 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
  .4 ASTM B88M-03, Standard Specification for Seamless Copper Water Tube Metric.
  .5 ASTM E202-04, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

.5 Manufacturers Standardization Society (MSS)
  .1 MSS SP67-2002a, Butterfly Valves.
  .2 MSS SP70-1998, Cast Iron Gate Valves, Flanged and Threaded Ends.
  .3 MSS SP71-1997, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
  .4 MSS SP80-2003, Bronze Gate, Globe, Angle and Check Valves.
  .5 MSS SP85-2002, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 QUALITY ASSURANCE

.1 Regulatory Requirements: ensure Work is performed in compliance with applicable Provincial /Territorial regulations.

.2 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
  .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.

2 Products

2.1 TUBING

.1 Type A hard drawn copper tubing: to ASTM B88M.

2.2 FITTINGS

.1 Cast bronze threaded fittings: to ANSI/ASME B16.15.

.2 Wrought copper and copper alloy solder joint pressure fittings: to ANSI/ASME B16.22.

.3 Cast iron threaded fittings: to ANSI/ASME B16.4.

.4 Cast copper alloy solder joint pressure fittings: to ANSI B16.18.

2.3 FLANGES

.1 Brass or bronze: threaded.

.2 Cast iron: threaded.

.3 Orifice flanges: slip-on, raised face, 2100 kPa.

2.4 JOINTS

.1 Solder, tin-antimony, 95:5: to ASTM B32.

.2 Silver solder BCUP: to ANSI/AWS A5.8.

.3 Brazing: as indicated.

2.5 VALVES

.1 Connections:
  .1 NPS 2 and smaller: ends for soldering.
  .2 NPS 2 1/2 and larger: flanged or grooved ends.

.2 Gate Valves Application: isolating equipment, control valves, pipelines:
  .1 NPS 2 and under:
    .1 Mechanical Rooms: Class 125, rising stem split wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
    .2 Elsewhere: Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.

.3 Butterfly valves: application: isolating each section of multiple component equipment (eg. multi-section coils):
.1 NPS 2 1/2 and over: lug type, grooved ends: as specified Section 23 05 17 - Pipe Welding.

.4 Globe valves: application: throttling, flow control, emergency bypass:
.1 NPS 2 and under:
.1 Mechanical Rooms: with PFTE disc, as specified Section 23 05 23.01 - Valves - Bronze.
.2 Elsewhere: with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.

.5 Balancing, for TAB:
.1 Sizes: calibrated balancing valves, as specified.
.2 NPS 2 and under:
.1 Automatic flow control device.

.6 Drain valves: gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.

.7 Swing check valves:
.1 NPS 2 and under:
.1 Class 125, swing, with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.
.2 NPS 2 1/2 and over:
.1 Flanged, Grooved ends: as specified Section 23 05 23.02 - Valves - Cast Iron.

.8 Silent check valves:
.1 NPS 2 and under:
.1 As specified Section 23 05 23.01 - Valves - Bronze.

.9 Ball valves:
.1 NPS 2 and under: as specified Section 23 05 23.01 - Valves - Bronze.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PIPING INSTALLATION

.1 Refer to Section 23 05 05 Installation of Pipework

.2 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.3 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping where ever practical.

.4 Slope piping in direction of drainage and for positive venting.

.5 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.

.6 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

.7 Assemble piping using fittings manufactured to ANSI standards.

3.3 VALVE INSTALLATION

.1 Refer to Section 23 05 05 - Installation of Pipework.

.2 Install rising stem valves in upright position with stem above horizontal.

.3 Install butterfly valves on chilled water and condenser water lines only.

.4 Install gate, ball or butterfly valves at branch take-offs and to isolate each piece of equipment, and as indicated.

.5 Install globe valves for balancing and in by-pass around control valves as indicated.

.6 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

.7 Install chain operators on valves NPS 2 1/2 and over where installed more than 2400 mm above floor in Boiler Rooms and Mechanical Equipment Rooms.

.8 Install ball valves for glycol service.

3.4 BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated.

.2 Remove handwheel after installation and TAB is complete.

.3 Tape joints in prefabricated insulation on valves installed in chilled water mains.

3.5 AUTOMATIC CONTROL VALVES

.1 Install where indicated.

.2 Record flow or valve identification tag.

.3 Flow to be within 10% of specified value.

3.6 FLUSHING AND CLEANING

.1 Flush and clean in presence of Departmental Representative.

.2 Flush after pressure test for a minimum of 4h.

.3 Fill with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8h.

.4 Refill system with clean water. Circulate for at least 4h. Clean out strainer screens/baskets regularly. Then drain.

.5 Refill system with clean water. Circulate for at least 2h. Clean out strainer screens/baskets regularly. Then drain.

.6 Drainage to include drain valves, dirt pockets, strainers, low points in system.

.7 Re-install strainer screens/baskets only after obtaining Departmental Representative's approval.

3.7 FILLING OF SYSTEM

.1 Refill system with clean water/glycol solution, adding water treatment as specified.

3.8 FIELD QUALITY CONTROL

.1 Testing:
- .1 Test system in accordance with Section 230801 Performance Verification Mechanical Piping Systems.

.2 Balancing:
- .1 Balance water systems to within plus or minus 5% of design output.

.3 Glycol Charging:
- .1 Provide mixing tank and positive displacement pump for glycol charging.
- .2 Retest for concentration to ASTM E202 after cleaning.
- .3 Provide report to Departmental Representative.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.
- .1 Materials and installation for steel piping, valves and fittings for hydronic systems in building services piping.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME).
- .1 ASME B16.1-98, Cast Iron Pipe Flanges and Flanged Fittings.
- .2 ASME B16.3-98, Malleable Iron Threaded Fittings.
- .3 ASME B16.5-03, Pipe Flanges and Flanged Fittings.
- .4 ASME B16.9-01, Factory-Made Wrought Buttwelding Fittings.
- .5 ASME B18.2.1-03, Square and Hex Bolts and Screws (Inch Series).
- .6 ASME B18.2.2-87 (R1999), Square and Hex Nuts (Inch Series).

.2 American Society for Testing and Materials International, (ASTM).
- .1 ASTM A47/A47M-99, Standard Specification for Ferritic Malleable Iron Castings.
- .2 ASTM A53/A53M-02, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
- .3 ASTM A536-84 (1999)e1, Standard Specification for Ductile Iron Castings.
- .4 ASTM B61-02, Standard Specification for Steam or Valve Bronze Castings.
- .5 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .6 ASTM E202-00, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.

.3 American Water Works Association (AWWA).
- .1 AWWA C111-00, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International).
- .1 CSA B242-M1980 (R1998), Groove and Shoulder Type Mechanical Pipe Couplings.
- .2 CAN/CSA W48-01, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).

.5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).
- .1 MSS-SP-67-025, Butterfly Valves.
- .2 MSS-SP-70-98, Cast Iron Gate Valves, Flanged and Threaded Ends.
- .3 MSS-SP-71-97, Cast Iron Swing Check Valves Flanged and Threaded Ends.
- .4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
- .5 MSS-SP-85-02, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Closeout Submittals.
.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals and include following:
.1 Special servicing requirements.

1.4 QUALITY ASSURANCE

.1 Health and Safety.
.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 MAINTENANCE

.1 Extra Materials.
.1 Provide following spare parts:
.1 Valve seats: one for every ten valves, each size. Minimum one.
.2 Discs: one for every ten valves, each size. Minimum one.
.3 Stem packing: one for every ten valves, each size. Minimum one.
.4 Valve handles: two of each size.
.5 Gaskets for flanges: one for every ten flanges.

2 Products

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
.1 To NPS6.

2.2 PIPE JOINTS

.1 NPS2 and under: screwed fittings with PTFE tape.

.2 NPS2-1/2 and over: flanges to CAN/CSA W48.

.3 Roll grooved: standard coupling to CSA B242.

.4 Flanges: plain or raised face, slip-on weld neck to AWWA C111.

.5 Orifice flanges: slip-on raised face, 2100 kPa.

.6 Flange gaskets: to AWWA C111.

.7 Pipe thread: taper.

.8 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.

.9 Roll grooved coupling gaskets: type EPDM.

2.3 FITTINGS

.1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.

.2 Pipe flanges and flanged fittings:
.1 Cast iron: to ASME B16.1, Class 125.
.2 Steel: to ASME B16.5.

.3 Butt-welding fittings: steel, to ASME B16.9.

.4 Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.

.5 Fittings for roll grooved piping: malleable iron to ASTM A47/A47M, ductile iron to ASTM A536.

2.4 VALVES

.1 Connections:
- .1 NPS2 and smaller: screwed ends.
- .2 NPS2.1/2 and larger: Flanged or grooved ends.

.2 Gate valves: to MSS-SP-70. Application: Isolating equipment, control valves, pipelines:
- .1 NPS2 and under:
  - .1 Mechanical Rooms: Class 125, rising stem, split wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 Elsewhere: Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
- .2 NPS21/2 and over:
  - .1 Mechanical Rooms: non-rising stem, solid wedge disc, lead free bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
    - .1 Operators: handwheel.
  - .2 Elsewhere: Non-rising stem, solid wedge disc, lead free bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
    - .1 Operators: handwheel.

.3 Butterfly valves: to MSS-SP-67 Application: Isolating cells or section of multiple component equipment (eg. multi section coils, multi-cell cooling towers):
- .1 NPS21/2 and over: Lug type, Grooved ends: as specified Section 23 05 17 - Pipe Welding.

.4 Globe valves: to MSS-SP-80, 85 Application: Throttling, flow control, emergency bypass:
- .1 NPS2 and under:
  - .1 Mechanical Rooms: with PTFE disc, as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 Elsewhere: Globe, with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.
- .2 NPS21/2 and over:
  - .1 With composition lead free, bronze disc, lead free, bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
  - .2 Operators: handwheel.

.5 Balancing, for TAB:
- .1 Sizes: Calibrated balancing valves, as specified this section.
- .2 NPS2 and under:
  - .1 Automatic flow control device where specified.
  - .2 Circuit setter where specified.

.6 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.

.7 Swing check valves: to MSS-SP-71.

.1 NPS2 and under:
.1 Class 125, swing, with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.
.2 NPS21/2 and over:
.1 Flanged or Grooved ends: as specified Section 23 05 23.02 - Valves - Cast Iron.

.8 Silent check valves:
.1 NPS2 and under:
.1 As specified Section 23 05 23.01 - Valves - Bronze.
.2 NPS21/2 and over:
.1 Flanged or Grooved ends: as specified Section 23 05 23.02 - Valves - Cast Iron.

.9 Ball valves:
.1 NPS2 and under: as specified Section 23 05 23.01 - Valves - Bronze.

.10 Lubricated Plug Valves
.1 NPS21/2 and over:
.1 As specified Section 23 05 23.02 - Valves - Cast Iron.

3 Execution

3.1 PIPING INSTALLATION

.1 Install pipework in accordance with Section 23 05 05 - Installation of Pipe Work.

3.2 BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated.

.2 Remove handwheel after installation and when TAB is complete.

.3 Tape joints in prefabricated insulation on valves installed in chilled water mains.

3.3 CLEANING, FLUSHING AND START-UP

.1 In accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

3.4 TESTING

.1 Test system in accordance with Section 23 05 00 Common Work Results for Mechanical.

.2 For glycol systems, retest with propylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair leaking joints, fittings or valves.

3.5 BALANCING

.1 Balance water systems to within plus or minus 5% of design output.

.2 Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

3.6 GLYCOL CHARGING

.1 Provide mixing tank and positive displacement pump for glycol charging.

.2 Retest for concentration to ASTM E202 after cleaning.

3.7 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01 - Performance Verification of Mechanical Piping.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Expansion tanks.
.2 Air vents.
.3 Air separators.
.4 Strainers.
.5 Pump suction fittings.
.6 Combination fittings.
.7 Flow indicators, controls, meters.
.8 Radiator valves.
.9 Relief valves.
.10 Glycol specialties.

1.2 QUALITY ASSURANCE

.1 Comply with Provincial Regulations and have CSA approval.

.2 Grooved joint piping specialties shall be of the same manufacturer as the adjoining couplings.

.3 Construct pressure tanks to ASME Code for unfired pressure vessels.

1.3 REFERENCES

.1 ASME - SEC 8D - Boilers and Pressure Vessels Code - Rules for Construction of Pressure Vessels.

1.4 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.

.3 Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

.4 Provide operating and service procedures for expansion tank, including setting tank pressure, replacing bladder etc.

1.5 PROJECT RECORD DOCUMENTS

.1 Section 01 78 00: Submittals for project closeout.

.2 Record actual locations of flow controls.

1.6 OPERATION AND MAINTENANCE DATA

.1 Section 01 78 00: Submittals for project closeout.

.2 Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

2 Products

2.1 EXPANSION TANKS

.1 Construction: Welded steel with heavy duty butyl air/water interface, tank style to match equipment schedule. Tank shall be cleaned, prime coated, and supplied with steel support saddles; with tappings for installation of accessories.
- .1 Pressure rating: 860 kPa.
- .2 Size: As noted on equipment schedule.

.2 Tank shall be tested and stamped to ASME SEC 8-D.

.3 Quick Connect Air Inlet:
- .1 Expansion Tank: Inlet tire check valve, manual air vent, tank drain, and pressure relief valve.

.4 Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check back flow preventer, test cocks, strainer, vacuum breaker, and valved bypass.

.5 Hot Water Heating System:
- .1 Select expansion tank pressure relief valve to match boiler..
- .2 Set pressure reducing valve at select 35 kPa.

.6 Precharge air side to 84 kPa (12 PSI) initial fill pressure of system.

2.2 AIR VENTS

.1 Manual Type: Short vertical sections of 50 mm diameter pipe to form air chamber, with 12mm (1/2") full port ball valve at top of chamber. Discharge to u-bend copper, PEX or plastic tubing of sufficient length to permit discharge to 5 gallon pail. Where pipe sizes are less than 64mm (2-1/2") air chamber shall be line size.

.2 Float Type:
- .1 Cast iron body and cover, with stainless steel, brass and EPDM internal components, and NPS 19 mm inlet connection, 9.5 mm discharge and rated at 1034 kPa working pressure.
- .2 Float: solid material suitable for system operating temperature and pressure. Minimum temperature to be 121 Deg.C.
- .3 Provide isolating valve before inlet.

2.3 SEPARATORS

.1 Combination Air Separators/Strainers:
- .1 Centrifugal air separator, steel, tested and stamped to ANSI/ASME SEC 8-D; for 860 kPa operating pressure, with integral galvanized steel strainer with 5mm perforations, tangential inlet and outlet flanged or grooved connections, and internal stainless steel air collector tube.

2.4 SUCTION DIFFUSER

.1 Fitting: Angle pattern, cast-iron body, threaded for 50 mm and smaller, flanged for 65 mm and larger, rated for 1200 kPa working pressure, with full length straightening vanes, cylinder strainer with 5 mm diameter openings, disposable fine mesh stainless steel strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

.2 Accessories: Adjustable foot support, 25mm (1") blowdown tapping in bottom, pressure gauge tappings.

2.5 COMBINATION PUMP INLET AND STRAINER FITTING

.1 Provide angle type suction guide fitting with flanged cast iron or grooved (inlet) ductile iron body, stainless steel, steel or cast iron guide vanes and removable stainless steel strainer. Design based on Victaulic Series 731-I

.2 Accessories: drain tapping in bottom, pressure gauge tappings

2.6 COMBINATION PUMP DISCHARGE VALVES

.1 Triple-Duty Valve Assembly: Shall not be permitted.

2.7 CIRCUIT SETTER (STATIC BALANCING)

.1 Provide bronze (copper alloy), ductile iron or cast iron with bronze or copper alloy disc, complete with pressure tappings, memory lock and insulation blocks.

2.8 AUTOMATIC FLOW RESTRICTOR

.1 Automatic flow control valve complete with isolation and strainer, sized for design flow rate

.2 Construction: Forged or cast brass or bronze body with union on inlet, temperature and pressure test ports on inlet and outlet.

.3 Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 13.7 kPa.

.4 Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.

.5 In-line strainer with 20 mesh stainless steel filter screen and drain valve.

.6 Isolation Valve: Ball valve with Teflon seats, refer to valve specifications.

2.9 RELIEF VALVES

.1 Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.10 RADIATOR BALANCING VALVES

.1 Angle or straight pattern, rising stem, inside screw globe valve for 860 kPa working pressure, with bronze body and integral union for screwed connections, renewable composition disc.

.2 Provide stainless steel indicating dial plate and lockable balancing yoke.

.3 Provide automatic flow restrictors and/or circuit setters where indicated on details.

2.11 IN FLOOR PIPING MANIFOLD

.1 Shall be of cast bronze construction and shall have integral circuit balancing valves, individual circuit control valves and electric actuators. Manifolds shall be provided complete with support brackets, pipe bend supports, and end caps

2.12 SIDE-STREAM FILTRATION SYSTEM

.1 System: Flow indicator, filter housing with cartridge filter, shut-off valves, and flow control valve.

.2 Performance: Design flow 0.25 L/sec with maximum pressure drop of 20.7 kPa.

.3 Hot Water and Glycol Filter Housing: Glass reinforced nylon plastic suitable for 105 degrees C and 1380 kPa operating conditions.

.4 Chilled Water Filter Housing: Reinforced polypropylene plastic housing suitable for 52 degrees C and 860 kPa operating conditions.

.5 Cartridges: 0.03 mm for start-up and 0.005 mm for system operation.

.6 Provide one case of thirty 20-micron cartridges and one case of thirty 5-micron cartridges.

3 Execution

3.1 INSTALLATION

.1 Install specialties to manufacturer's written instructions.

.2 Clean and flush glycol system before adding glycol solution. Refer to Section 23 25 00.

3.2 EXPANSION TANKS

.1 Support tanks inside building from building structure.

.2 Refer to equipment schedule and drawings for size and configuration.

.3 Adjust expansion tank pressure to suit actual site conditions.

.4 Install lockshield type valve at inlet to tank.

3.3 AIR VENTS

.1 Provide manual air vents at system high points and as indicated.

.2 Install automatic air vents at system air separator, heating units and system high points not readily accessible for servicing.

.3 Install gate valve on automatic air vent inlet. Run discharge to nearest drain or service sink.

.4 For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

.5 Where large air quantities can accumulate, provide enlarged air collection standpipes.

3.4 SEPARATOR

.1 Provide in line air separator on suction side of system circulation pump.

3.5 RELIEF VALVES

.1 Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, expansion tanks and where indicated.

.2 Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

.3 Pipe relief valve outlet to nearest floor drain.

.4 Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

3.6 PUMP FITTINGS

.1 Provide pump suction fitting and strainer on suction side of centrifugal pumps. Remove temporary strainers after cleaning systems.

.2 Combination strainer and suction fitting may be utilized in lieu of individual suction diffuser and strainer.

.3 Provide balancing device on discharge of pump, refer to details for style.

.4 A combination balance, check, and isolation valve may be used on pump discharge where indicated or required to conserve space.

.5 Support pump fittings with floor mounted pipe and flange supports to eliminate undue stress on pump connection

3.7 RADIATOR BALANCING VALVES

.1 Angle or straight pattern, rising stem, inside screw globe valve for 860 kPa working pressure, with bronze body and integral union for screwed connections, renewable composition disc.

.2 Provide stainless steel indicating dial plate and lockable balancing yoke.

3.8 HYDRONIC BALANCING VALVES

.1 Provide balancing valves on all heating and cooling equipment and all hydronic terminal devices to facilitate system balancing.

.2 Provide balancing valves on branch lines, as indicated, to facilitate system balancing.

.3 Provide circuit setters on heating and cooling equipment as indicated on details and schematics.

.4 Provide automatic flow restrictors on heating and cooling equipment as indicated on details and schematics.

3.9 IN FLOOR MANIFOLD

.1 Install in locations indicated on drawings complete with access covers. Configuration to suit number of zones.

3.10 SIDE STREAM FILTER

.1 Provide side-stream filtration system for each and every separate closed loop hydronic system. Install across main circulating pumps with flow from pump discharge to pump suction.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 In-line circulators.
.2 Vertical in-line pumps.
.3 Close coupled pumps.
.4 Base mounted pumps.

1.2 REFERENCES

.1 UL 778 - Motor-Operated Water Pumps.

1.3 PERFORMANCE REQUIREMENTS

.1 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

1.4 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

.3 Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

.4 Millwright's Certificate: Certify that base mounted pumps have been aligned.

1.5 OPERATION AND MAINTENANCE DATA

.1 Section 01 78 00: Submittals for project closeout.

.2 Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.6 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum three years experience.

.2 Alignment: Align base mounted pumps by qualified millwright.

1.7 REGULATORY REQUIREMENTS

.1 Products Requiring Electrical Connection: Listed and classified by ULC as suitable for the purpose specified and indicated.

2 Products

2.1 GENERAL REQUIREMENTS

.1 Statically and dynamically balance rotating parts.

.2 Construction shall permit complete servicing without breaking piping or motor connections.

.3 Pumps shall operate at 1750 RPM unless specified otherwise.

.4 Pump connections shall be flanged.

.5 Heating pumps shall be suitable for handling water at 110 deg.C (230 deg.F).

.6 Refer to equipment schedules for pump size, capacity, and minimum efficiency.

.7 Pumps to be complete with suction and discharge gauge ports.

.8 Pumps shall be rated for greater of 862 kPa (125 psi) or 1.5 times maximum working pressure.

2.2 SYSTEM LUBRICATED CIRCULATORS

.1 Type: Horizontal shaft, single stage, direct connected with multiple speed wet rotor motor for in-line mounting, 110 degrees C maximum water temperature.

.2 Casing: Cast iron with flanged pump connections.

.3 Impeller, Shaft, Rotor: Stainless Steel.

.4 Bearings: Metal Impregnated carbon (graphite) and ceramic.

.5 Starter housing and terminal box to be aluminum.

.6 Motor: Impedance protected single speed or multiple speed with external speed selector as indicated on equipment schedule.

2.3 IN-LINE CIRCULATORS

.1 Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated.

.2 Casing: Cast iron, with flanged pump connections.

.3 Impeller: Cadmium plated steel or bronze, keyed to shaft.

.4 Bearings: Two, oil lubricated bronze sleeves.

.5 Shaft: Alloy or stainless steel with copper or bronze sleeve, integral thrust collar.

.6 Seal: Carbon rotating against a stationary ceramic seat, viton fitted, 135 degrees C maximum continuous operating temperature.

.7 Drive: Flexible coupling.

2.4 VERTICAL IN-LINE PUMPS

.1 Type: Vertical, single stage, close coupled, radially or horizontally split casing, for in-line mounting, suitable for horizontal or vertical operation.

.2 Casing: Cast iron, with suction and discharge gauge port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.

.3 Impeller: Bronze, fully enclosed, keyed directly to motor shaft or extension and secured with locknut.

.4 Shaft: Stainless steel or carbon steel with bronze or stainless steel sleeve through seal chamber.

.5 Seal Options:
- .1 Carbon rotating against a stationary ceramic seat, viton fitted, 107 degrees C maximum continuous operating temperature.
- .2 Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 110 degrees C maximum continuous operating temperature.

2.5 CLOSE COUPLED PUMPS

.1 Type: Horizontal shaft, single stage, close coupled, radially split casing, for 860 kPa maximum working pressure.

.2 Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

.3 Impeller: Bronze, fully enclosed, keyed to motor shaft extension.

.4 Shaft: Stainless steel.

.5 Seal options:
- .1 Carbon rotating against a stationary ceramic seat, 107 degrees C] maximum continuous operating temperature.
- .2 Carbon rotating against a stationary ceramic seat, viton fitted, 135 degrees C maximum continuous operating temperature.
- .3 Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 110 degrees C maximum continuous operating temperature.

2.6 BASE MOUNTED PUMPS

.1 Type: Horizontal shaft, single stage, direct connected, radially or horizontally split casing.

.2 Casing: Cast iron, split volute, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

.3 Impeller: Bronze, fully enclosed, keyed to shaft.

.4 Bearings: Oil lubricated roller or ball bearings.

.5 Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

.6 Seal options:
- .1 Carbon rotating against a stationary ceramic seat, 107 degrees C] maximum continuous operating temperature.
- .2 Carbon rotating against a stationary ceramic seat, Viton fitted, 135 degrees C maximum continuous operating temperature.
- .3 Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 110 degrees C maximum continuous operating temperature.

.7 Drive: Flexible coupling with coupling guard.

.8 Baseplate: High grade heat treated cast iron or reinforced heavy steel with integral drain rim.

2.7 INTEGRAL VARIABLE SPEED PUMPS

.1 The self-sensing product shall consist of a factory prepackaged and preprogrammed pump, drive, motor, and integral controls package. Note that controller shall be mounted remotely from pump.

.2 The drive shall be mounted on wall and wired to the motor. It shall be mounted with rubber vibration mounts. The mounting and packing of the drive shall be done in a manner that transmitted acceleration levels will be three times below the allowable limits published by the drive manufacturer. These limits will apply to a frequency range of 0-10,000 HZ.

.3 The performance speed of this package shall 1750 RPM nominal as standard. Exceptions for 3600 RPM will be noted in the schedules. 3600 RPM shall NOT be an allowable substitution for a specified 1750 PRM package. 3600 RPM products might be considered as a substitution for 1750 RPM only if that manufacturer provides a spare motor, drive, and seal for each pumping unit.

.4 Pump logic controller, variable frequency drives, sensor/transmitters and related equipment shall be installed by the mechanical contractor as shown on the plans. Electrical shall wire power to controller and from controller to pump motor.

.5 Pump Logic Controller:
- .1 The controller operation shall operate the system using a tested and proven program that safeguards against undesirable or damaging conditions including:
  - .1 Motor overload
  - .2 Pump flow surges
  - .3 Hydraulic cycling (hunting).
  - .4 End of curve unstable operation: The pump logic controller, through a factory pre-programmed algorithm, shall be capable of protecting the pumps from hydraulic damage due to operation beyond their published end-of-curve. This feature requires a flow meter for activation. The operator interface shall include an owner adjustable flow set point to set the parameters for this routine.
- .2 The pump logic controller shall be capable of starting, unloading, and stopping pumps based on a system performance program that will minimize energy consumption, provide reliable performance and bumpless transitions.

.3 The integrated logic controller shall be capable of running four different hydronic optimization sub-routines

.1 Setup one: This subroutine shall allow the pump package to track a quadratic system curve and will optimize a secondary distribution loop. It shall use a technology that allows the pump, drive, and motor package to translate the hydronic data from both a pump and system curve and translate it to electrical data. This allows the drive to know exactly where it is in the hydronic world.

.2 Setup two: This subroutine shall allow two pumps to run as backup for each other and shall alternate the pumps based on a real time clock.

.3 Setup three: This subroutine shall allow the package to run in a customer defined flow rate. The package will always seek to run at the user defined flow even with fouling causing system changes. It shall use a technology that allows the pump, drive, and motor package to translate the hydronic data from both a pump and system curve and translate it to electrical data. This allows the drive to know exactly where it is in the hydronic world.

.4 Setup four: This subroutine shall incorporate a traditional external sensing and control platform. It shall allow the option of controlling the pumps with three zones of differential pressure or central plant differential temperature. This optional setup shall allow the owner the option of external sensing without adding an external controller.

.4 The control platform shall include a subroutine equal to allow for the automatic balancing of secondary system distribution pumps. The package shall automatically run system distribution pumps to a user defined duty point and will recognize that duty point and hold the pumps at a speed that matches the actual installed system quadratic system curve. The package will then use this data to set up a new duty point as the max point for the quadratic control curve. Use of external balancing devices will not be needed.

.5 The package shall serve as a flow metering device and will display pump flow at the user interface.

.6 Variable Frequency Drives:

.1 The VFD shall convert incoming fixed frequency three-phase ac power into an adjustable frequency and voltage for controlling the speed of three-phase ac motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for the driven load and to eliminate the need for motor derating. When properly sized, the VFD shall allow the motor to produce full rated power at rated motor voltage, current, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.

.1 The VFD shall include an input full-wave bridge rectifier and maintain a fundamental (displacement) power factor near unity regardless of speed or load.

.2 The VFD shall have a dual 5% impedance DC link reactor on the positive and negative rails of the dc bus to minimize power line harmonics and protect the VFD from power line transients. The chokes shall be non-saturating. Swinging chokes that do not provide full harmonic filtering throughout the entire load range are not acceptable. VFDs with saturating (non-linear) dc link reactors shall require an

additional 3% AC line reactor to provide acceptable harmonic performance at full load, where harmonic performance is most critical.

.3 The VFD's full load output current rating shall meet or exceed nec table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 120% of rated torque for up to 0.5 second while starting.

.4 The VFD shall provide full motor torque at any selected frequency from 20 hz to base speed while providing a variable torque v/hz output at reduced speed. This is to allow driving direct drive fans without high speed derating or low speed excessive magnetization, as would occur if a constant torque v/hz curve was used at reduced speeds. Breakaway current of 160% shall be available.

.5 A programmable automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continuously monitor the motor's speed and load to adjust the applied voltage to maximize energy savings.

.6 The VFD must be able to produce full torque at low speed to operate direct drive fans.

.7 Output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD.

.8 An automatic motor adaptation algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to perform the test.

.9 Galvanic isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog i/o and discrete digital i/o shall include additional isolation modules.

.10 VFD shall minimize the audible motor noise through the used of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD operation while reducing motor noise. VFDs with fixed carrier frequency are not acceptable.

.11 All VFDs shall contain integral emi filters to attenuate radio frequency interference conducted to the ac power line.

.12 The drive enclosure shall be standard as NEMA 12 (ip 55) and optional shall be NEMA 4X (ip 66). See schedules for project requirements.

.13 Protective Features:

.1 A minimum of class 20 i2t electronic motor overload protection for single motor applications shall be provided. Overload protection shall automatically compensate for changes in motor speed.

.2 Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over voltage, under voltage, VFD over temperature and motor over temperature. The VFD shall display all faults in plain language. Codes are not acceptable.

.3 Protect VFD from input phase loss. The VFD should be able to protect itself from damage and indicate the phase loss condition. During an input phase loss condition, the VFD shall be able to be programmed to either trip off while displaying an alarm, issue a warning while running at reduced output capacity, or issue a

warning while running at full commanded speed. This function is independent of which input power phase is lost.

.4 Protect from under voltage. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output, without faulting, with an input voltage as low as 70% of the nominal voltage.

.5 Protect from over voltage. The VFD shall continue to operate without faulting with a momentary input voltage as high as 130% of the nominal voltage.

.6 The VFD shall incorporate a programmable motor preheat feature to keep the motor warm and prevent condensation build up in the motor when it is stopped in a damp environment by providing the motor stator with a controlled level of current.

.7 VFD shall include a "signal loss detection" algorithm with adjustable time delay to sense the loss of an analog input signal. It shall also include a programmable time delay to eliminate nuisance signal loss indications. The functions after detection shall be programmable.

.8 VFD shall function normally when the keypad is removed while the VFD is running. No warnings or alarms shall be issued as a result of removing the keypad.

.9 VFD shall catch a rotating motor operating forward or reverse up to full speed without VFD fault or component damage.

.10 Selectable over-voltage control shall be provided to protect the drive from power regenerated by the motor while maintaining control of the driven load.

.11 VFD shall include current sensors on all three output phases to accurately measure motor current, protect the VFD from output short circuits, output ground faults, and act as a motor overload. If an output phase loss is detected, the VFD will trip off and identify which of the output phases is low or lost.

.12 If the temperature of the VFD's heat sink rises to 80?c, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. It shall also be possible to program the VFD so that it reduces its output current limit value if the VFD's temperature becomes too high.

.13 In order to ensure operation during periods of overload, it must be possible to program the VFD to automatically reduce its output current to a programmed value during periods of excessive load. This allows the VFD to continue to run the load without tripping.

.14 The VFD shall have temperature controlled cooling fan(s) for quiet operation, minimized losses, and increased fan life. At low loads or low ambient temperatures, the fan(s) may be off even when the VFD is running.

.15 The VFD shall store in memory the last 10 alarms. A description of the alarm, and the date and time of the alarm shall be recorded.

.16 When used with a pumping system, the VFD shall be able to detect no-flow situations, dry pump conditions, and operation off the end of the pump curve. It shall be programmable to take

appropriate protective action when one of the above situations is detected.

.2 Internal Control Algorithm

.1 This is a standard HVAC drive that has been upgraded and modified by pump experts for hydronic applications. It is set up with a closed loop internal control sequence that will optimize life cycle, system comfort, and minimize energy consumption.

.3 Interface Features

.1 Hand, off and auto keys shall be provided to start and stop the VFD and determine the source of the speed reference. It shall be possible to either disable these keys or password protect them from undesired operation.

.2 There shall be an "info" key on the keypad. The info key shall include "on-line" context sensitive assistance for programming and troubleshooting.

.3 The VFD shall be programmable to provide a digital output signal to indicate whether the VFD is in hand or auto mode. This is to alert the building automation system whether the VFD is being controlled locally or by the building automation system.

.4 Password protected keypad with alphanumeric, graphical, backlit display can be remotely mounted. Two levels of password protection shall be provided to guard against unauthorized parameter changes.

.5 All VFDs shall have the same customer interface. The keypad and display shall be identical and interchangeable for all sizes of VFDs.

.6 To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFD's keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters. Keypad shall provide visual indication of copy status.

.7 Display shall be programmable to communicate in multiple languages including English and French.

.8 A red fault light, a yellow warning light and a green power-on light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.

.9 A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD. The VFD shall also have individual fan, pump, and compressor menus specifically designed to facilitate start-up of these applications.

.10 A four-feedback PID controller to control the speed of the VFD shall be standard. This controller shall accept up to four feedback signals. It shall be programmable to compare the feedback signals to a common setpoint or to individual setpoints and to automatically select either the maximum or the feedback signal as the controlling signal. It shall also be possible to calculate the controlling feedback signal as the average of all feedback signals or the difference between a pair of feedback signals.

.1 The VFD shall be able to apply individual scaling to each feedback signal.

.2 The VFD's PID controller shall be able to actively adjust its setpoint based on flow. This allows the VFD to compensate for a pressure feedback sensor which is located near the output of the pump rather than out in the controlled system.

.11 The VFD shall have three additional PID controllers which can be used to control damper and valve positioners in the system and to provide setpoint reset.

.12 Floating point control interface shall be provided to increase/decrease speed in response to contact closures.

.13 Five simultaneous meter displays shall be available. They shall include at a minimum, frequency, motor current, motor voltage, VFD output power, VFD output energy, VFD temperature in degrees, among others.

.14 Programmable sleep mode shall be able to stop the VFD. When its output frequency drops below set "sleep" level for a specified time, when an external contact commands that the VFD go into sleep mode, or when the VFD detects a no-flow situation, the VFD may be programmed to stop. When the VFD's speed is being controlled by its PID controller, it shall be possible to program a "wake-up" feedback value that will cause the VFD to start. To avoid excessive starting and stopping of the driven equipment, it shall be possible to program a minimum run time before sleep mode can be initiated and a minimum sleep time for the VFD.

.15 A run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of initiating an output "run request" signal to indicate to the external equipment that the VFD has received a request to run.

.16 VFD shall be programmable to display feedback signals in appropriate units, such as inches of water column (in-wg), pressure per square inch (psi) or temperature (deg.F).

.17 VFD shall be programmable to sense the loss of load and signal this condition via a keypad warning, relay output and/or over the serial communications bus. To ensure against nuisance indications, this feature must be based on motor torque, not current, and must include a proof timer to keep brief periods of no load from falsely triggering this indication.

.4 Standard Control And Monitoring Inputs And Outputs

.1 Six dedicated, programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.

.1 Two terminals shall be programmable to act as either as digital outputs or additional digital inputs.

.2 Two programmable relay outputs, Form C 240 V AC, 2 A, shall be provided for remote indication of VFD status.

.1 Each relay shall have an adjustable on delay / off delay time.

.3 Two programmable analog inputs shall be provided that can be either direct-or-reverse acting. Each shall be independently selectable to be used with either an analog voltage or current signal.

.1 The maximum and minimum range of each shall be able to be independently scalable from 0 to 10 V dc and 0 to 20 mA.

.2 A programmable low-pass filter for either or both of the analog inputs must be included to compensate for noise.

.3 The VFD shall provide front panel meter displays programmable to show the value of each analog input signal for system set-up and troubleshooting,

.4 One programmable analog current output (0/4 to 20 mA) shall be provided for indication of VFD status. This output shall be programmable to show the reference or feedback signal supplied to the VFD and for VFD output frequency, current and power. It shall be possible to scale the minimum and maximum values of this output.

.5 It shall be possible through serial bus communications to read the status of all analog and digital inputs of the VFD.

.6 It shall be possible to command all digital and analog output through the serial communication bus.

.5 Optional Control And Monitoring Inputs And Outputs

.1 It shall be possible to add optional modules to the VFD in the field to expand its analog and digital inputs and outputs.

.1 These modules shall use rigid connectors to plug into the VFD's control card.

.2 The VFD shall automatically recognize the option module after it is powered up. There shall be no need to manually configure the module.

.3 Modules may include such items as:

a) Additional digital outputs, including relay outputs
b) Additional digital inputs
c) Additional analog outputs
d) Additional analog inputs, including Ni or Pt temperature sensor inputs

.4 It shall be possible through serial bus communications to control the status of all optional analog and digital outputs of the VFD.

.6 Standard programmable firefighter's override mode allows a digital input to control the VFD and override all other local or remote commands. It shall be possible to program the VFD so that it will ignore most normal VFD safety circuits including motor overload. The VFD shall display firemode whenever in firefighter's override mode. Firemode shall allow selection of forward or reverse operation and the selection of a speed source or preset speed, as required to accommodate local fire codes, standards and conditions.

.7 A real-time clock shall be an integral part of the VFD.

.1 It shall be possible to use this to display the current date and time on the VFD's display.

.1 Ten programmable time periods, with individually selectable ON and OFF functions shall be available. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter setpoints and output relays. Is shall be possible to program unique events that occur only during normal work days, others that occur only on non-work days, and others that occur on specific days or dates. The manufacturer shall provide free PC-based software to set up the calendar for this schedule.

.2 All VFD faults shall be time stamped to aid troubleshooting.

.3 It shall be possible to program maintenance reminders based on date and time, VFD running hours, or VFD operating hours.

.4 The real-time clock shall be able to time and date stamp all faults recorded in the VFD fault log.

.8 The VFD shall be able to store load profile data to assist in analyzing the system demand and energy consumption over time.

.9 The VFD shall include a sequential logic controller to provide advanced control interface capabilities. This shall include:

.1 Comparators for comparing VFD analog values to programmed trigger values

.1 Logic operators to combine up to three logic expressions using Boolean algebra

.2 Delay timers

.3 A 20-step programmable structure

10. The VFD shall include a cascade controller which allows the VFD to operate in closed loop set point (PID) control mode one motor at a controlled speed and control the operation of 3 additional constant speed motor starters.

.11 Serial communications

.1 The VFD shall include a standard eia-485 communications port and capabilities to be connected to the following serial communication protocols at no additional cost and without a need to install any additional hardware or software in the VFD:

.1 Modbus RTU

.2 BACnet MS/TP

.3 LonWorks Free Topology (FTP)

.4 VFD shall have standard rs-485 port for direct connection of personal computer (pc) to the VFD. The manufacturer shall provide no-charge pc software to allow complete setup and access of the VFD and logs of VFD operation through the rs-485 port. It shall be possible to communicate to the VFD through this usb port without interrupting VFD communications to the building management system.

.5 The VFD shall have provisions for an optional 24 v DC back-up power interface to power the VFD's control card. This is to allow the VFD to continue to communicate to the building automation system even if power to the VFD is lost.

12. Adjustments

.1 The VFD shall have a manually adjustable carrier frequency that can be adjusted in 0.5 khz increments to allow the user to select the desired operating characteristics. The VFD shall also be programmable to automatically reduce its carrier frequency to avoid tripping due to thermal loading.

.1 Four independent setups shall be provided.

.2 Four preset speeds per setup shall be provided for a total of 16.

.3 Each setup shall have two programmable ramp up and ramp down times. Acceleration and deceleration ramp times shall be adjustable over the range from 1 to 3,600 seconds.

.4 Each setup shall be programmable for a unique current limit value. If the output current from the VFD reaches this value, any

further attempt to increase the current produced by the VFD will cause the VFD to reduce its output frequency to reduce the load on the VFD. If desired, it shall be possible to program a timer which will cause the VFD to trip off after a programmed time period.

.5 If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: external interlock, under-voltage, over-voltage, current limit, over temperature, and VFD overload.

.6 The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.

.7 An automatic "start delay" may be selected from 0 to 120 seconds. During this delay time, the VFD shall be programmable to either apply no voltage to the motor or apply a DC braking current if desired.

.8 Four programmable critical frequency lockout ranges to prevent the VFD from operating the load at a speed that causes vibration in the driven equipment shall be provided. Semi-automatic setting of lockout ranges shall simplify the set-up.

.13 Optional features

.1 All optional features shall be built and mounted by VFD manufacturer. All optional features shall be UL listed by the VFD manufacturer as a complete assembly and carry a UL label.

.1 All panels shall be marked for their short circuit current rating in compliance with UL.

.14 Service conditions

.1 Ambient temperature, continuous, full speed, full load operation:

.1 -10 to 45°C (14 to 113°F) through 125 hp @ 460 and 600 volt, through 60 hp @ 208 volt

.2 -10 to 40°C (14 to 104°F) 150 hp and larger

.1 0 to 95% relative humidity, non-condensing.

.2 Elevation to 3,300 feet without derating.

.3 AC line voltage variation, -10 to +10% of nominal with full output.

.4 No side clearance shall be required for cooling.

.5 All power and control wiring shall be done from the bottom.

.6 All VFDs shall be plenum rated.

.7 Pumps

.1 Inline pump matched to VFD and factory tested.

3 Execution

3.1 PREPARATION

.1 Verify that electric power is available and of the correct characteristics (voltage and phase) prior to ordering pump.

3.2 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.

.3 Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 102 mm and over. Refer to Section 23 05 48.

.4 Provide line sized shut-off isolation valve and strainer on pump suction, and line sized soft seated check valve, balancing device, and shut-off isolation valve on pump discharge.

.5 Provide air cock and drain connection on horizontal pump casings.

.6 Provide drains for bases and stuffing boxes piped to and discharging into floor drains.

.7 Provide common pressure gauge, piped complete with isolation valves to suction and discharge side of pump.

.8 Check, align, and certify alignment of base mounted pumps prior to start-up.

.9 Install close coupled and base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 03 30 00.

.10 Lubricate pumps before start-up.

3.3 INTEGRAL VARIABLE SPEED PUMPS

.1 Install equipment in accordance with manufacturer’s instructions and all applicable codes.

.2 Ensure that pump is pipe-mounted and free to float with any movement, expansion and contraction of piping system.

- .1 Support pump using floor mounted saddle or wall bracket as required.
- .2 For vertical in-line pumps supported from structure, ensure no pipe strain is imposed on pump flanges.

.3 Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per manufacturer’s instructions and all applicable codes.

.4 Control wiring for remote mounted switches and sensor/transmitters shall be the responsibility of the controls contractor. All wiring shall be performed per manufacturer’s instructions and all applicable codes.

.5 Demonstration:

- .1 The control package manufacturer’s factory trained representative shall provide start-up of the packaged pumping system. This start-up shall include verification of proper installation, system initiation, adjustment and fine tuning. Start-up shall not be considered complete until the sequence of operation, including all alarms, has been sufficiently demonstrated to the Owner or

Owner's designated representative. This jobsite visit shall occur only after all hook-ups, tie-ins, and terminations have been completed and signed-off on the manufacturer's start-up request form.

.2 The pump control package manufacturer's factory trained representative shall provide on-site training for owner's personnel. This training shall fully cover maintenance and operation of all system components.

3.4 PERFORMANCE VERIFICATION

.1 General
- .1 In accordance with manufacturer's recommendations and as specified herein.

.2 Exclusions:
- .1 This paragraph does not apply to small fractional horse-power (lower than 1/2 hp) circulators.

.3 Assumptions: these PV procedures assume that:
- .1 Manufacturer's performance curves are accurate.
- .2 Valves on pump suction and discharge provide tight shut-off.

.4 Net Positive Suction Head (NPSH):
- .1 Application: measure NPSH for pumps which operate on open systems and with water at elevated temperatures.
- .2 Measure using procedures prescribed in the Standard.
- .3 Where procedures do not exist, discontinue PV, report to and await instructions.

.5 Multiple Pump Installations - Series and Parallel:
- .1 Repeat PV procedures specified above for pump performance and pump BHP for combinations of pump operations.

.6 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.

.7 Include reports in Operation and Maintenance Manuals:
- .1 Record of point(s) of actual performance at maximum and minimum conditions and for single and parallel operation as finally set at completion of commissioning on pump curves.
- .2 Pump performance curves (family of curves) to be provided with report.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Materials and installation for copper tubing and fittings for refrigerant.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)
- .1 ASME B16.22-01, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.
- .2 ASME B16.24-02, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
- .3 ASME B16.26-88, Cast Copper Alloy Fittings for Flared Copper Tubes.
- .4 ASME B31.5-01, Refrigeration Piping and Heat Transfer Components.

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM A307-04, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 ASTM B280-03, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.3 Canadian Standards Association (CSA International)
- .1 CSA B52-99, Mechanical Refrigeration Code.

.4 Environment Canada (EC)
- .1 EPS 1/RA/1-96, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

.5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
- .2 Submit WHMIS MSDS in accordance with Specifications. Indicate VOC's for adhesive and solvents during application and curing.

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Comply with Provincial Regulations and Mechanical Refrigeration Codes.

.2 Qualifications of installer:
- .1 Installing contractor shall have Certificate of Qualification as a Refrigeration Mechanic.
- .2 Contractor must provide list of all installers that will work on refrigeration systems with shop drawings for equipment. List must include photocopy of the refrigeration tech's certificate of registration, along with name and certification number.
- .3 Following installation, the certified refrigeration mechanic(s) will provide verification that they installed the refrigeration system components.

.3 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 START-UP AND TESTING

.1 Supply initial charge of refrigerant and oil for each refrigeration system. Losses of oil or refrigerant prior to acceptance of equipment or due to defects covered under guarantee shall be replaced. Supply to the Owner, one complete charge of lubricating oil in addition to that placed in the system.

.2 Charge the system with refrigerant and test entire system for leaks after completion of installation. Repair leaks, put system into operation, and test equipment performance.

.3 Shut-down system if initial start-up testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

.4 Provide cooling season start-up, winter season shut-down for first year of operation.

2 Products

2.1 TUBING

.1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
- .1 Hard copper: to ASTM B280, type ACR.
- .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.2 FITTINGS

.1 Service: design pressure 2070 kPa and temperature 121 degrees C.

.2 Brazed:
- .1 Fittings: wrought copper to ASME B16.22.
- .2 Joints: silver solder or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.

.3 Flanged:
- .1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.
- .2 Gaskets: suitable for service.
- .3 Bolts, nuts and washers: to ASTM A307, heavy series.

.4 Flared:
- .1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

.1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

.1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.

.2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

2.5 LIQUID INDICATORS

.1 Liquid indicators shall be double port type with copper or brass body, and flared or solder ends.

.2 Provide removable seal caps on each port to inspect refrigerant condition.

2.6 STRAINERS

.1 Refrigerant strainers shall be angle replaceable cartridge type with brass shell.

.2 Cartridge material and screen size shall be suitable for refrigerant and pipe material utilized in the system.

2.7 FILTER DRIERS

.1 Combination filter driers shall be angle type, with brass shell and incorporate a combined straining and drying material.

.2 Desiccant material shall be replaceable.

2.8 SOLENOID VALVES

.1 Solenoid valves shall have copper or brass body with flared or screwed ends.

.2 Coil assembly shall be replaceable.

.3 Valves shall incorporate a manually operated stem to serve as a bypass in case of coil failure.

2.9 EXPANSION VALVES

.1 Provide angle type or straight through expansion valves suitable for the refrigerant utilized in the system.

.2 Valves shall have brass body, internal or external equalizer, adjustable super-heat setting and be complete with capillary tube and remote sensing bulb.

2.10 CHARGING VALVES

.1 Provide general purpose type refrigerant charging valves with brass body, flared or solder ends and with removable valve core.

.2 Provide valve inlet with quick coupling connection for ease of charging.

2.11 FLEXIBLE CONNECTORS

.1 Flexible connectors shall consist of close pitch corrugated bronze hose with single layer of exterior braiding to provide additional strength and prevent elongation of corrugated section.

.2 Connectors shall be minimum 9" long and provided with bronze fittings to facilitate connection to equipment.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 GENERAL

.1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5, Section 23 05 01 - Installation of Pipework.

3.3 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

3.4 PIPING INSTALLATION

.1 General:
- .1 Soft annealed copper tubing: bend without crimping or constriction. Hard drawn copper tubing: do not bend. Minimize use of fittings.

.2 Hot gas lines:
- .1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
- .2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
- .3 Provide inverted deep trap at top of risers.
- .4 Provide double risers for compressors having capacity modulation.
  - .1 Large riser: install traps as specified.
  - .2 Small riser: size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.

3.5 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2MPa and 1MPa on high and low sides respectively.

.3 Test Procedure: build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.6 DX EQUIPMENT START-UP AND TESTING

.1 Refrigeration equipment: Prepare system for start-up by having manufacturer's factory trained representative supervise testing, dehydration and charging of machine. Do start-up including co-ordination on start-up of condensers.

.2 Testing:
- .1 Provide sufficient refrigerant, dry nitrogen and refrigeration oil for pressure and operational testing under manufacturer's supervision.
- .2 Prior to testing ensure that system is complete. Protect relief valves during test procedure. After completion of test, reconnect and make good piping connections and leak test entire system.

3.7 AIR COOLED CONDENSING UNIT

.1 Check unit for damage before and after placement:
- .1 Protect and cover exposed units to the elements during construction.
- .2 Conform to installation drawings. Mount units on roof mounting frame.

3.8 LIQUID INDICATORS

.1 Provide full size liquid indicators in main liquid line leaving condenser. If receiver is used install in liquid line leaving receiver.

3.9 STRAINERS

.1 Provide full size strainer ahead of each automatic valve. Where multiple expansion valves with integral strainers are used, install single main liquid line strainer.

.2 On steel piping systems provide adequate strainer in suction line to remove scale and rust inherent in steel pipe.

.3 Provide shut-off valve on each side of strainer to facilitate maintenance.

3.10 FILTER-DRIERS

.1 Filter-driers may be used in systems instead of separate strainers and driers.

.2 Install with three valve bypass assembly to permit isolation for servicing.

3.11 SOLENOID VALVES

.1 Provide solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

.2 Provide solenoid valves with manually operated stems.

3.12 EXPANSION VALVES

.1 Size expansion valves properly to avoid penalty of being undersized at full load and of being excessively oversized at partial load.

.2 Properly evaluate refrigerant pressure drop through system to determine the available pressure drop across the valve.

.3 Select valves for maximum load at design operating pressure and minimum 7.2 deg.C of superheat.

.4 Locate remote expansion valve sensing bulb immediately after evaporator outlet on suction line.

3.13 CHARGING VALVES

.1 Provide refrigerant charging connections in liquid line between receiver shut-off valve and expansion valve.

3.14 FLEXIBLE CONNECTORS

.1 In general install suction and hot gas piping connections to compressors with three directional changes for distance of minimum six pipe diameters before reaching point of support.

.2 Flexible connectors shall only be utilized at or near compressors where it is not physically possible to absorb vibration within piping configuration.

3.15 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:
- .1 Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13 degrees C for at least 12 hours before and during dehydration.

.3 Use copper lines of largest practical size to reduce evacuation time.

.4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5Pa absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
- .1 Twice to 14 Pa absolute and hold for 4 h.
- .2 Break vacuum with refrigerant to 14 kPa.
- .3 Final to 5 Pa absolute and hold for at least 12 h.
- .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
- .5 Submit test results to Departmental Representative.

.7 Charging:
- .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
- .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
- .3 Re-purge charging line if refrigerant container is changed during charging process.

.8 Checks:
- .1 Make checks and measurements as per manufacturer's operation and maintenance instructions.
- .2 Record and report measurements Departmental Representative.

.9 Manufacturer's Field Services:
- .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, at stages listed:
  - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
  - .2 Twice during progress of Work at 25% and 60% complete.
  - .3 Upon completion of the Work, after cleaning is carried out.
- .4 Obtain reports, within 3 days of review, and submit, immediately to Departmental Representative.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Metal duct work.
.2 Nonmetal duct work.
.3 Casing and plenums.
.4 Buried duct work.
.5 Kitchen hood duct work.
.6 Duct cleaning.

1.2 REFERENCES

.1 ASTM A36/A36M - Carbon Structural Steel.
.2 ASTM A90/A90M - Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
.3 ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
.4 ASTM A480/A480M - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
.5 ASTM A568/A568M - General Requirements for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
.6 ASTM A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.7 ASTM A1008/A1008M - Steel, Sheet, Cold-Rolled Carbon, Structural, High-Strength Low-Alloy and High Strength Low-Alloy with Improved Formability.
.8 ASTM A1011/A1011M - Standard Specification for Steel, Sheet, and Strip Hot-Rolled, Carbon, Structural, High-Strength, Low-Alloy with Improved Formability.
.9 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
.10 ASTM C14/C14M - Concrete Sewer, Storm Drain, and Culvert Pipe.
.11 ASTM C443 - Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
.12 AWS D9.1 - Sheet Metal Welding Code.
.13 NBS PS 15 - Voluntary Product Standard for Custom Contact-Moulded Reinforced-Polyestor Chemical Resistant Process Equipment.
.14 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
.15 NFPA 90B - Installation of Warm Air Heating and Air-Conditioning Systems.
.16 NFPA 91 - Exhaust Systems for Air Conveying of Vapours, Gases, Mists, and Noncombustible Particulate Solids.
.17 NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Operations.
.18 SMACNA - HVAC Air Duct Leakage Test Manual.
.19 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
.20 SMACNA - Fibrous Glass Duct Construction Standards.
.21 UL 181 - Factory-Made Air Ducts and Connectors.

1.3 DEFINITIONS

.1 Low pressure/low velocity: Static pressure in duct less than 498 Pa (2" w.g.) and velocities less than 10 meters/second (2000 fpm).

.2 Medium pressure/high velocity: Static pressure in duct less than 996 Pa (4" w.g.) and velocities between 10 meters/second (2000 fpm) and 20 meters/second (4000 fpm).

.3 High pressure/high velocity: Static pressure in ducts more than 996 Pa (4" w.g.) And velocities greater than 4000 fpm.

.4 Duct sizes: as shown on drawings are outside dimensions. For acoustically lined or internally insulated ducts, sizes shown are actual duct sizes and the insulation thickness has been accounted for.

1.4 PERFORMANCE REQUIREMENTS

.1 No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts to ASHRAE table of equivalent rectangular and round ducts.

1.5 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work for 1000 kPa pressure class and higher systems.

.3 Product Data: Provide data for duct materials.

.4 Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.6 QUALITY ASSURANCE

.1 Perform Work to SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

.2 Ductwork shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems, and NFPA No. 96, Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapours from Commercial Cooking Equipment

1.7 QUALIFICATIONS

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Installer: Company specializing in performing the work of this section with minimum 3 years documented experience.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

.2 Maintain temperatures during and after installation of duct sealants.

2 Products

2.1 DUCT MATERIALS

.1 Galvanized Steel Ducts: ASTM A653 galvanized steel sheet, lock-forming quality, having G60 zinc coating to ASTM A90 on both sides.

.2 Steel Ducts: ASTM A1008.

.3 Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061- T6 or of equivalent strength.

.4 Stainless Steel Ducts: ASTM A167, Type 304.

.5 Concrete Ducts: ASTM C14; hub and spigot concrete sewer pipe with ASTM C443 joints, rubber gaskets.

.6 Fasteners: use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts.

2.2 SEALANT

.1 Oil resistant, water based or solvent based, anti-microbial, anti-bacterial, ultra violet resistant, polymer type, flame resistant duct sealant.

.2 VOC content to be less than VOC limits of the State of California's South Coast Air Quality District Rule #1168. VOC content less than 30 g/L (less water and less exempt compounds) for sealing metal to metal contact.

.3 Sealant shall be cured for a minimum of 48 hours.

.4 Flame Spread Rating: 0 (zero).

.5 Smoke Spread Raring: 0 (zero).

2.3 TAPE

.1 Polyvinyl treated, open weave fibre glass, 50 mm wide.

2.4 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
up to 500	B
Over 500	A

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.

.3 Class C: transverse joints and connections made air tight with gaskets. Longitudinal seams unsealed.

.4 Unsealed seams and joints.

2.5 DUCT WORK FABRICATION

.1 Fabricate and support to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

.2 Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centreline. Where not possible and where rectangular elbows are used, provide air foil turning vanes.

.3 Complete metal ducts within themselves with no single partition between ducts. Where width of duct exceeds 450 mm, cross break for rigidity. Open corners are not acceptable.

.4 Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.

.5 Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

.6 Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints: minimum 100 mm cemented slip joint, brazed or electric welded. Prime coat welded joints.

.7 Provide standard 45 degree lateral wye takeoffs unless duct manufacturer can show 90 degree and tap has less static pressure loss.

.8 Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breath, rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled.

.9 Provide easements where low pressure ductwork conflicts with piping and structure where easements exceed 10% duct area, split into two ducts maintaining original duct area.

.10 Exposed ductwork to be fabricated from Aluminum for aesthetics.

2.6 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows.
- .1 Rectangular: standard radius with single thickness turning vanes. Centreline radius: 1.5 times width of duct.
- .2 Round: smooth radius. Centreline radius: 1.5 times diameter.
- .3 Oval: 7 gore 90’s, 5 gore 45’s.

.3 Mitred elbows, rectangular:
- .1 To 400 mm: with single thickness Airfoil turning vanes.
- .2 Over 400 mm: with double thickness Airfoil turning vanes.

.4 Branches:
- .1 Rectangular main and branch: with radius on branch 1.5 times width of duct.
- .2 Round main and branch: enter main duct at 45 degrees with conical connection.
- .3 Provide volume control damper in branch duct near connection to main duct.
- .4 Main duct branches: with splitter damper.

.5 Transitions:
- .1 Diverging: 15 degrees maximum included angle when increasing duct sizes.
- .2 Converging: 45 degrees maximum included angle downstream of equipment.
- .3 Diverging: 30 degrees maximum included angle upstream of equipment.

.6 Offsets:
.1 Full radiused elbows, as indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.
.1 Maximum included angles: as for transitions.

2.7 MANUFACTURED DUCT WORK AND FITTINGS

.1 Manufacture to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

.2 Flat Oval Ducts:
.1 Machine made from round spiral lockseam duct with light reinforcing corrugations; fittings manufactured of at least two gauges heavier metal than duct.

.3 Double Wall Insulated Flat Oval Ducts:
.1 Machine made from round spiral lockseam duct with light reinforcing corrugations, galvanized steel outer wall, 25 mm thick fibreglass insulation, perforated galvanized steel inner wall; fittings manufactured with solid inner wall.

.4 PVC Coated Steel Ducts:
.1 UL 181, Class 1, galvanized steel duct coated with polyvinyl chloride plastic, 0.1 mm thick on outside and 0.05 mm thick on inside.

.5 Transverse Duct Connection System:
.1 SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

2.8 CASINGS

.1 Fabricate casings to SMACNA HVAC Duct Construction Standards - Metal and Flexible and construct for operating pressures indicated.

.2 Mount floor mounted casings on 100 mm high concrete curbs. At floor, rivet panels on 200 mm centres to angles. Where floors are acoustically insulated, provide liner of 1.20 mm galvanized expanded metal mesh supported at 300 mm centres, turned up 300 mm at sides with sheet metal shields.

.3 Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection. Provide clear wire glass observation ports, minimum 150 X 150 mm size.

.4 Fabricate acoustic casings with reinforcing turned inward. Provide 1.50 mm back facing and 0.80 mm perforated front facing with 2.4 mm diameter holes on 4 mm centres. Construct panels 75 mm thick packed with 72 kg/cu m minimum glass fibre media, on inverted channels of 1.50 mm.

2.9 FIRESTOPPING

.1 Retaining angles around duct, on both sides of fire separation

.2 Fire stopping material and installation must not distort duct.

2.10 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping Equipment.

.1 Band hangers: use on round and oval ducts up to 500 mm diameter, of same material as duct but next sheet metal thickness heavier than duct.

.2 Trapeze hangers: ducts over 500 mm diameter or longest side, to SMACNA.

.3 Hangers: steel angle with black steel rods to following table.

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp or steel plate washer.

.1 Mount to top cord.

.3 For steel beams: manufactured beam clamps:

2.11 WIRE ROPE SUSPENSION SYSTEMS

.1 Wire rope suspension systems shall be ULC, CSA and SMACNA approved and tested.

.2 Wire suspensions systems consist of a pre-formed wire rope sling with either a ferruled loop, permanently fixed threaded 1/4ins (or 3/8ins) stud, or permanently fixed nipple end with toggle, at one end or hook or eyelet. The end fixings and the wire must be of the same manufacturer. The system is secured and tensioned with a hanger self-locking grip at the other end.

.3 Only wire and or supports supplied and or approved, shall be used with the system.

.4 The contractor shall select the correct specification of wire hanger to use for supporting each particular service from table 1 below. Each size is designated with a maximum Safe Working Load Limit (which incorporates a 5:1 safety factor). The correct specification of wire hanger required is determined using the following formula:

Weight per metre of object suspended (kg) x Distance between suspension points (m) = Weight loading per hanger suspension point (kg).

Table 1 Wire Hanger Safe Working Loads

Size	**Working Load Limit (kg)** **Working Load Limit (lbs)**
No. 1	0 - 10 kg 0 - 22 lbs
No. 2	10.5 - 45.5 kg 23 - 100 lbs

No. 3	46 - 91 kg 101 - 200 lbs
No. 4	95.5 - 225 kg 210 - 495 lbs
No. 5	225.5 - 325 kg 496 - 715 lbs

(i) Where the installed wire rope is not vertical then the working load limit shall be reduced in accordance with the recommendations given in the manufacturer's handbook.

.5 The Contractor shall select and use the correct length of wire rope required to support the service.

.6 No in-line joins shall be permitted in the rope.

3 Execution

3.1 GENERAL REQUIREMENTS

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.
.1 Ensure diffuser is fully seated.

.3 Support risers in accordance with SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints and manufactured equipment in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

.7 At each point where ducts pass through partitions, the joints around the duct shall be sealed with non-combustible material.

3.2 INSTALLATION

.1 Install and seal ducts to SMACNA HVAC Duct Construction Standards - Metal and Flexible according to seal classification specified.

.2 Provide openings in duct work where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated duct work, install insulation material inside a metal ring.

.3 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

.4 Use double nuts and lock washers on threaded rod supports.

.5 Provide access doors for inspection.

.6 Tape joints of PVC coated metal duct work with PVC tape.

.7 Connect terminal units to supply ducts directly or with 300 mm maximum length of flexible duct. Do not use flexible duct to change direction.

.8 Connect diffusers to low pressure ducts directly. To decouple diffuser from duct system, use 1.5 m maximum length of flexible duct held in place with caulking compound and strap or clamp. Do not use flexible duct to change direction.

.9 Connect flexible ducts to metal ducts with adhesive and strap or clamp.

.10 Set plenum doors 150 to 300 mm above floor. Arrange door swings so that fan static pressure holds door in closed position.

.11 During construction provide temporary closures of metal or taped polyethylene on open duct work to prevent construction dust from entering duct work system.

.12 Provide floor drains in fresh air coil, and humidifier sections with deep seal traps.

3.3 CLEANING

.1 Clean work to requirements of Division 1 and as detailed herein.

.2 Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

.3 Provide adequate access into duct work for cleaning purposes.

.4 Prior to occupancy and during initial occupancy, building shall be flushed at maximum outdoor air volume. Supply a total of 4,300 cu.m of outdoor air per sq.m of floor area or approximately 30,564,400cu.m of outdoor air or approximately 54 days of flushing. Note that a minimum of 3 weeks of flushing will be required prior to occupancy.

3.4 WATER TIGHT DUCTS

.1 Provide watertight duct for:
- .1 Fresh air intake.
- .2 As indicated.

.2 Form bottom of horizontal duct without longitudinal seams.
- .1 Solder or weld joints of bottom and side sheets.
- .2 Seal other joints with duct sealer.

.3 Slope horizontal branch ductwork down towards hoods served.
- .1 Slope header ducts down toward risers.

.4 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and discharging to open funnel drain.

3.5 WIRE ROPE SUSPENSION SYSTEMS

.1 The wire hangers shall be fixed to the building structure in accordance with the standard practice and structural limitations.

.2 Loop end can be wrapped around purlins, beams, roof trusses and other accessible building features.

.3 Stud end can be fixed with suitable anchors into concrete ceilings and structures, metal decking and pressed metal brackets (using nuts).

.4 Toggle end can be fixed into profile roof cladding, light fittings and luminaries.

.5 Other wire rope systems can be fixed to an approved structure, as determined by the Departmental Representative.

.6 The wire hangers shall not be fixed to any other services, without the approval of the Departmental Representative.

.7 The free end of the wire rope should be threaded through one channel of the self-locking grip before being either passed around the object being suspended or connected to it, using a suitable fixing. The wire rope is then threaded back through the second channel in the grip until the required level is achieved.

.8 Adjust duct elevations as required to remain level and plumb, the weight of the suspended object must be independently supported while making adjustments.

.9 The wire rope must not be damaged, twisted or deformed in any way prior to, or during, installation. Any such ropes must be discarded and replaced.

.10 When installing wire hangers the angle between the ropes when exiting the grip must never exceed the manufacturer's recommendations and/or 60 degrees.

.11 Lubricants, paint or any other coating shall not be applied to the wire hanger as it may impair its performance.

.12 Wire hangers must be installed in accordance with the manufacturer's loading and installation instructions and all the manufacturer's recommendations.

3.6 LEAKAGE TESTS

.1 Refer to Section 23 05 94.

.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Do leakage tests in sections.

.4 Make trial leakage tests as instructed to demonstrate workmanship.

.5 Do not install additional ductwork until trial test has been passed.

.6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.

.7 Complete tests before performance insulation or concealment Work.

3.7 SEALANT APPLICATION

.1 Contractor shall apply sealant on exposed ductwork in a 50mm band centered on joint.

.2 Sealant shall be applied evenly with a clean edge finish perpendicular to duct and plumb.

.3 Tape shall be utilized to provide clean edge finish to sealant application.

3.8 SOUND ATTENUATING TRANSFER DUCTS

.1 Sound attenuating transfer air ducts shall be installed where indicated on drawings complete with internal acoustic insulation in accordance with Section 23 07 13.

.2 Elbows on sound attenuating transfer air ducts shall not utilize turning vanes.

.3 Geometry of all sound attenuating transfer air ducts shall ensure that sound contacts a minimum of two duct surfaces.

.4 Provide single elbow configurations or double elbow configurations as indicated on drawings. It is permissible to utilize double elbow configurations in lieu of single elbow but not vice versa.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and installation of high-pressure metallic ductwork, joints and accessories.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
.2 American Society for Testing and Materials (ASTM).
  .1 ASTM A653/A653M-04a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process. (Metric).
.3 Department of Justice Canada (Jus).
  .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  .2 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  .1 Material Safety Data Sheets (MSDS).
.5 Sheet Metal Air Conditioning Contractors' National Association (SMACNA).
  .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible, 95 (Addendum No. 1, (1997).
  .2 SMACNA HVAC Air Duct Leakage Test Manual, 1st Edition 1985.
  .3 SMACNA IAQ Guideline for Occupied Buildings under Construction, 1st Edition 1995.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS - Section 02 61 33 - Hazardous Materials for the following:
  .1 Sealants.
  .2 Tape.
  .3 Proprietary joints.
  .4 Fittings.

1.4 QUALITY ASSURANCE

.1 Certification of Ratings:
  .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to Codes and Standards.

.2 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.5 DEFINITIONS

.1 Low pressure/low velocity: static pressure in duct less than 498 Pa and velocities less than 10 meters/second.

.2 Medium pressure/high velocity: Static pressure in duct less than 996 Pa and velocities between 10 meters/second and 20 meters/second.

.3 High pressure/high velocity: Static pressure in ducts more than 996 Pa and velocities greater than 4000 fpm.

.4 Duct sizes: as shown on drawings are outside dimensions. For acoustically lined or internally insulated ducts, sizes shown are actual duct sizes and the insulation thickness has been accounted for

1.6 QUALITY ASSURANCE

.1 Ductwork shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems, and NFPA No. 96, Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapours from Commercial Cooking Equipment.

.2 Fabricate in accordance with SMACNA duct manuals and ASHRAE handbooks.

1.7 INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN

.1 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

2 Products

2.1 GENERAL

.1 Fasteners: Use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts.

.2 Complete metal ducts within themselves with no single partition between ducts. Where width of duct exceeds 450 mm, cross break for rigidity. Open corners are not acceptable.

.3 Lop metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.

.4 Where 1.5 time radius elbows are not possible and where rectangular elbows possible, use rectangular elbows and provide approved type air foil turning vanes. Where acoustical lining is provided, provide turning vanes of perforated metal type with fibre glass inside.

.5 Rigidly constructed metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breath, rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled.

2.2 DUCTWORK

.1 Material:
- .1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.
- .2 Thickness: to SMACNA.

.2 Construction - round and oval.
- .1 Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA.
- .2 Transverse joints up to 900 mm: slip type with tape and sealants.
- .3 Transverse joints over 900 mm: Vanstone.
- .4 Fittings:
  - .1 Elbows: smooth radius or seven-piece (for 90 degrees), five-piece (for 45 degrees). Centreline radius: 1.5 x diameter.
  - .2 Branches: conical transition with conical branch at 45 degrees and 45 degrees elbow.

.3 Construction - rectangular:
- .1 Ducts: to SMACNA.
- .2 Transverse joints: welded or proprietary duct joints to SMACNA seal Class A.
- .3 Fittings:
  - .1 Elbows: smooth radius; centreline radius 1.5 x width of duct. No vanes.
  - .2 Branches: with conical branch at 45 degrees and 45 degrees elbow except where duct manufacturer can show 90 degree and tap has less static pressure loss.

.4 Firestopping:
- .1 50 x 50 x 3 mm retaining angles around duct, on both sides of fire separation.
- .2 Firestopping material must not distort duct.

2.3 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
2500	A
1500	A
1000	A
750	A

.2 Seal classification:
- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant, gaskets, tape or combination thereof.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with gaskets, sealant, tape or combination thereof.

2.4 SEALANT

.1 Oil resistant, water based, anti-microbial, anti-bacterial, ultra violet resistant, polymer type, flame resistant duct sealant.

.2 VOC content to be less than VOC limits of the State of California's South Coast Air Quality District Rule #1168. VOC content less than 30 g/L (less water and less exempt compounds) for sealing metal to metal contact.

.3 Sealant shall be cured for at minimum of 48 hours.

.4 Flame spread Rating: 0 (zero).

.5 Smoke Spread Rating: 0 (zero).

2.5 TAPE

.1 Polyvinyl treated, open weave fibre glass, 50 mm wide.

2.6 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC air duct leakage test manual.

2.7 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping Equipment.

.1 Band hangers: use on round and oval ducts up to 500 mm diameter, of same material as duct but next sheet metal thickness heavier than duct.

.2 Trapeze hangers: ducts over 500 mm diameter or longest side, to SMACNA.

.3 Hangers: steel angle with black steel rods to following table.

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp or steel plate washer.

.1 Mount to top cord.

.3 For steel beams: manufactured beam clamps:

2.8 WIRE ROPE SUSPENSION SYSTEMS

.1 Wire rope suspension systems shall be ULC, CSA and SMACNA approved and tested.

.2 Wire suspensions systems consist of a pre-formed wire rope sling with either a ferruled loop, permanently fixed threaded 1/4ins (or 3/8ins) stud, or permanently fixed nipple end with toggle, at one end or hook or eyelet. The end fixings and the wire must be of the same manufacturer. The system is secured and tensioned with a hanger self-locking grip at the other end.

.3 Only wire and or supports supplied and or approved, shall be used with the system.

.4 The contractor shall select the correct specification of wire hanger to use for supporting each particular service from table 1 below. Each size is designated with a maximum Safe Working Load Limit (which incorporates a 5:1 safety factor). The correct specification of wire hanger required is determined using the following formula:

Weight per metre of object suspended (kg) x Distance between suspension points (m) = Weight loading per hanger suspension point (kg).

Table 1 Wire Hanger Safe Working Loads

Size	**Working Load Limit (kg)** **Working Load Limit (lbs)**
No. 1	0 - 10 kg 0 - 22 lbs
No. 2	10.5 - 45.5 kg 23 - 100 lbs
No. 3	46 - 91 kg 101 - 200 lbs
No. 4	95.5 - 225 kg 210 - 495 lbs
No. 5	225.5 - 325 kg 496 - 715 lbs

(i) Where the installed wire rope is not vertical then the working load limit shall be reduced in accordance with the recommendations given in the manufacturer's handbook.

.5 The contractor shall select and use the correct length of wire rope required to support the service.

.6 No in-line joins shall be permitted in the rope.

3 Execution

3.1 GENERAL

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .1 Insulate band hangers 100 mm beyond insulated duct.
- .2 Ensure diffuser is fully seated.

.3 Support risers in accordance with SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Ensure installation of firestopping does not distort duct.

.6 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal cam with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

.7 Clean duct systems and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning.

.8 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

.9 Connect terminal units to medium pressure ducts with 300 mm maximum length of flexible duct. Do not use flexible duct to change directions.

.10 At each point where ducts pass through partitions, the joints around the duct shall be sealed with non-combustible material.

3.2 HANGERS

.1 Band hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 SEALING AND TAPING

.1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturer's recommendations.

3.4 WIRE ROPE SUSPENSION SYSTEMS

.1 The wire hangers shall be fixed to the building structure in accordance with the standard practice and structural limitations.

.2 Loop end can be wrapped around purlins, beams, roof trusses and other accessible building features.

.3 Stud end can be fixed with suitable anchors into concrete ceilings and structures, metal decking and pressed metal brackets (using nuts).

.4 Toggle end can be fixed into profile roof cladding, light fittings and luminaries.

.5 Other wire rope systems can be fixed to an approved structure, as determined by the Departmental Representative.

.6 The wire hangers shall not be fixed to any other services, without the approval of the Departmental Representative.

.7 The free end of the wire rope should be threaded through one channel of the self-locking grip before being either passed around the object being suspended or connected to it, using a suitable fixing. The wire rope is then threaded back through the second channel in the grip until the required level is achieved.

.8 Adjust duct elevations as required to remain level and plumb, the weight of the suspended object must be independently supported while making adjustments.

.9 The wire rope must not be damaged, twisted or deformed in any way prior to, or during, installation. Any such ropes must be discarded and replaced.

.10 When installing wire hangers the angle between the ropes when exiting the grip must never exceed the manufacturer's recommendations and/or 60 degrees.

.11 Lubricants, paint or any other coating shall not be applied to the wire hanger as it may impair its performance.

.12 Wire hangers must be installed in accordance with the manufacturer's loading and installation instructions and all the manufacturer's recommendations.

3.5 LEAKAGE TESTS

.1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.

.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Perform leakage tests in sections.

.4 Perform trial leakage tests, as instructed to demonstrate workmanship.

.5 Do not install additional ductwork until trial tests have been achieved.

.6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.

.7 Complete tests before performing insulation or concealment Work.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Silencers.

1.2 REFERENCES

.1 AABC - National Standards for Total System Balance.
.2 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
.3 AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
.4 AMCA 302 - Application of Sone Ratings for Non-Ducted Air Moving Devices.
.5 AMCA 303 - Application of Sound Power Level Ratings for Fans.
.6 ANSI S1.1 - Acoustical Terminology.
.7 ANSI S1.8 - Preferred Reference Quantities for Acoustical Levels.
.8 ANSI S1.13 - Measurement of Sound Pressure Levels in Air.
.9 ARI 270 - Sound Rating of Outdoor Unitary Equipment.
.10 ARI 575 - Measuring Machinery Sound Within an Equipment Space.
.11 ASA 16 (ANSI S1.36) - Survey Methods for Determination of Sound Power Levels of Noise Sources.
.12 ASA 47 (ANSI S1.4) - Specification for Sound Level Meters.
.13 ASA 49 (ANSI S12.1) - Preparation of Standard Procedures to Determine the Noise Emission from Sources.
.14 ASHRAE 68 - Laboratory Method of Testing to Determine the Sound Power in a Duct.
.15 ASHRAE Handbook - Systems Volume, Chapter "Sound and Vibration Control".
.16 ASTM E90 - Method for Laboratory Measurement of Airborne Sound Transmission loss of Building Partitions and Elements.
.17 ASTM E477 - Method of Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
.18 ASTM E596 - Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures.
.19 NEBB - Procedural Standards for Measuring Sound and Vibration.
.20 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.3 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate assembly, materials, thicknesses, dimensional data, pressure losses, acoustical performance, layout, and connection details.

.3 Product Data: Provide catalogue information indicating, materials, dimensional data, pressure losses, and acoustical performance.

.4 Design Data: Provide engineering calculations, referenced to specifications and AMCA 301 standards indicating that maximum room sound levels are not exceeded.

.5 Test Reports: Indicate dynamic insertion loss and noise generation values of silencers.

.6 Manufacturer's Installation Instructions: Indicate installation requirements which maintain integrity of sound isolation.

1.4 PROJECT RECORD DOCUMENTS

.1 Section 01 78 00: Submittals for project closeout.

.2 Record actual locations of silencers and sound attenuating devices.

1.5 QUALITY ASSURANCE

.1 Perform Work to AMCA 300 standards and recommendations of ASHRAE 68.

1.6 QUALIFICATIONS

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Design application of duct silencers under direct supervision of a Departmental Representative experienced in design of this work and licensed at the place where the Project is located.

2 Products

2.1 DUCT SILENCERS

.1 Description: Duct section with sheet metal outer casing, sound absorbing fill material, and inner casing of perforated sheet metal; incorporating interior baffles of similar construction. Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.2 Configuration and performance: as noted on equipment schedule, insertion loss to ASTM E477

.3 Materials:

- .1 Outer Casing: Minimum 0.8 mm (22 gauge) thick galvanized steel stiffened as required, with mastic filled lock formed seams, 50 mm long, 2.9 mm slip joints on both ends.
- .2 Inner Casing and Splitters: Minimum 0.6 mm (26 gauge) thick perforated galvanized steel.
- .3 Fill: Formaldehyde free Glass fibre or mineral wool of minimum 64 kg/cu m density.
- .4 Fill Liner: 0.0254 mm Mylar or Tedlar film.

2.2 CROSS TALK SILENCERS

.1 Description: manufactured dual elbow silencer with sheet metal outer casing, sound absorbing fill material, and inner casing of perforated sheet metal; incorporating interior baffles of similar construction. Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.2 Configuration and performance: as noted on equipment schedule, insertion loss to ASTM E477

.3 Materials:

.1 Outer Casing: Minimum 0.8 mm (22 gauge) thick galvanized steel stiffened as required, with mastic filled lock formed seams, 75 mm long, 2.9 mm slip joints on both ends.

.2 Inner Casing and Splitters: Minimum 0.8 mm (22 gauge) thick perforated galvanized steel.

.3 Fill: Formaldehyde free Glass fibre or mineral wool of minimum 64 kg/cu m density.

.4 Specification Based on VAW Model XTS

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Support duct silencers independent of duct work with flexible duct connections, lagged with leaded vinyl sheet on inlet and outlet. Refer to Section 23 33 00.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Air turning devices/extractors.
.2 Backdraft dampers.
.3 Combination fire and smoke dampers.
.4 Duct access doors.
.5 Duct test holes.
.6 Fire dampers.
.7 Flexible duct connections.
.8 Volume control dampers.

1.2 REFERENCES

.1 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
.2 NFPA 92A - Smoke-Control Systems.
.3 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
.4 UL 33 - Heat Responsive Links for Fire-Protection Service.
.5 UL 555 - Fire Dampers.
.6 UL 555S - Smoke Dampers.

1.3 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Provide for shop fabricated assemblies including volume control dampers.

.3 Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

.4 Manufacturer's Installation Instructions: Indicate for dampers including fire and fire/ smoke dampers.

1.4 PROJECT RECORD DOCUMENTS

.1 Section 01 78 00: Submittals for project closeout.

.2 Record actual locations of access doors.

1.5 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Accessories shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems.

.3 Fabricate in accordance with ASHRAE handbooks and SMACNA duct manuals.

1.6 REGULATORY REQUIREMENTS

.1 Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Protect dampers from damage to operating linkages and blades.

1.8 EXTRA MATERIALS

.1 Section 01 78 00: Submittals for project closeout.

.2 Provide two of each size and type of fusible link.

2 Products

2.1 TURNING VANES

.1 Factory or shop fabricated single thickness or double thickness, to recommendations of SMACNA and as indicated.

.2 Shall be airfoil type.

.3 Where acoustical lining is provided, provide turning vanes of perforated metal type with fibre glass inside.

2.2 BACKDRAFT DAMPERS.

.1 Gravity Backdraft Dampers, Size 450 x 450 mm or Smaller Provided with Air Moving Equipment: Air moving equipment manufacturers standard construction.

.2 Extruded aluminum 6063T5 backdraft damper frame shall not be less than 1.52 mm in thickness. Frame shall be 63.5 mm deep.

.3 Blades shall be extruded aluminum (6063T5) profiles and shall be less than 1.52 mm in thickness.

.4 Blade and side seals shall be extruded silicone. Seals are to be secured in integral slots within the aluminum extrusions.

.5 Bearing system shall be composed of Celcon bearings rotating on zinc-plated 12.7 mm steel pivot points.

.6 Linkage system shall consist of hard alloy aluminum (6005T6) crank arms fastened to zinc-plated steel pivot rods and shall be doubly secured within channel running along top of blade. Large diameter 8.73 mm hard alloy aluminum (6065-T6C) linkage rod shall connect the crank arms by means of a zinc-plated steel trunnion.

.7 Cup point trunnion set screw shall create a compression hard spot where it secures to the linkage rod for a slip-proof grip.

.8 Trunnions shall be zinc-plated to provide a hard, smooth and long-lasting rotating surface.
- .1 Performance:
- .2 Temperature range: -40 deg.C to 100 deg.C.
- .3 Leakage: 101.2 l/s per square meter at 0.25 kPa.
- .4 Pressure Drop: less than 24.9 Pa.

.9 Backdraft dampers shall be made to size required. Minimum section size shall be 152 mm wide x 152 mm high. Maximum section size shall be 914 mm wide by 3658 mm high. Mullion breaks shall be used when damper height exceeds 1220 mm.

.10 Backdraft dampers with dimensions greater than maximum section size shall be manufactured in multiple sections. Multiple sections are not interlinked or connected. To install, each section must be individually fastened to a structural frame prepared on site.

.11 Fully adjustable device to permit setting for varying differential static pressures less than 2.49 Pa.

2.3 DUCT ACCESS DOORS

.1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

.2 Access doors to be ULC labelled.

.3 Fabrication for un-insulated ducts: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices.

.4 Fabrication for insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation with sealing gaskets and quick fastening locking devices.

.5 Gaskets: neoprene.

.6 Hardware:
- .1 Less Than 300 mm Square: Secure with sash locks complete with safety chain.
- .2 Up to 450 mm Square: Provide two hinges and two sash locks.
- .3 451 to 1000 mm: piano hinge and minimum two sash locks.
- .4 Doors over 1000 mm: piano hinge and two handles operable from both sides.
- .5 300 x 300 mm glass viewing panels where indicated.
- .6 Hold open devices.

.7 Access doors with sheet metal screw fasteners are not acceptable.

2.4 DUCT TEST HOLES

.1 Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

.2 Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.5 FLEXIBLE DUCT CONNECTIONS

.1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

.2 Connector:
- .1 Fabric: cUL listed fire-retardant self extinguishing neoprene coated woven glass fibre fabric to NFPA 90A, minimum density 1.0 kg/sq m. Approximately 50mm of fabric clenched by means of double locked seams.

.2 Frame: 75 mm wide, 0.6 mm thick galvanized sheet metal.
.3 Attach edging strip to ducting and equipment by screws or bolts at 150 mm (6") intervals

.3 Leaded Vinyl Sheet: Minimum 14 mm0.55 inch thick, 4.2 kg/sq m0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.6 DRYER VENT

.1 Provide stainless steel side wall commercial dryer vent complete with backdraft damper, wind guard, and rain cap. Vent to be minimum 26 gauge metal.

3 Execution

3.1 INSTALLATION

.1 Install accessories to manufacturer's written instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

.2 Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

3.2 ACCESS DOORS

.1 Provide adequately sized duct access doors for inspection and cleaning.

.2 Sizes:
.1 600 x 600 mm for person size entry.
.2 900 x 900 mm for servicing entry.
.3 300 x 300 mm for viewing.
.4 As indicated.

.3 Locations (before and after):
.1 Fire and smoke dampers (install at fire dampers).
.2 Control dampers.
.3 Devices requiring maintenance.
.4 Required by code.
.5 Reheat coils.
.6 Filters.
.7 To facilitate cleaning of ductwork (minimum
.8 Elsewhere as indicated.

.4 Provide 100 mm x 100 mm (4" x 4") quick opening access doors for inspection at balancing dampers, before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust duct work to NFPA 96. Provide minimum 200 x 200 mm size for hand access, 450 x 450 mm size for shoulder access, and as indicated. Provide 100 x 100 mm for balancing dampers only. Review locations prior to fabrication.

3.3 TEST PORTS

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Provide duct test ports where indicated and required for testing and balancing purposes.

.3 Install insulation port extensions as required.

.4 Locations:
- .1 For traverse readings:
  - .1 Ducted inlets to roof and wall exhausters.
  - .2 Inlets and outlets of other fan systems.
  - .3 Main and sub-main ducts.
  - .4 And as indicated.
- .2 For temperature readings:
  - .1 At outside air intakes.
  - .2 In mixed air applications in locations as approved by Departmental Representative.
  - .3 At inlet and outlet of coils.
  - .4 Downstream of junctions of two converging air streams of different temperatures.
  - .5 And as indicated.

3.4 FLEXIBLE CONNECTORS

.1 Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment, and supported by vibration isolators, including but not limited to the following:
- .1 Inlets and outlets to supply air units and fans.
- .2 Inlets and outlets of exhaust and return air fans.
- .3 As indicated.

.2 Length of connection: 100 mm.

.3 Minimum distance between metal parts when system in operation: 75 mm.

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:
- .1 Ducting on sides of flexible connection to be in alignment.
- .2 ensure slack material in flexible connection.

.6 For fans developing static pressures of 1250 Pa and over, cover connections with leaded vinyl sheet, held in place with metal straps.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Balancing dampers for mechanical forced air ventilation and air conditioning systems.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA).
- .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-1985.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures..
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Health and Safety Requirements:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 MANUAL VOLUME CONTROL DAMPERS.

.1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

.2 Splitter Dampers:
- .1 Fabricate from same material as duct but one sheet metal thickness heavier (minimum 16 gauge), with appropriate stiffening to avoid vibration.
- .2 Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous piano hinge.
- .3 Operator: Minimum 6 mm diameter rod in self aligning, universal joint action, flanged bushing with set screw and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Folded leading edge.
- .6 Size on basis of straight air volume proportioning.

.3 Single Blade Dampers:
- .1 Fabricate for duct sizes up to 150 (in depth) x 760 mm.
- .2 Fabricate from same material as duct, but one sheet metal thickness heavier (minimum 16 gauge). V-groove stiffened.
- .3 Size and configuration to recommendations of SMACNA
- .4 Locking quadrant with shaft extension to accommodate insulation thickness.
- .5 Inside and outside nylon end bearings.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

.4 Multi-Blade Damper:
- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height: 100 mm
- .4 Bearings: self-lubricating oil impregnated nylon.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

.5 End Bearings: Except in round duct work 300 mm and smaller, provide end bearings.

.6 Quadrants:
- .1 Provide locking, indicating quadrant regulators on single and multi-blade dampers.
- .2 On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
- .3 Where rod lengths exceed 750 mm provide regulator at both ends.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install where specified, where required for balancing and where indicated on drawings.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Use splitter dampers only where indicated.

.4 Provide commercial balancing dampers on all low velocity duct take-offs to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly unless specifically noted otherwise.

.5 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts. Where indicated on the drawings, a balancing damper is not required for runouts in non-accessible ceiling spaces provided a damper is specified on the register and diffuser.

.6 Dampers: shall be installed vibration free.

.7 Ensure damper operators are observable and accessible. Provide access doors in ceilings/ walls where required.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Operating dampers for mechanical forced air ventilation and air conditioning systems.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
- .1 ASTM A653/A653M-04a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals
- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 Certificates:
- .1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency.

2 Products

2.1 MULTI-LEAF DAMPERS

.1 Opposed airfoil blade type as indicated.

.2 Extruded aluminum (6063T5) damper frame shall not be less than 2.03 mm thickness. Damper frame to be 100 mm deep.

.3 Blades to be extruded aluminum (6063T5) profiles. Aluminum end caps are to be press fitted to blade ends, in order to seal hollow interior and reduce air leakage rate.

.4 Blade and frame seals shall be of extruded silicone. Seals are to be secured in an integral slot within the aluminum extrusions.

.5 Bearings are to be composed of a Celcon inner bearing fixed to a 11.11 mm aluminum hexagon blade pin, rotating within a polycarbonate outer bearing inserted in the frame, resulting in no metal-to-metal or metal-to-plastic contact.

.6 Linkage hardware shall be installed in the frame side and constructed of aluminum and corrosion-resistant, zinc-plated steel, complete with cup-point trunnion screws for a slip-proof grip.

.7 Standard air leakage data to be certified under the AMCA Certified Ratings Program.

.8 Dampers shall be made to size required without blanking off free area.

.9 Intermediate or tubular steel structural support is required to resist applied pressure loads for dampers that consist of two or more sections in both height and width.

.10 Operator: to Division 25.

.11 Insulated aluminum dampers:
- .1 Frames: insulated with extruded polystyrene foam with RSI 0.88.
- .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.

.12 Performance:
- .1 Temperature Range: -40 deg.C to 100 deg.C.
- .2 Leakage: 15.2 l/s per sq.meter at 0.25 kPa, 40.5 l/s per sq.meter at 1.0 kPa. Shall meet Class 1A at 0.25 kPa.
- .3 Pressure Drop: less than 4 Pa at 5.08 m/s.

2.2 DISC TYPE DAMPERS

.1 Frame: insulated brake formed, welded, 1.6 mm thick, galvanized steel to ASTM A653/A653M.

.2 Disc: insulated spin formed, 1.6 mm thick, galvanized steel to ASTM A653/A653M.

.3 Gasket: extruded neoprene, field replaceable, with 10 year warranty.

.4 Bearings: roller self lubricated and sealed.

.5 Operator: compatible with damper, linear stroke operator, spring loaded actuator, zinc-aluminum foundry alloy casting cam follower.

.6 Performance:
- .1 Leakage: in closed position less than 0.001 % of rated air flow at .25 kPa pressure differential across damper.
- .2 Pressure drop: at full open position less than 5 Pa differential across damper at 5.08 m/s.

2.3 BACKDRAFT DAMPERS

.1 Extruded aluminum 6063T5 backdraft damper frame shall not be less than 1.52 mm in thickness. Frame shall be 63.5 mm deep.

.2 Blades shall be extruded aluminum (6063T5) profiles and shall be less than 1.52 mm in thickness.

.3 Blade and side seals shall be extruded silicone. Seals are to be secured in integral slots within the aluminum extrusions.

.4 Bearing system shall be composed of Celcon bearings rotating on zinc-plated 12.7 mm steel pivot points.

.5 Linkage system shall consist of hard alloy aluminum (6005T6) crank arms fastened to zinc-plated steel pivot rods and shall be doubly secured within channel running along top of blade. Large diameter 8.73 mm hard alloy aluminum (6065-T6C) linkage rod shall connect the crank arms by means of a zinc-plated steel trunnion.

.6 Cup point trunnion set screw shall create a compression hard spot where it secures to the linkage rod for a slip–proof grip.

.7 Trunnions shall be zinc-plated to provide a hard, smooth and long-lasting rotating surface.

.8 Performance:
- .1 Temperature range: -40 deg.C to 100 deg.C.
- .2 Leakage: 101.2 l/s per square meter at 0.25 kPa.
- .3 Pressure Drop: less than 24.9 Pa.

.9 Backdraft dampers shall be made to size required. Minimum section size shall be 152 mm wide x 152 mm high. Maximum section size shall be 914 mm wide by 3658 mm high. Mullion breaks shall be used when damper height exceeds 1220 mm.

.10 Backdraft dampers with dimensions greater than maximum section size shall be manufactured in multiple sections. Multiple sections are not interlinked or connected. To install, each section must be individually fastened to a structural frame prepared on site.

.11 Fully adjustable device to permit setting for varying differential static pressures less than 2.49 Pa.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.5 Ensure dampers are observable and accessible.

.6 Install insulated dampers at interface with outdoors including outdoor air intakes, exhaust ducts, and relief ducts.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Fire and smoke dampers, and fire stop flaps.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)
- .1 ANSI/NFPA 90A-2002, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.3 Underwriters Laboratories of Canada (ULC)
- .1 CAN4-S112-M1990, Fire Test of Fire Damper Assemblies.
- .2 CAN4-S112.2-M84, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.
- .3 ULC-S505-1974, Fusible Links for Fire Protection Service.

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate the following:
  - .1 Fire dampers.
  - .2 Smoke dampers.
  - .3 Fire stop flaps.
  - .4 Operators.
  - .5 Fusible links.
  - .6 Design details of break-away joints.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals:
- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Provide a Fire Damper Schedule identifying the following: damper tag, duct size, location, access door size, location.

1.4 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 Certificates:
.1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.5 MAINTENANCE

.1 Extra Materials:
.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
.2 Provide following:
.1 Six (6) fusible links of each type.

2 Products

2.1 FIRE DAMPERS

.1 Fabricate to NFPA 90A and as indicated.

.2 Fire dampers: arrangement Type A, B and C, listed and bear label of ULC, UL, Warnock Hersey, meet requirements of authorities having jurisdiction. Fire damper assemblies fire tested in accordance with CAN4-S112. Fusible links on fire dampers shall be constructed to ULC Standard S505.

.3 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation
.1 Fire dampers: 1-1/2 hour fire rated unless otherwise indicated or required.
.2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.

.4 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.

.5 Ceiling Dampers: Galvanized steel, 0.76 mm frame and 1.5 mm flap, two layers 3.2 mm ceramic fibre on top side, and one layer on bottom side for round flaps, with locking clip

.6 Horizontal Dampers: Galvanized steel, 0.76 mm frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

.7 Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 250 Pa pressure class ducts up to 300 mm in height.

.8 Multiple Blade Dampers: 1.5 mm galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 3.2 x 12.7 mm plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

.9 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.10 Fusible Links: separate at 71 degrees C (161 Deg.F.) with adjustable link straps for combination fire/balancing dampers.

.11 Fire dampers in low pressure ductwork may be multi-blade, offset butterfly of curtain type.

.12 Fabricate combination fire and balancing dampers with linkage readily adjustable in open position.

.13 50 x 50 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.14 Equip fire dampers with steel sleeve and frame installed disruption ductwork (breakaway ductwork) to ensure damper operation is not impaired. Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening, except where noted otherwise. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.

.15 Fire dampers mounted on through the ceiling/floor security grilles shall utilize the security grille frame as the sleeve through the rated structure. Fire damper to be mounted on the service side to the security grille frame.

2.2 COMBINATION FIRE AND SMOKE DAMPERS

.1 Fabricate to NFPA 90A, UL 555, UL 555S, and as indicated.

.2 Provide factory sleeve and collar for each damper.

.3 Multiple Blade Dampers: Fabricate with 1.5 mm galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 3.2 x 12.7 mm plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 12.7 mm actuator shaft.

.4 Smoke Rating: Leakage Class III Smoke Damper in accordance with UL555S. A Class lll smoke damper leaks no more than 80 cubic feet per minute (2.27 m^3/min) at 4 in. wg. (1 kPa.) differential pressure

.5 Operators: UL listed and labelled Electric 24V, 60 Hz, two-position, fail close, externally mounted.

.6 Duct Smoke Detector: Factory mounted duct smoke detector with no minimum velocity requirement and complete with single point low voltage electrical connection. Sensor to be photo electronic type.

.7 Normally Open Smoke Responsive Fire Dampers: opposed blades complete with factory mounted actuator, flexible stainless steel blade edge seals to provide constant sealing pressure.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

.2 Install fire dampers and combination smoke and fire dampers to ANSI/NFPA 90A and in accordance with conditions of ULC listing.

.3 Maintain integrity of fire separation.

.4 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.5 Install access door adjacent to each damper.

.6 Co-ordinate with installer of firestopping.

.7 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.8 Install break-away joints of approved design on each side of fire separation.

.9 Contractor to individually tag each and every fire damper and provide a fire damper schedule in the Operation and Maintenance manual showing tag, size, type and location.

.10 Contractor shall tag fire damper and access door with fire damper tag.

.11 Demonstrate re-setting of fire dampers to Owner's representative.

.12 Where required by authority, seal dampers against smoke with non-intumescent (non-expanding) fire rated sealant.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and installation of flexible ductwork, joints and accessories.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 Department of Justice Canada (Jus).
  .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  .2 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  .1 Material Safety Data Sheets (MSDS).

.4 National Fire Protection Association (NFPA).
  .1 NFPA 90A-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.
  .2 NFPA 90B-02, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.

.5 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).
  .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 95 (Addendum No.1, November 1997).
  .2 SMACNA IAQ Guideline for Occupied Buildings under Construction, 1st Edition 1995.

.6 Underwriters' Laboratories Inc. (UL).
  .1 UL 181-96, Standard for Factory-Made Air Ducts and Air Connectors.

.7 Underwriters' Laboratories of Canada (ULC).
  .1 CAN/ULC-S110-1986 (R2001), Fire Tests for Air Ducts.

1.3 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS in accordance with Section 02 81 01 - Hazardous Materials for the following:
  .1 Thermal properties.
  .2 Friction loss.
  .3 Acoustical loss.
  .4 Leakage.
  .5 Fire rating.

.3 Samples: submit samples with product data of different types of flexible duct being used in accordance with Section 01 33 00 - Submittal Procedures.

1.4 QUALITY ASSURANCE

.1 Certification of Ratings:
- .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to Codes and Standards.

.2 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 GENERAL

.1 Factory fabricated to CAN/ULC-S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 FLEXIBLE DUCT MATERIALS

.1 Two ply vinyl film supported by helically wound spring steel wire.
- .1 Pressure Rating: 2.50 kPa positive and 250 Pa negative.
- .2 Maximum Velocity: 20.3 m/sec.
- .3 Temperature Range: -23 to 71 degrees C.

.2 ULC Labeled, black polymer film supported by helically wound spring steel wire.
- .1 Pressure Rating: 1000 Pa positive and 175 Pa negative.
- .2 Maximum Velocity: 20.3 m/sec.
- .3 Temperature Range: -28 to 79 degrees C.

.3 ULC labeled, multiple layers of aluminum laminate supported by helically wound spring steel wire.
- .1 Pressure Rating: 2.50 kPa positive and 250 Pa negative.
- .2 Maximum Velocity: 20.3 m/sec.
- .3 Temperature Range: -28 to 99 degrees C.

2.3 INSULATED FLEXIBLE DUCT MATERIALS

.1 Two ply vinyl film supported by helically wound spring steel wire; fibreglass insulation; polyethylene vapour barrier film.
- .1 Pressure Rating: 2.50 kPa positive and 250 Pa negative.
- .2 Maximum Velocity: 20.3 m/sec.
- .3 Temperature Range: -23 to 71 degrees C.

.2 Black polymer film supported by helically wound spring steel wire; fibreglass insulation; polyethylene vapour barrier film.
- .1 Pressure Rating: 1000 Pa positive and 175 Pa negative.

.2 Maximum Velocity: 20.3 m/sec.
.3 Temperature Range: -28 to 79 degrees C.

.3 Multiple layers of aluminum laminate supported by helically wound spring steel wire; fibreglass insulation; polyethylene vapour barrier film.
.1 Pressure Rating: 2.50 kPa positive and 250 Pa negative.
.2 Maximum Velocity: 20.3 m/sec.
.3 Temperature Range: -28 to 99 degrees C.

Part 3 Execution

3.1 DUCT INSTALLATION

.1 Install in accordance with: SMACNA.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Centrifugal fans.
.2 Roof and Wall Exhausters.
.3 Axial fans.
.4 Propeller fans.
.5 Fan accessories.
.6 Roof curbs.
.7 Motors and Drives.
.8 Cabinet Exhaust Fans

1.2 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

.3 Product Data:
- .1 Provide literature which indicates dimensions, weights, capacities, ratings, fan performance, gauges and finishes of materials, and electrical characteristics and connection requirements.
- .2 Provide data of filter media, filter performance data, filter assembly, and filter frames.
- .3 Provide fan curves with specified operating point clearly plotted.
- .4 Submit sound power level data for both fan outlet and casing radiation at rated capacity.
- .5 Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

1.3 SOURCE QUALITY CONTROL

.1 Fans used shall not decrease motor size, increase noise level, increase tip speed by more than 10 percent or increase inlet air velocity by more than 20 percent, from specified criteria; and capable of accommodating static pressure variations of plus or minus 10 percent.

1.4 OPERATION AND MAINTENANCE

.1 Submit operation and maintenance data to requirements of Section 01 78 00.

.2 Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

2 Products

2.1 CENTRIFUGAL FANS

.1 Wheel and Inlet
- .1 Backward Inclined: Steel construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate, cast hub riveted to back plate and keyed to shaft with set screws.
- .2 Forward Curved: Steel construction with inlet flange, back plate, shallow blades with inlet and tip curved forward in direction of air flow, mechanically secured to flange and back plate, steel hub swaged to back plate and keyed to shaft with set screw.
- .3 Airfoil Wheel: Steel construction with smooth curved inlet flange, heavy back plate, die formed hollow airfoil shaped blades continuously welded at tip, flanged and back plate, cast hub riveted to back plate and keyed to shaft with set screws.

.2 Housing
- .1 Heavy gage steel, spot welded, designed to minimize turbulence with spun inlet bell and shaped cut-off.
- .2 Factory finish before assembly in prime coated. For fans handling air downstream of humidifiers, provide two additional coats of paint. Prime coating on aluminum parts is not required.
- .3 Provide bolted construction with horizontal flanged split housing.
- .4 Fabricate plug fans without volute housing, with steel cabinet, lined.
- .5 Shafts: Hot rolled steel, ground and polished, with key-away and protectively coated with lubricating oil.
- .6 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed, variable and adjustable pitch sheaves for motors 11.2 kW and under, fixed sheaves for 15 kW and over, matched belts, drive rated minimum 1.5 times nameplate rating of the motor.
- .7 Belt Guards: Fabricate to SMACNA Low Pressure Duct Construction Standards.

.3 Accessories
- .1 Adjustable Inlet Vanes: Steel construction with blades supported at both ends with two permanently lubricated bearings, variable mechanism terminating in single control lever with control shaft for double width fans.
- .2 Discharge Dampers: Opposed blade heavy duty steel dampers assembly with blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked out of air stream to single control lever.
- .3 Inlet/Outlet Screens: Galvanized steel welded grid.
- .4 Access Doors: Shaped to conform to scroll with quick opening latches and gaskets.
- .5 Scroll Drain: 15 mm steel pipe coupling welded to low point of fan scroll.

2.2 AXIAL FANS

.1 Hub and Impeller
- .1 Airfoil Impeller Blades: Adjustable die cast aluminum alloy or welded steel die formed blades with belt drive.
- .2 Hub: Die cast aluminum alloy or cast iron hub or with belt drive of spun, welded steel, bored and keyed to shaft.

.3 Controllable Pitch Assemblies: Incorporate ball bearing, counterbalanced blade and variable pitch assembly into hub with mechanical link to casing exterior mounted actuator, or pneumatic or electric actuator incorporated within hub.

.2 Casing

.1 Casing: 6 mm steel for fans 1000 mm in diameter and smaller and 0.9 mm steel for larger fans.

.2 Fabrication: Continuously weld with inlet and outlet flanges connections, motor or shaft supports. Incorporate flow straightening guide vanes for fans specified for static pressures greater than 250 Pa.

.3 Finish: One coat enamel.

.4 Shafts: Hot rolled steel, ground and polished, with key-away and protectively coated with lubricating oil.

.5 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed, variable and adjustable pitch sheaves for motors 1.12 kW and under, fixed sheaves for 15 kW and over, matched belts, drive rated minimum 1.5 times nameplate rating of the motor.

.6 Belt Guards: Fabricate to SMACNA Low Pressure Duct Construction Standards.

.7 Lubrication: Extend lubrication fittings to outside of casing.

.3 Accessories

.1 Adjustable Inlet Vanes: Steel construction with blades supported at both ends with two permanently lubricated bearings, variable mechanism terminating in single control lever with control shaft for double width fans.

.2 Inlet Bell: Bell mouth inlet fabricated of steel with flange.

.3 Outlet Cones: Fabricated of steel with flanges, outlet area/inlet area ratio of 1.5/1.0.

.4 Inlet Screens: Galvanized steel welded grid to fit inlet bell.

.5 Dampers: Welded steel construction, consisting of two semi-circular pivoted vanes in short casing section, finished with one coat enamel. Provide airstream operation closing blades by reversing air flow and gravity.

.6 Access Doors: Shaped to conform to casing with quick opening latches and gaskets.

.7 Blade Pitch Actuator: Factory mounted and calibrated, electric actuator requiring single phase power and accepting electric input.

2.3 ROOF AND WALL EXHAUSTERS

.1 Roof Mounted Fans

.1 Centrifugal or Axial Fan: V-belt or direct driven, with spun aluminum housing, resilient mounted motor, 12 mm mesh bird screen, square base to suit roof curb, continuous curb gaskets, plate bolts and screws.

.2 Roof Curb: 200 mm high self-flashing curb with continuously welded seams, built in cant strip, factory installed door nailer strip.

.3 Disconnect Switch: Factory wired non-fusible in housing for thermal overload protected motor and wall mounted.

.4 Back Draft Damper: Gravity activated, aluminum multiple blade construction, felt edged with nylon bearings.

.5 V-belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed, variable and adjustable pitch motor sheave selected so requiring rpm is obtained with sheaves set at mid-position, fan shaft with self aligning pre-lubricated ball bearings.

.2 Wall Exhausters
- .1 Centrifugal or Axial Fan: V-belt or direct driven, with spun aluminum housing, motor, 12 mm mesh bird screen, cadmium plated bolts and screws.
- .2 Disconnect Switch: Factory wired non-fusible in housing for thermal overload protected motor and wall mounted.
- .3 Back Draft Damper: Gravity activated, aluminum multiple blade construction, felt edge with nylon bearings.
- .4 V-belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed, variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position, fan shaft with self aligning pre-lubricated ball bearings.

2.4 CABINET EXHAUST FANS

.1 Cabinet and Ceiling Exhaust Fans
- .1 Centrifugal Fan: V-belt or direct driven, with galvanized steel housing lined with 15 mm acoustic insulation, resilient mounted motor, gravity back draft damper in discharge.
- .2 Disconnect Switch: Factory wired non-fusible in housing for thermal overload protected motor and wall mounted.
- .3 Grille for Ceiling Fan: Moulded white plastic grille or aluminum grille with baked white enamel finish.
- .4 V-belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed, variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position, fan shaft with self aligning pre-lubricated ball bearings.
- .5 To be complete with factory mounted solid state speed control for air balancing only. The speed control shall not be utilized as the disconnect switch.

2.5 RANGE HOODS

.1 Fan: Resiliently mounted, multi-blade direct driven fan and motor, with two-speed plug-in type motor with permanently lubricated bearings.

.2 Hood: Stainless steel or baked enamel as indicated on equipment schedule, with rocker type switches for light and fan, and washable aluminum mesh type filter.

3 Execution

3.1 PREPARATION

.1 Verify that electric power is available and of the correct characteristics (voltage and phase) prior to ordering pump.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Assemble high pressure packaged air units by bolting sections together. Isolate fan section with flexible duct connections.

.3 Install flexible connections between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm flex between ductwork and fan while running.

.4 Install fan restraining snubbers as indicated. Flexible connectors shall not be in tension while running.

.5 Pipe scroll drains to nearest floor drain.

.6 Provide access to adjustable blade axial fan wheels for varying blade angle setting. Adjust blades for varying range of volume and pressure.

.7 Provide floor mounted axial fans with reinforced legs and ceiling suspended units with support brackets bolted to casing flange.

.8 When fan inlet or outlet is exposed, provide safety screen.

.9 Install unit on vibration isolators with static deflection of 50 mm. For smaller fans, vibration isolators to be as recommended by manufacturer.

.10 Set roof mounted fans on metal, self flashing curbs 200 mm minimum above roof. Provide acoustic insulation on duct to below roof line and one fan inlet plenum and drip pan for collecting condensation.

.11 Provide exhaust fans with multi-blade, rattle free, back draft damper with felt lines blades edges, bird screen, disconnect switch and curb caps.

.12 Supply and install sheaves as necessary for final air balancing.

.13 Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Supply, return and exhaust grilles and registers, diffusers and linear grilles, for commercial and residential use.
- .2 Sustainable requirements for construction and verification.

1.2 SYSTEM DESCRIPTION

.1 Performance Requirements:
- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to Codes and Standards.

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate following:
  - .1 Capacity.
  - .2 Throw and terminal velocity.
  - .3 Noise criteria.
  - .4 Pressure drop.
  - .5 Neck velocity.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Air flow tests and sound level measurement shall be made in accordance with ANSI/ ASHRAE Standard 70.

.2 Manufacturer shall have published performance data.

.3 Manufacturer shall certify catalogued performance and ensure correct application of air outlet types.

1.5 JOB CONDITIONS

.1 Review requirements of outlets as to size, finish and type of mounting prior to submitting shop drawings and schedules of outlet.

.2 Positions indicated are approximate only. Check location of outlets and make necessary adjustment in position to conform with Architectural features, symmetry, performance, and lighting arrangement.

2 Products

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Base air outlet application on space noise level, either by Noise Criteria (NC) curves or Room Criteria (RC) curves, as listed below:

.1	Meeting Rooms	NC 30
.2	Offices	NC 30
.3	Other Spaces	NC 30

.3 Frames:

.1 Full perimeter gaskets.

.2 Plaster frames for diffusers, located in plaster surface.

.3 Concealed fasteners.

.4 Concealed manual volume control damper operators.

.5 Provide baffles to direct air away from walls, columns or other obstructions within the radius of diffuser operation.

.6 Provide anti-smudge frames or plaques on diffusers located in rough textured surfaces such as acoustical plaster.

.7 Refer to equipment schedule for specification of air outlets.

.8 Colour: as directed by Departmental Representative.

2.2 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.3 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 Sidewall and ceiling exhaust grilles shall have streamlined blades, depth of which exceeds 20 mm spacing. Provide spring tension or other device to set blades. Provide units with horizontal face.

.2 Provide 25 mm narrow margin frame with countersunk screw holes.

.3 Fabricate of steel with 20 gauge minimum frames and 22 gauge minimum blades, steel and aluminum with 20 gauge minimum frame, or heavy aluminum extrusions.

.4 Provide exhaust grilles, with integral, gang-operated opposed blade dampers with removable key operator, operable from face, where indicated.

.5 Finish in factory baked enamel finish, colour by Departmental Representative.

2.4 GRID CORE RETURN AND EXHAUST GRILLES

.1 Fabricate fixed grilles of 13 mm x 13 mm x 13 mm louvres.

.2 Provide 32 mm margin frame with lay-in frame for suspended grid ceilings.

.3 Fabricate of aluminum.

.4 Provide exhaust grilles, where not individually connected to exhaust fans, with integral, gang-operated opposed blade dampers with removable key operator, operable from face, where indicated.

2.5 LOUVRED SUPPLY GRILLES

.1 Ceiling supply grilles shall have streamlined and individually adjustable curved blades to discharge air along face of grille. Units shall have two-way deflection.

.2 Provide 25 mm narrow margin frame with countersunk screw holes.

.3 Fabricate of heavy aluminum extrusions.

.4 Provide grilles with integral, gang-operated opposed blade dampers with removable key operator, operable from face, and equalizing grid, where indicated.

.5 Finish in factory enamel finish, colour as selected by Departmental Representative.

2.6 SECURITY GRILLE

.1 Perorated faced steel maximum security grilles of size and mountings as indicated on drawings.

.2 Grilles shall be from approved list of security grilles as follows:

- .1 Chubb OP-20V from www.gunnebo.com
- .2 Simpson V-2 from www.simpsoninstall@email.com and (902) 664-6266.
- .3 Eneround security-type ventilating grille from www.dthompson@heatingproducts.nf.net and (709) 754-9100
- .4 Virtucom SCO Security from www.virtucom-inc.com

.3 Grille to be stamped with manufacturer and model number on faceplate of grille.

.4 Grilles to be secured using Chubb or S&C flathead or equivalent flathead steel spanners from grille manufacturer.

.5 Grilles to be complete with a minimum of 2 spanner tools for the installation/removal of flathead steel spanner screws. Spanner tools to be turned over to owner at completion of project.

.6 Finish: as noted on drawings.

2.7 OUTSIDE LOUVRES

.1 Refer to Section 23 37 20 - Louvres, Intakes and Vents.

2.8 LINEAR FLOOR SUPPLY REGISTERS/GRILLES

.1 Type: Streamlined blades with 0 or 15 degree deflection (refer to schedule), 3 x 19 mm on 13 mm centres.

.2 Frame: heavy duty frame with countersunk screw mounting

.3 Fabrication: Steel, welded construction with factory baked enamel finish.

2.9 LINEAR FLOOR SUPPLY REGISTERS/GRILLES (secure areas)

.1 Type: Streamlined blades with 0 or 15 degree deflection (refer to schedule), 3 x 19 mm on 13 mm centres.

.2 Frame: extra heavy duty frame with countersunk screw mounting

.3 Fabrication: Steel, welded construction with factory baked enamel finish.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturer’s instructions.

.2 Install with oval head, stainless steel screws in countersunk holes where fastenings are visible.

.3 Bolt grilles, registers and diffusers, in place, where indicated.

.4 With security grilles, contractor shall use high yield grout to fill any space between back of the face plate and the mounting surface.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Mechanical louvers; intakes; vents; and reinforcement and bracing for air vents, intakes and gooseneck hoods.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA)
- .1 ANSI/NFPA 96-04, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM E90-04, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.5 Society of Automotive Engineers (SAE)

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:
- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.4 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate following:
  - .1 Pressure drop.
  - .2 Face area.
  - .3 Free area.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Test Reports:

.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

1.5 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

2 Products

2.1 FIXED LOUVRES - ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth. Blade and frame fillet welds concealed from view.

.2 Material: extruded aluminum alloy 6063-T5; blades and frames minimum 2.7 mm thick.

.3 Blade: stationary with drainable gutters, reinforcing bosses and maximum blade length of 1500 mm or manufacturer’s recommendations.

.4 Frame, head, sill and jamb: 100 or 150 mm deep one piece extruded aluminum, minimum 2 mm thick with approved caulking slot, integral to unit. Depth as indicated. Frames shall be jointed at each corner with full length weld.

.5 Mullions: at 1500 mm maximum centres, visible vertical mullions.

.6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 12 mm exhaust, 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 Finish: factory applied enamel. Colour: as selected by Departmental Representative.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 In accordance with manufacturer's and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 REFERENCES

.1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
- .1 ANSI/NFPA 96- 1994, Ventilation Control and Fire Protection of Commercial Cooking Operations.

.2 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
- .1 ASHRAE 52.1- 1992, Gravimetric And Dust Spot for Testing Air-cleaning Devices Used in General Ventilation for Removing Particulate Matter.

.3 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-115.10- M90, Disposable Air Filters for the Removal of Particulate Matter from Ventilating Systems.
- .2 CAN/CGSB-115.11- M85, Filters, Air, High Efficiency, Disposable, Bag Type (Reaffirmed April 1985).
- .3 CAN/CGSB-115.12- M85, Filters, Air, Medium Efficiency, Disposable, Bag Type (Reaffirmed April 1985).
- .4 CAN/CGSB-115.13- 85, Filter Media, Automatic Roll (Reaffirmed April 1985).
- .5 CAN/CGSB-115.14- M91, High Efficiency Cartridge Type Supported Air Filters for the Removal of Particulate Matter from Ventilating Systems.
- .6 CAN/CGSB-115.15- M91, High Efficiency Rigid Type Air Filters for Removal of Particulate Matter from Ventilating Systems.
- .7 CAN/CGSB-115.16- M82, Activated Carbon for Odor Removal from Ventilating Systems.
- .8 CAN/CGSB-115.18- M85, Filter, Air, Extended Area Panel Type, Medium Efficiency.
- .9 CAN/CGSB-115.20- 95, Polarized Media Air Filter.

.4 Underwriters' Laboratories of Canada
- .1 ULC -S111- M80, "Fire Tests for Air Filter Units".
- .2 ULC-S649-1993, Grease Filters for Commercial and Institutional Kitchen Exhaust Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawing and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Filters shall be product of and supplied by one manufacturer. Filter components assembled to form filter banks shall be products of same manufacturer.

.2 Filter media shall be UL listed, Class I or Class II, as approved by local authority.

1.5 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as frames and filters, addresses of suppliers, list of specialized tools necessary for adjusting, repairing or replacing for inclusion in operating manual.

1.6 ALTERNATIVES

.1 Size, media face area, Merv rating, initial and final resistance of alternative manufacturer’s shall be same as type specified.

1.7 EXTRA MATERIALS

.1 Spare filters: in addition to filters to be installed immediately prior to acceptance by Departmental Representative , supply one complete set of filters for each filter unit or filter bank in accordance with section 01 78 00 - Closeout Submittals. Total number of filters for each and every filter bank as follows:
- .1 One set for testing, balancing and commissioning.
- .2 One set to be installed at acceptance.
- .3 One spare set to be used by Owner during first year of operation.

2 Products

2.1 GENERAL

.1 Media: suitable for air at 100% RH and air temperatures between minus 40 and 50 °C.

.2 Number of units, size and thickness of panels, overall dimensions of filter bank, configuration and capacities: as indicated.

.3 Pressure drop when clean and dirty, sizes and thickness: as indicated on schedule.

.4 Fire rated to: ULC S111

.5 Final filters for all supply air systems shall be MERV 14 to meet LEED requirements.

2.2 ACCESSORIES

.1 Seals: to ensure leakproof operation.

.2 Blank-off plates: as required, to fit all openings and of same material as holding frames.

.3 Access and servicing: through doors/panels on each side and/or from upstream or downstream face of filter bank.

2.3 FIBROUS GLASS PANEL FILTERS

.1 Disposable fibrous glass media: to CAN/CGSB-115.10 with adhesive.

.2 Holding frame: 1.2 mm minimum thick galvanized steel with 3 mm diam hinged wire mesh screen.

.3 Performance: as indicated, to ASHRAE 52.2.

.4 Fire rated: to ULC -S111.

.5 Nominal thickness: as indicated.

2.4 COTTON PANEL FILTERS

.1 Disposable pleated reinforced cotton dry media: to CAN/CGSB 115.18.

.2 Holding frame: galvanized steel, or slide in channel for side access.

.3 Performance: as indicated, to ASHRAE 52.2.

.4 Fire Rated: to ULC -S111.

.5 Nominal thickness: as indicated.

2.5 FILTER GAUGES - MANOMETER TYPE

.1 Direct Reading Dial: 90 mm diameter diaphragm actuated dial in metal case, vent valves, black figures on white background, front recalibration adjustment, range 0 Pa to two times initial pressure, 2 percent of full scale accuracy.

.2 Inclined Manometer: One piece moulded plastic with epoxy coated aluminum scale, inclined-vertical indicating tube and built-in spirit level, range 0 Pa to two times initial pressure, 3 percent of full scale accuracy.

.3 Accessories: Static pressure tips with integral compression fittings, 6 mm aluminum tubing, 2-way or 3-way vent valves.

2.6 RIGID, SUPPORTED BAG TYPE FILTERS

.1 Media: disposable preformed fibrous glass, cartridge with approximately 4.6 sq.m. (50 sq.ft.) of media per 472 l/s capacity (1000 CFM).

.2 Holding frame: galvanized steel with bracing. Provision for front mounted panel pre-filter and front or rear removal of filter media.

.3 Media support: welded wire grid.

.4 High efficiency: to CAN/CGSB-115.11.

.5 Medium efficiency: to CAN/CGSB-115.12

.6 Nominal thickness: as indicated.

2.7 CARTRIDGE FILTERS

.1 Media: deep pleated, disposable, high efficiency, to CAN/CGSB-115.14.

.2 Holding frame: galvanized steel with bracing.

.3 Media support: welded wire grid.

2.8 FILTER FRAMES AND HOUSINGS

.1 General: Fabricate filter frames and supporting structures of 1.50 mm (16 gauge) galvanized steel or extruded aluminum T-section construction with necessary gasketing between frames and walls.

.2 Standard Sizes: Provide for interchangeability of filter media of other manufacturers; for panel filters; for extended surface and high efficiency particulate air filters, provide for upstream mounting of panel filters.

.3 Side Servicing Housings: Flanged for insertion into ductwork, of reinforced 1.5 mm galvanized steel; access doors with continuous gasketing and positive locking devices on both sides; extruded aluminum tracks or channels for primary and secondary filters with positive sealing gaskets.

3 Execution

3.1 INSTALLATION GENERAL

.1 Install in accordance with manufacturer’s recommendations and with adequate space for access, maintenance and replacement.

.2 Filter banks shall have removal and access indicated.

.3 Do not operate fan systems without filtration in place.

3.2 REPLACEMENT MEDIA

.1 Replace all media with new upon acceptance.

.2 Filter media to be new and clean, as indicated by pressure gauge, at time of acceptance.

3.3 FILTER GAUGES

.1 Install type as indicated across each filter bank (pre-filter and final filter) in approved and easy readable location.

.2 Mark each filter gauge with value of pressure drop for clean condition and manufacturer's recommended replacement (dirty) value.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Fabricated breechings.
.2 Manufactured chimneys for gas fired equipment.
.3 Vent dampers.
.4 Manufactured double wall chimneys for fuel fired equipment.

1.2 REFERENCES

.1 ANSI Z21.66 - Automatic Vent Damper Devices for Use with Gas-Fired Appliances.
.2 ANSI Z21.67 - Mechanically Actuated Automatic Vent Damper Devices for Use with Gas-Fired Appliances.
.3 ANSI Z21.68 - Thermally Operated Automatic Vent Damper Devices for Use with Gas-Fired Appliances.
.4 ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
.5 ASTM A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.6 ASTM A1011/A1011M - Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
.7 ASTM C401 - Classification of Alumina and Alumina-Silicate Castable Refractories.
.8 NEMA MG1 - Motors and Generators.
.9 NFPA 31 (ANSI Z95.1) - Standard for the Installation.
.10 NFPA 54 (ANSI Z223.1) - The National Fuel Gas Code.
.11 NFPA 82 - Standard on Incinerators and Waste and Linen Handling Systems and Equipment.
.12 NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances.
.13 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
.14 UL 103 - Standard for Factory Built Chimneys for Residential Type and Building Heating Appliances.
.15 UL 127 - Standard for Factory-Built Fireplaces.
.16 UL 378 - Standard for Safety for Draft Equipment.
.17 UL 441 - Standard for Safety for Gas Vents.
.18 UL 641 - Type L Low-Temperature Venting Systems.
.19 UL 959 (ANSI Z181.1) - Medium Heat Appliance Factory Built Chimneys.

1.3 DEFINITIONS

.1 Breeching: Vent Connector.

.2 Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.

.3 Smoke Pipe: Round, single wall vent connector.

.4 Vent: That portion of a venting system designed to convey flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

.5 Vent Connector: That part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

1.4 DESIGN REQUIREMENTS

.1 Factory built vents and chimneys used for venting natural draft appliances to NFPA 211, UL listed and labeled.

1.5 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate general construction, dimensions, weights, support and layout of breechings. Submit layout drawings indicating plan view and elevations where factory built units are used.

.3 Product Data: Provide data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.

.4 Submit manufacturer's installation instructions: Indicate assembly, support details, and connection requirements.

1.6 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years documented experience.

1.7 REGULATORY REQUIREMENTS

.1 Conform to applicable code for installation of natural gas burning appliances and equipment.

.2 Conform to applicable code for installation of oil burning appliances and equipment.

.3 Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

2 Products

2.1 BREECHING

.1 Fabricate of ASTM A1011 carbon steel. Fabricate breechings less than 24 inch (600 mm) diameter of galvanized sheet steel, lock forming quality with ASTM A653 G90 zinc coating.

.2 Fabricate unlined breechings from following minimum gauges. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.1 Sizes up to 300 mm: 1.2 mm (18 gauge)

.2 Sizes 325 to 600 mm: 1.6 mm (16 gauge)
.3 Sizes 625 to 900 mm: 2.0 mm (14 gauge)
.4 Sizes 925 to 1500 mm: 2.6 mm. (12 gauge)
.5 Sizes over 1500 mm: 3.3 mm. (10 gauge)

.3 Fabricate lined breechings from 2.6mm (12 gauge) sheet, all sizes. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.4 Weld longitudinal seams. Fabricate joints by welding, lapping and bolting, or with companion flanges. For breechings less than 600 mm diameter provide groove seam (pipe lock or flat lock) with end joints beaded and crimped.

.5 Reinforce rectangular breeching with angle frames and round breeching with flanged girth joints or angle frames. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible.
.1 Sizes up to 750 mm: No reinforcing required.
.2 Sizes 780 to 900 mm: 40 x 40 x 5 mm, at 1500 mm centres.
.3 Sizes 925 to 1500 mm: 50 x 50 x 6 mm, at 1500 mm centres.
.4 Sizes over 1500 mm: 75 x 75 x 12 mm, at 1500 mm centres.

.6 Fabricate breeching fittings to match adjoining breechings. Fabricate elbows with centre-line radius equal to breeching width. Limit angular tapers to 20 degrees maximum.

2.2 TYPE B DOUBLE WALL GAS VENTS

.1 Fabrication: Inner pipe of sheet aluminum, and outer pipe of galvanized sheet steel, tested in compliance with UL 441.

2.3 DOUBLE WALL METAL STACKS (TYPE A)

.1 Provide double wall metal stacks, tested to UL 103 and cUL listed, for use with building heating equipment, in compliance with NFPA 211.

.2 Fabricate with 25 mm minimum air space between walls. Construct inner jacket of 0.9 mm ASTM A167 Type 304 stainless steel. Construct outer jacket of aluminum coated steel 0.6 mm for sizes 250 mm to 600 mm and 0.9 mm for sizes 700 mm to 1200 mm.

2.4 ACCESSORIES

.1 Accessories shall be cUL labeled:

.2 Ventilated Roof Thimble: Consists of roof penetration, vent flashing with spacers and storm collar.

.3 Exit Cone: Consists of inner cone, and outer jacket, to increase stack exit velocity 1.5 times.

.4 Stack Cap (Rain Cap): Consists of conical rainshield with inverted cone for partial rain protection with low flow resistance.

.5 Cleanouts: bolted, gasketted type, full size of breeching. Provide cleanout doors of same gauge as breeching, where required by code, specified or indicated on Drawings.

.6 Barometric dampers: Provide adjustable self-actuating barometric draft dampers, where indicated or required by equipment manufacturer, full size of breeching.

.7 Expansion sleeves with heat resistant caulking, held in place as indicated.

.8 Breeching Gaskets: High temperature fibre glass.

2.5 VENTS FOR CONDENSING OR NEAR CONDENSING APPLIANCES

.1 Material: AL-29-4C or Polypropylene

.2 Class: to suit appliance.

.3 Venting must be rated for use with maximum flue gas temperature of appliance at appliances minimum efficiency.

2.6 POLYPROYLENE VENTING

.1 Polypropylene venting to be rated for use with Category II and Category IV appliances and Type BH gas venting systems.

.2 System to be certified for operating flue gas temperature of 110 Deg.C (230 Deg.F) per ULC-S636 and CE certified for sustained flue gases up to 120 Deg.C (248 Deg.F).

.3 Vent system shall be suitable for service pressure up to 5000 Pa (20" w.c.).

.4 Vent System shall have zero clearance to combustibles.

.5 Manufacturer to provide a 10 year limited warranty on vent system.

.6 Vent System shall be rated for use with appliance being vented.

3 Execution

3.1 FABRICATION

.1 Fabricate chimneys with baseplate, anchors, cleanout, provision for support, expansion and contraction, tee-sections, flashing and counterflashing and raincap

3.2 APPLICATION

.1 Provide type B for atmospheric natural gas-fired equipment.

.2 Provide Type A for forced draft natural gas-fired equipment.

.3 Vent material for vents serving condensing or near condensing appliances shall be as specified for entire length.

3.3 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Install to NFPA 54 (ANSI Z223.1).

.3 Install breechings with minimum of joints. Align accurately at connections, with internal surfaces smooth.

.4 Support breechings from building structure, rigidly with suitable ties, braces, hangers and anchors to hold to shape and prevent buckling; minimum 1.5m (5') centres. Support vertical breechings, chimneys, and stacks at 4 m spacing, to adjacent structural surfaces, or at floor penetrations. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for equivalent duct support configuration and size.

.5 Install concrete inserts for support of breechings, chimneys, and stacks in coordination with formwork.

.6 Pitch breechings with positive slope up from fuel-fired equipment to chimney or stack. With the exception of required slope, chimney and stacks shall be level and plumb.

.7 Install vent dampers, locating close to draft hood collar, and secured to breeching.

.8 Coordinate installation of dampers, where required

.9 Insulate breechings to Section 23 05 50.

.10 At appliances, provide slip joints permitting removal of appliances without removal or dismantling of breechings, breeching insulation, chimneys, or stacks.

.11 Provide minimum length of breeching to connect appliance to chimney. Provide Type B chimney continuously from appliances.

.12 For Type B double wall gas vents, maintain cUL listed minimum clearances from combustibles. Assemble pipe and accessories as required for complete installation.

.13 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney. Pack annular space with heat resistant caulking.

.14 Install flashing and counter flashing on chimneys penetrating roofs and exterior walls, ensure penetration is sealed and moisture drains away from penetration.

.15 Install rain caps on outdoor terminations. For condensing appliances, if acceptable to the authority having jurisdiction and manufacturer, provide velocity discharge cone in lieu of rain cap.

.16 Clean breechings, chimneys, and stacks after installation, removing dust and debris.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Boilers.
.2 Controls and boiler trim.
.3 Hot water connections.
.4 Fuel connection.
.5 Collector, draft hood, and chimney connection.
.6 Collector, induced draft fan, and chimney connection.

1.2 REFERENCES

.1 AGA - Directory of Certified Appliances and Accessories.
.2 ANSI Z21.13/CSA 4.9
.3 ANSI/ASHRAE 15-1994, Section 8.13.6
.4 ASME SEC 4 - Boiler and Pressure Vessel Codes - Rules for Construction of Heating Boilers.
.5 ASME SEC 8D - Boilers and Pressure Vessel Codes - Rules for Construction of Pressure Vessels.
.6 HI (Hydronics Institute) - Testing and Rating Standard for Cast Iron and Steel Heating Boilers.
.7 NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
.8 NFPA 54 (AGA Z223.1) - National Fuel Gas Code.
.9 NFPA 58 - Liquified Petroleum Gas Code.
.10 UL - Gas and Oil Equipment Directory.

1.3 SUBMITTALS FOR REVIEW

.1 Product Data: Provide data indicating general assembly, components, controls, safety controls, and wiring diagrams with electrical characteristics and connection requirements.

.2 Submit manufacturer's installation instructions. Indicate assembly, support details, connection requirements, and include start-up instructions.

.3 Manufacturer's Field Reports: Indicate condition of equipment after start-up including control settings and performance chart of control system.

1.4 REGULATORY REQUIREMENTS

.1 Conform to applicable code for internal wiring of factory wired equipment.

.2 Conform to ASME SEC 4 and SEC 8D for boiler construction.

.3 Units: CSA Certified

.4 Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

.5 Comply with provincial regulations.

1.5 DELIVERY, STORAGE, AND PROTECTION

.1 Protect units before, during, and after installation from damage to casing by leaving factory shipping packaging in place until immediately prior to final acceptance.

1.6 WARRANTY

.1 The pressure vessel/heat exchanger of the boiler shall carry a 10 year prorated, limited warranty against failure due to condensate corrosion, thermal stress, mechanical defects or workmanship. A Warranty Certificate must be issued to the Owner from the manufacturer and a copy of warranty to be submitted for Departmental Representative's approval.

1.7 START-UP

.1 Provide start-up service, make adjustments and efficiency tests, and instruct operators. This is to include integration of boiler controls with Building Management System.

.2 Start-up to be performed by factory trained personnel who are approved by the manufacturer.

.3 Complete and submit copies of manufacturers start-up report for inclusion in Operating and Maintenance manual.

2 Products

2.1 MANUFACTURED UNITS

.1 Boiler modules shall be natural gas fired, condensing design with a modulating forced draft power burner and positive pressure vent discharge approved for use with a 30% propylene glycol / 70% water mixture circulating fluid.

.2 Each boiler shall be; UL Listed, CSD-1 approved, ASME coded and stamped, and incorporate a gas train designed in accordance with FM.

2.2 HEAT EXCHANGER

.1 The boiler shall be capable of handling return water temperatures down to 40 F without any failure due to thermal shock or fireside condensation.

.2 The heat exchangers shall be ASME stamped for a working pressure not less than 160 psig.

.3 The boiler water pressure drop shall *not exceed* 4.9 psig at the maximum flow rate.

.4 The boiler water connections shall be flanged 150 lb. ANSI rated.

.6 The boiler shall be designed so that the thermal efficiency increases as the boiler firing rate decreases.

.7 The heat exchangers shall be constructed of stainless steel.

2.3 FUEL BURNING SYSTEM

.1 The boiler burner shall be capable of a 10 to 1 turndown ratio of the firing rate without loss of combustion efficiency or staging of gas valves.

.2 The burner shall be metal fiber mesh covering a stainless steel body, with spark ignition and flame rectification.

.3 All burner material exposed to the combustion zone shall be of stainless steel construction.

.4 There shall be no moving parts within the burner itself.

.5 A modulating air/fuel valve shall meter the air and natural gas input. The modulating motor must be linked to both the gas valve body and air valve body with a single linkage. The linkage shall not require any field adjustment.

.6 A variable frequency drive (VFD) controlled cast aluminum pre-mix blower shall be utilized to ensure the optimum mixing of air & fuel between the air/fuel valve and the burner.

.7 The boiler(s) shall have a firing/leak test valve as required by CSD-1.

.8 The boiler(s) shall have dual-seated main gas valve.

.9 Gas control trains shall have a redundant safety shut-off feature, main gas regulation, shut-off cock and plugged pressure tapping to meet the requirements of ANSI Z21.13/CSA 4.9.

.10 The boiler(s) shall be equipped with a 100 percent safety shutdown.

.11 The ignition shall be Fully Interrupted Spark or Hot Surface Ignition type with full flame rectification by remote sensing separate from the ignition source, with a three-try-for-ignition sequence, to ensure consistent operation.

.12 The igniter will be located to the side of the heat exchanger to protect the device from condensation during start-up.

.13 The ignition control module shall include an LED that indicates six (6) individual diagnostic flash codes.

.14 An external viewing port shall be provided, permitting visual observation of burner operation.

2.4 EXHAUST MANIFOLD

.1 The exhaust manifold shall be of corrosion resistant cast aluminum with a 6"diameter flue connection.

.2 The exhaust manifold shall have a gravity drain for the elimination of the condensation with collecting reservoir.

2.5 TRIM

.1 The following safety controls shall be provided:
- .1 Limit temperature controller with automatic reset shall control burner to prevent boiler water temperature from exceeding safe system temperature.
- .2 35 PSIG ASME pressure relief valve, piped by the installer to an approved drain
- .3 Temperature and pressure gauge (shipped loose)
- .4 Low water cut-off with automatic reset and inlet flow switch to automatically prevent burner operation when water falls below safe level or there is no flow through boiler

.2 Provide boiler air vent tapping.

.3 Provide approved breeching and venting system to suit installation. Exact arrangement and lengths to be determined in conjunction with Mechanical Contractor and are to suit site conditions. Vent and combustion air pipe material to be as specified for condensing equipment.

2.6 CONTROLS

.1 Temperature Setpoint (4ma-20ma). Boiler shall include integral factory wired operating controls to control all operation and energy input of the boiler. The controller shall have the ability to vary boiler input throughout its full range to maximize the condensing capability of the boiler without header temperature swings.

.2 The boiler will operate to vary header temperature setpoint linearly as an externally applied 4 ma to 20 ma signal is supplied. Main header outlet temperature shall not be more than +/- 2 degrees C from setpoint at any pint of operation. The boiler shall have LCD display for monitoring of all sensors and interlocks. Refer to Controls Division 25 for operating parameters.

.3 Interlock boiler control and operation of associated boiler circulating pump.

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's written instructions and in compliance with all Local and Provincial Codes

.2 Install to NFPA 54 and CSA B139.1.

.3 Install boiler on concrete housekeeping base, sized minimum 100 mm larger than boiler base. Refer to Section 03 30 00.

.4 Provide connection of natural gas service to NFPA 54 (AGA Z223.1) and CSA B139.1.

.5 Provide piping connections and accessories as indicated; refer to Section 23 05 20.

.6 Pipe relief valves to nearest floor drain.

.7 Provide for connection to electrical service. Refer to Electrical.

.8 Boiler capacity, size and performance shall be as per Equipment Schedule

3.2 MANUFACTURER'S FIELD SERVICES

.1 Prepare and start systems with factory trained personnel.

.2 Test during operation and adjust if necessary:
1. Safeties
2. Operating Controls
3. Static and full load gas supply pressure
4. Gas manifold and blower air pressure
5. Amp draw of blower

.3 Submit copy of start-up report to Departmental Representative.

.4 Provide factory authorized service representative to train maintenance personnel on procedures and schedules related to start-up, shut-down, troubleshooting, servicing, and preventive maintenance.

END OF SECTION

1. General

1.1 WORK INCLUDED

.1 Packaged roof top heating/cooling units.
.2 Operating controls.
.3 Thermostat.
.4 Roof mounting frame.

1.2 REFERENCES

.1 AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
.2 AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
.3 AMCA 99 - Standards Handbook.
.4 AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
.5 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
.6 AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
.7 AMCA 500 - Method of Testing Louvres for Ratings.
.8 AMCA 5000 - Method of Testing Dampers for Ratings.
.9 ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
.10 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
.11 UL 900 - Air Filter Units.
.12 ASHRAE 90.1 Energy Code.
.13 ARI Standard 1060 - Rating Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment.
.14 NEMA MG1 - Motors and Generators.
.15 NFPA 70 - National Electrical Code.
.16 UL 723 - Test for Surface Burning Characteristics of Building Materials.
.17 UL 1995 - Standard for Heating and Cooling Equipment.
.18 UL 94 - Test for Flammability of Plastic Materials for Parts in Devices and Appliances.
.19 IBC 2000, 2003 - International Building Code.
.20 NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
.21 NFPA 5000 - Building Construction and Safety Code.
.22 ANSI/AHRI Standard 210/240

1.3 QUALITY ASSURANCE

.1 Meet the requirements of CSA, Provincial and Municipal Codes and be CSA listed.

.2 Test and rate cooling systems to ARI Standard 210.

.3 Units shall be products of manufacturers who provide local service personnel from factory representative, franchised dealer or certified maintenance service shop.

.4 Supply service of manufacturer's certified representative to supervise testing and charging of equipment, gas pressure, internal controls, and instruction on operation and maintenance to Owner. Provide written certification that all systems have been verified and tested.

.5 Packaged air-cooled condenser units shall be certified in accordance with ANSI/AHRI Standard 210/240 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment.

.6 Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

.7 Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.

.8 Unit Seasonal Energy Efficiency Ratio (SEER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.

.9 Unit shall be certified by ETL and ETL Canada listed. Unit nameplate shall include the ETL/ETL Canada label. The nameplate, safety labels and warnings will be in English and French.

.10 Refrigeration systems shall utilize an HFC refrigerant only. Refer to schedule.

.11 Unit shall be certified in accordance with ANSI Z21.47b/CSA 2.3b and ANSI Z83.8/CSA 2.6, Safety Standard Gas-Fired Furnaces.

.12 Unit Seasonal Energy Efficiency Ratio (SEER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings

1.4 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

.3 Product Data:
- .1 Provide literature which indicates dimensions, weights, capacities, ratings, fan performance, gauges and finishes of materials, and electrical characteristics and connection requirements.
- .2 Provide data of filter media, filter performance data, filter assembly, and filter frames.
- .3 Provide fan curves with specified operating point clearly plotted and fan efficiencies.
- .4 Submit sound power level data for both fan outlet and casing radiation at rated capacity.
- .5 Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

.4 Manufacturer's Installation Instructions.

1.5 EXTENDED WARRANTY

.1 Provide 5 year unconditional parts warranty on compressor unit.

.2 Provide 3 year unconditional parts warranty on electric heating coils

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.7 EXTRA MATERIALS

.1 Provide one set of spare fan belts for each fan.

.2 Provide extra filter sets as indicated, refer to Section 23 41 00 - Particulate Air Filtration.

2. Products

2.1 PACKAGED ROOF TOP UNIT WITH 100% FRESH AIR (RTU-1 and RTU-2)

.1 Type:
- .1 Provide roof mounted type units with electric heat and electric refrigeration.
- .2 Packaged rooftop unit shall be self-contained and include compressors, evaporator coils, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, gas heaters, exhaust fans, energy recovery wheels, and unit controls.
- .3 Units shall have at minimum the following features:
  - .1 Variable capacity compressor with 10-100% capacity control
  - .2 Direct drive supply fans
  - .3 Double wall cabinet construction insulated with a minimum R-value of 13
  - .4 Stainless steel drain pans
  - .5 Hinged access doors with lockable handles
  - .6 All other provisions of the specifications must be satisfactorily addressed
- .4 Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket.
- .5 Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
- .6 Unit components shall be labeled, including refrigeration system components and electrical and controls components.
- .7 Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
- .8 Installation, Operation, and Maintenance manual shall be supplied within the unit.
- .9 Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.
- .10 Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

.2 Construction:
- .1 All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
- .2 Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610 deg.F.
- .3 Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.
- .4 Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 210/240. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
- .5 Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
- .6 Access to filters, dampers, cooling coils, heaters, exhaust fans, energy recovery wheels, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.

.7 Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
.8 Units with cooling coils shall include double sloped 304 stainless steel drain pans.
.9 Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.
.10 Unit shall include lifting lugs on the top of the unit.
.11 Manufacturer shall provide roof curb matched to unit with integral duct transition to facilitate side discharge/intake for both supply and exhaust airflow streams. Refer to drawings.

.3 Electrical:
.1 Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
.2 Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

.4 Supply Fans:
.1 Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
.2 Blowers and motors shall be dynamically balance and mounted on rubber isolators.
.3 Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
.4 Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency

.5 Exhaust Fans:
.1 Exhaust dampers shall be sized for 100% relief.
.2 Fans and motors shall be dynamically balanced.
.3 Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
.4 Access to exhaust fans shall be through double wall, hinged access doors with quarter turn lockable handles.
.5 Unit shall include belt driven, unhoused, backward curved, plenum exhaust fans.
.6 Fan motors shall be premium efficiency.

.6 Cooling Coils:
.1 Evaporator Coils
a) Coils shall be designed for use with an HFC refrigerant like R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
b) Coils shall be standard capacity.
c) Coils shall be hydrogen or helium leak tested.
d) Coils shall be furnished with factory installed expansion valves.

.7 Refrigeration System:
.1 Unit shall be factory charged with R-410A refrigerant.
.2 Compressors shall be scroll type with thermal overload protection and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.
.3 Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.

.4 Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.

.5 Each refrigeration circuit shall be equipped with expansion valve type refrigerant flow control.

.6 Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed replaceable core liquid line filter driers.

.7 Unit shall include a variable capacity scroll compressor on the refrigeration circuit which shall be capable of modulation from 10-100% of its capacity.

.8 First capacity stage shall be provided with on/off condenser fan cycling and adjustable compressor lockout to allow cooling operation down to 35 deg.F.

.8 Condensers:

.1 Air-Cooled Condenser

a) Condenser fans shall be a vertical discharge, axial flow, direct drive fans.

b) Coils shall be designed for use with R-410A refrigerant. Coils shall be multi-pass and fabricated from aluminum microchannel tubes or coils shall be constructed of copper tubes with aluminum (copper) fins mechanically bonded to the tubes and aluminum end casings. Fin design of copper tube coils shall be sine wave rippled.

c) Coils shall be designed for a minimum of 10 deg.F of refrigerant sub-cooling.

d) Coils shall be hydrogen or helium leak tested.

e) Condenser fans shall be high efficiency electrically commutated motor driven with multiple speeds which are controlled with a fan cycle switch based on head pressure and allow matching condenser airflow with cooling capacity steps.

.9 Gas Heating:

.1 Stainless steel heat exchanger furnace shall carry a 25 year non-prorated warranty, from the date of original equipment shipment from the factory.

.2 Gas furnace shall consist of stainless steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.

.3 Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.

.4 Unit shall include a single gas connection and have gas supply piping entrances in the unit base for through-the-curb gas piping and in the outside cabinet wall for across the roof gas piping.

.5 Natural gas furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation. Electronic controller includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjusted to suit space thermostat. Gas heating assemblies shall be capable of operating at any firing rate between 100% and 30% of their rated capacity.

.10 Filters:

.1 Unit shall include 4 inch thick, pleated panel filters with an ASHRAE efficiency of 95% and a MERV rating of 14, upstream of the cooling coil. Unit shall also include 2 inch thick, pleated panel pre filters with an ASHRAE efficiency of 30% and MERV rating of 8, upstream of the 4 inch standard filters.

.2 Units shall include a Magnehelic gauge mounted in the controls compartment.

.11 Energy Recovery:

.1 Unit shall contain a factory mounted and tested energy recovery wheel. The energy recovery wheel shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings. Frame shall slide out for service and removal from the cabinet.

.2 The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.

.3 Wheel shall be wound continuously with one flat and one structured layer in an ideal parallel plate geometry providing laminar flow and minimum pressure drop-to-efficiency ratios. The layers shall be effectively captured in stainless steel wheel frames or aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix.

.4 Wheel shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.

.5 All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.

.6 The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.

.7 Energy recovery wheel cassette shall carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard AAON limited parts warranty. The remaining period of the warranty shall be covered by Airxchange. The 5 year warranty applies to all parts and components of the cassette, with the exception of the motor, which shall carry an 18 month warranty. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the Airxchange written instructions for Installation, Operation, and Maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts. Refer to the Airxchange Energy Recovery Cassette Limited Warranty Certificate.

.8 Unit shall include 2 inch thick, pleated panel outside air filters with an ASHRAE efficiency of 30% and MERV rating of 8, upstream of the wheels.

.9 Hinged service access doors shall allow access to the wheel.

.10 Total energy recovery wheels shall be coated with silica gel desiccant permanently bonded by a process without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

.11 Unit shall include energy recovery wheel rotation detection sensors and a set of normally open and normally closed contracts for field indication of wheel rotation.

.12 Controls:

.1 Factory Installed and Factory Provided Controller

a) Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested. Controller shall be capable of stand alone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.

b) Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.

c) Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.

d) Constant Volume Controller:

a. Unit shall modulate cooling with constant airflow to meet space temperature cooling loads.

b. RTU-1: Unit shall modulate heating with constant airflow to meet space temperature heating loads. Modulating heating capacity shall modulate based on supply air temperature.

c. RTU-2: Unit shall modulate heating with constant airflow to meet discharge air temperature setpoint during heating loads. Modulating heating capacity shall modulate based on supply air temperature.

e) Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a LonWorks or BACnet network. [WattMaster Orion Controls System] but shall be commissioned in a standalone fashion at this time.

.13 Curbs:

.1 Curbs shall to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curb gasket shall be furnished within the control compartment of the rooftop unit to be mounted on the curb immediately before mounting of the rooftop unit.

.2 Knockdown curb (with duct support rails) shall be factory furnished for field assembly.

.3 Solid bottom curb shall be factory assembled and fully lined with 1 inch neoprene coated fiberglass insulation and include a wood nailer strip. (Curb shall be adjustable up to 3/4 inch per foot to allow for sloped roof applications.)

2.2 PACKAGED ROOF TOP UNIT WITH RETURN AIR (RTU-3, RTU-4, RTU-5 and RTU-6)

.1 Type:

.1 Provide roof mounted type units with electric heat and electric refrigeration.

.2 Units shall be self-contained, packaged, factory assembled and prewired consisting of a cabinet and frame, supply fan, heating coil, control, air filter, refrigerant cooling coil and compressor condenser coil and fan, and economizer.

.2 Construction:

.1 Cabinet: Heavy gauge steel with baked enamel finish, easily removed access doors or panels with quick fasteners, locking door handle type. Structural members shall be minimum 18 gauge, with removable panels minimum 20 gauge.

.2 Insulation: Foil faced non-hygroscopic glass fibre on surfaces where conditioned air is handled. Protect edges from erosion. Unit base to be fully insulated and insulation shall provide an air seal to the roof curb, eliminating the need to add a seal during installation.

.3 Electric Heat: Helix wound nichrome elements, individual element limit controls, wiring harness. Unit fuse block to be furnished as standard. Coil to have SCR Electric Heat Control to modulate small, precise increments of power to the electric heat load eliminating temperature fluctuations in the supplied air.

.4 Supply Fan: Centrifugal type direct drive, rubber isolated hinge mounted motor, statically and dynamically balanced. Complete fan assembly shall be isolated. Motor shall be variable speed ECM direct drive.

.5 Air Filters: 2" thick glass fibre disposable media in metal frames arranged for easy replacement, minimum MERV 13 rating.

.6 Intake extension kit: factory manufactured extension kit.

.3 Evaporator Coil:

.1 Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection, capillary tubes and expansion valve.

.2 Copper tube construction, enhanced rippled-edge aluminum fins, flared shoulder tubing connections, silver soldered construction for improved heat transfer. Cross row circuiting with rifled tubing to optimize both sensible and latent cooling capacity.

.3 Coil shall be factory leak tested.

.4 Plastic drain pan, sloped to meet drainage requirements of ASHRAE 62.1. Side or bottom drain connections. Reversible to allow connection at back of unit.

.5 Provide factory installed Drain Pan Overflow Switch to monitor condensate level in drain pan and shuts down unit if drain becomes clogged.

.4 Compressor:

.1 Provide hermetic or semi-hermetic two-stage scroll compressors, 3600 RPM maximum resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, service valves and filter drier.

.2 Timed off circuit shall limit number of compressor starts to 12 per hour.

.3 Outdoor thermostat shall energize compressor above 14 deg.C ambient.

.4 Provide step capacity control by cycling the compressors.

.5 Provide high pressure switch to protect compressor from overload conditions such as dirty condenser coils, blocked refrigerant flow, or loss of outdoor fan operation.

.6 Provide low Pressure Switch to protect compressor from low pressure conditions such as low refrigerant charge, or low/no airflow.

.7 Provide freezestat to protect the evaporator coil from damaging ice build-up due to conditions such as low/no airflow, or low refrigerant charge.

.5 Condenser (RTU-3 and RTU-5):

.1 Provide copper tube aluminum fin coil assembly with sub-cooling rows.

.2 Condenser coil shall be lightweight, all aluminum brazed fin construction. Constructed of three components: a flat extrusion tube, fins inbetween the flat extrusion tube and two refrigerant manifolds. Coil shall have face-split design.

.3 Mounting brackets with rubber inserts shall secure coil to unit providing vibration dampening and corrosion protection.

.4 Provide direct drive axial fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor.

.5 Motors shall be Variable speed (ECM) for energy efficient multistage air volume operation and quiet operation.

.6 Thermal overload protected, totally enclosed, permanently lubricated ball bearings, shaft up, wire basket mount.

.7 Provide PVC coated fan guard.

.8 Coil to be factory leak tested.

.6 Condenser (RTU-4):
- .1 Provide copper tube aluminum fin coil assembly with sub-cooling rows.
- .2 Copper tube construction, enhanced rippled-edge aluminum fins, flared shoulder tubing connections, silver soldered construction for improved heat transfer. Cross row circuiting with rifled tubing to optimize both sensible and latent cooling capacity
- .3 Mounting brackets with rubber inserts shall secure coil to unit providing vibration dampening and corrosion protection.
- .4 Provide direct drive axial fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor.
- .5 Motors shall be Variable speed (ECM) for energy efficient multistage air volume operation and quiet operation.
- .6 Thermal overload protected, totally enclosed, permanently lubricated sleave, shaft up, wire basket mount.
- .7 Provide PVC coated fan guard.
- .8 Coil to be factory leak tested.

.7 Supply/Return Casing:
- .1 Provide outside, return and relief dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper shall fall to closed position. Relief dampers may be gravity balanced.
- .2 Provide tight fitting dampers with neoprene or suitable edge gaskets. Dampers shall have nylon bearings.
- .3 Damper Operator (return and outside air): gear driven, 24 Volt, fully modulating spring return with motor and gear train sealed in oil.
- .4 Mixed Air Controls: Shall use outdoor air and return air sensors that are furnished with the unit. The Unit Controller shall compare outdoor air temperature and return air and using setpoints, enable the economizer when the outdoor air temperature is below the configured setpoint and cooler than return air. Lock out compressor below approximately 14 deg.C ambient. Ensure dampers modulate to provide minimum ventilation when not free cooling.
- .5 Provide barometric relief damper and exhaust hood with unit for field installation.

.8 Operating Controls:
- .1 Unit Controller shall be microprocessor-based control board that provides flexible control of all unit functions and is supplied by unit manufacturer.
- .2 Unit controller shall have the following features:
  - .1 Scrolling Display - Scrolls full text instead of numerical codes.
  - .2 Push Buttons - Simplified navigation during setup and diagnostics.
  - .3 Guided Setup Procedure - Insures proper installation and setup of the rooftop unit.
  - .4 Profile setup - Copy key setpoints between units with the same configuration greatly reducing setup time.
  - .5 USB Port - Easily download and transfer unit information via a USB flash drive and also interface with Manufacturer Software.
  - .6 Self Test Mode - Confirm proper component and system operation.
  - .7 Time Clock with Run-time Information
- .3 Unit controller shall have the following built in functions:
  - .1 Built-In Functions Include: Adjustable Blower On/Off Delay
  - .2 Built-in Control Parameter Defaults
  - .3 Compressor Time-Off Delay
  - .4 DDC Compatible but shall be commissioned as standalone system.
  - .5 Dirty Filter Switch Input
  - .6 Discharge Air Temperature Control
  - .7 Display/Sensor Readout
  - .8 Economizer Control – Differential Sensible Control
  - .9 Fresh Air Tempering

.10 Extensive Unit Diagnostics - minimum 100 diagnostic and status messages in English.
.11 Fresh air damper position control to maintain minimum fresh air.
.12 Permanent Diagnostic Code Storage
.13 Field Changeable Control Setpoints.
.14 Minimum Compressor Run Time
.15 Network Capable - Can be daisy chained to other units or controls.
.16 Return Air Temperature Limit Control
.17 Safety Switch Input - Allows Controller to respond to an external safety switch trip.
.18 Service Relay Output
.19 Staging – as required to meet sequence.
.20 Thermostat Bounce Delay
.21 LED Indicators
.22 PC Interface - For use with PC with optional Unit Controller software.
.23 Zone Sensor Operation - Controls zone temperature.
.24 Factory installed blower proving switch to shut down if blower fails.
.25 Factory installed dirty filter switch to indicate when filters are loaded.
.26 Fresh air tempering, to modulate heating coil to maintain discharge air temperature setpoint in heating mode.

.4 Heating control to include following features:
.1 Zero-Cross (fast cycling) feature to improve electric heater life with less contraction and expansion of the heating elements.
.2 SCR air tempering shall be controlled by a secondary thermostat and remote duct sensor, supplied with unit, field installed.
.3 SCR shall maintain discharge air temperature when there is no call for heat.
.4 A call for heat shall modulate heating to meet space requirements.
.5 A call for cooling (including economizer) shall override the SCR to prevent heating and cooling at same time.

.5 Unit to be complete with low voltage, adjustable thermostat shall control heat, compressor and condenser fan and supply fan to maintain temperature setting. Thermostat shall have the following features:
.1 Two stage Heating / Two-Stage Cooling
.2 Intuitive Touchscreen Interface
.3 Seven-Day Programmable
.4 Four Time Periods Per Day
.5 Economizer Output
.6 Backlit Display
.7 Automatic Changeover
.8 20K temperature sensor.

.9 Electrical:
.1 Circuit Breakers: HACR type. For overload and short circuit protection. Factory wired and mounted in the power entry panel. Current sensitive and temperature activated. Manual reset.
.2 Phase/Voltage Detection (3 Phase models only). Phase detection monitors power supply to assure phase is correct at unit start-up. If phase is incorrect, the unit will not start and an alarm code is reported to the unit controller. Protects unit from being started with incorrect phasing. Voltage detection monitors power supply voltage to assure proper voltage. If voltage is not correct (over/under voltage conditions) the unit will not start and an alarm code is reported to the unit controller.
.3 Disconnect Switch: factory installed accessible from outside of unit, spring loaded weatherproof cover furnished.
.4 GFI Service Outlets (2), 115V ground fault circuit interrupter (GFCI) type, non-powered, fieldwired.

.5 Field Installed: GFI Weatherproof Cover Single-gang cover. Heavy-duty UV-resistant polycarbonate case construction. Hinged base cover with gasket.

3. Execution

3.1 INSTALLATION

.1 Mount units on factory built roof mounting frame providing water-tight enclosure to protect ductwork and utility services.

.2 Installing contractor shall install unit, including field installed components, in accordance with manufacturers' Installation, Operation, and Maintenance manual instructions.

.3 Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit. A factory representative shall start up unit and provide start-up report.

.4 Install to ARI 435.

.5 Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

.6 Fabricate to provide smooth air flow through components. Limit air leakage to 1% of rated air flow at 2.5 kPa suction pressure.

.7 Remove all internal hold-down bolts and shipping fasteners and install any parts which were shipped loose. Level spring isolators.

.8 Check and re-align all access doors and dampers to ensure smooth operating through the entire range of travel.

.9 Upon start-up, each fan motor is to be checked for fan rotations, and amp draw for each phase. Amp readings are to be marked on the fan scroll and recorded in the Operation and Maintenance Manual.

.10 All belt drives are to be re-adjusted for tension and alignment.

.11 Provide a drain valve on each coil drain fitting and a vent valve on each coil vent.

.12 All pipe and conduit penetrations to the casing are to be thoroughly sealed and caulked to prevent air leakage.

.13 All floor penetrations are to be thoroughly sealed to ensure the water tightness and integrity of the entire floor.

.14 The Contractor shall provide certified wiring schematics to the electrical division for the equipment and controls.

.15 The Controls Contractor shall provide all necessary field control wiring as recommended by the manufacturer.

3.2 PERFORMANCE

.1 See Equipment Schedule.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Mechanical louvers; intakes; vents; and reinforcement and bracing for air vents, intakes and gooseneck hoods.
- .2 Sustainable requirements for construction and verification.

1.2 SECTION INCLUDES

.1 Packaged air conditioning units.

1.3 SUBMITTALS

.1 Submit shop drawings to requirements of Section 01 33 00.
.2 Indicate water, drain, electrical, and duct rough-in connections.
.3 Submit manufacturer's installation instructions to Section 01 33 00.
.4 Provide detailed wiring diagram and complete description of controls.

1.4 SUBMITTALS FOR INFORMATION

.1 Sections 01 33 00 and 01 78 00: Submission procedures.

.2 Manufacturer's Certificate: Certify that specified products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Section 01 33 00: Submission procedures.

1.6 OPERATION AND MAINTENANCE DATA

.1 Submit operation and maintenance data to requirements of Section 01 78 00.

.2 Include manufacturer’s descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

1.7 WARRANTY

.1 Provide a 5 year warranty to Section 01 78 00 and CCDC 2 General Conditions.

.2 Warranty: Include coverage of refrigerant compressors.

2 Products

2.1 DEDICATED ROOM AIR CONDITIONING UNITS

.1 Integrated package: to CAN/CSA-C656.

.2 System type:
- .1 Air flow arrangement: as noted on equipment schedule

.2 Cooling: direct expansion.
.3 Condensing: air cooled.

.3 Cooling capacity, with fan heat extracted: based on environment of 22 degrees C dry bulb and 50% R.H. (plus or minus 1 degree C and 5% R.H.), with minimum supply air temperature of 14 degrees C.

.4 Unit capacity: as indicated:

.5 Cabinet:
.1 Wall mounted, welded steel, unit construction, corrosion protected, 20 mm thick acoustic insulation, factory baked on external finish aesthetically compatible with typical computer and peripheral cabinets. Colour selected by Department Representative.
.2 Cabinet to house: cooling coil, fans, filters, unit environmental control system, motor starters or contactors and electrical disconnect switch.
.3 Provide adequate access to components for servicing.
.4 Corrosion protected welded structural steel floor stand having adjustable feet and locking device on corners, vibration isolators and compatible with raised floor system.
.5 Fans: DWDI centrifugal, statically and dynamically balanced, direct drive, with self-aligning, permanently lubricated, 100,000 hours minimum life ball or roller bearings.
.6 Fan Motors: Drip-proof permanently lubricated bearings for continuous duty, 40 degrees C maximum rise and variable pitch sheaves on belt driven systems.
.7 Provide hail guards over fins.

.6 Compressors:
.1 Semi hermetic type, minimum 2 required, with:
.1 Vibration isolators.
.2 Adjustable high and low pressure switches.
.3 Anti-slug device.
.4 Motor overload and over temperature protection pump down controls.
.5 Crank case heater.
.6 Compressor lead/lag switch.
.7 Refrigerant service valves.
.8 Capacity controls (variable speed compressor)

.7 Condenser:
.1 Outdoor Air cooled: free standing, welded steel unit construction, corrosion protected.
.1 Circuited to provide separate refrigerant circuit for each compressor/evaporator combination.
.2 Aluminum fins, mechanically bonded to copper tubes, tested to 3.1 MPa.
.3 Propeller or centrifugal type fans. Direct drive.
.4 Electrical and control components housed in weather-tight access panels with electrical disconnect switch and control cable for control interconnection and designed for year round operation.
.5 Vibration isolation: providing at least 95% isolation efficiency.
.6 Capacity: to heat rejection capacity of 35 degrees C.
.7 Variable speed compressor for capacity control.

.8 Filters:
- .1 Prefilters: Cleanable.
- .2 Mounting: in corrosion resistant racks with service access.

.9 Refrigerant Piping, Valves, Fittings, and Accessories within unit
- .1 To CSA B52.
- .2 Include for each refrigerant circuit:
  - .1 Thermal expansion valve, external equalizing type.
  - .2 Combination filter-dryer.
  - .3 Solenoid valves.
  - .4 Liquid sight glass with moisture indicator.
  - .5 Suction line insulation: flexible elastomeric unicellar to ASTM C547, 25 mm minimum thickness.
  - .6 Liquid refrigerant receiver.

.10 Environmental Controls
- .1 Solid state electronic control system.
- .2 Front mounted operating panel with visual display.
- .3 Panel to include following:
  - .1 Manual operation and adjustment:
    - .1 On-Off air conditioning system control.
    - .2 Room temperature set point, indicator and sensitivity adjustment controller.
    - .3 Alarm silencing switch for each alarm point.
    - .4 Alarm circuits test switch.
  - .2 Operational: Visual and Audible Alarm:
    - .1 Loss of air flow.
    - .2 Loss of liquid flow.
    - .3 High room temperature.
    - .4 Low room temperature.
    - .5 High head pressure.

.11 Refrigerant Charge
- .1 Charge refrigerant system at factory, seal and test.
- .2 Holding charge of refrigerant applied at factory.

.12 Capacity and Line Sizing
- .1 Manufacturer and Mechanical Contractor shall ensure that system will operate at capacities indicated in equipment schedule despite distance from condensing units to indoor units and elevation change.
- .2 Contractor shall ensure refrigerant liquid and suction lines are sized in accordance with manufacturer’s requirements for elevation change and distance between indoor and outdoor unit.
- .3 Pipe distance as indicated on drawings.

3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's installation instructions. Refer to Section 23 23 00 for qualifications of installer.

.2 Coordinate installation of units with architectural, mechanical, and electrical work.

.3 Provide initial start-up and shut-down during first year of operation, including routine servicing and check-out.

.4 Mount condensing units at ground level in courtyard. Mount on raised metal stand to ensure minimum of 610mm clearance above ground with stand on concrete pads as indicated by Architect. Mechanical to provide stand.

.5 Supply units fully charged with refrigerant and filled with oil.

.6 Provide shut-off valves in condenser water inlet and outlet piping.

.7 Pipe drain pan condensate to nearest floor drain or mop sink as indicated on drawings.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Finned tube radiation.
.3 Unit heaters.
.4 Cabinet unit heaters.

1.2 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Procedures for submittals.

.2 Product Data: Provide typical catalogue of information including arrangements.

.3 Shop Drawings:
- .1 Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
- .2 Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
- .3 Indicate mechanical and electrical service locations and requirements.,

1.3 OPERATION AND MAINTENANCE DATA

.1 Section 01 78 00: Submittals for project closeout.

.2 Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.4 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience who issues complete catalogue data on such products.

1.5 REGULATORY REQUIREMENTS

.1 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2 Products

2.1 PERFORMANCE

.1 Unit performance and capacity shall be as scheduled on equipment schedule.

.2 Electrical characteristics shall be as scheduled.

2.2 FINNED TUBE RADIATION

.1 Heating Elements: 32 mm ID seamless copper tubing, 3mm (1/8") minimum wall thickness mechanically expanded into evenly spaced aluminum fins sized 100 x 100 mm, suitable for soldered fittings.

.2 Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

.3 Enclosures: 1.2 mm (18 gauge) steel up to 450 mm (18") in height, 1.5 mm (16 gauge) steel over 450 mm (18") in height, with easily jointed components for wall to wall installation. Support rigidly, on wall mounted brackets at 900 mm (36") centres maximum.

.4 Enclosure Finish: Factory applied electrostatic enamel baked finish, color as selected by Architect..

.5 Damper: Where not thermostatically controlled, provide knob-operated internal damper at enclosure air outlet.

.6 Access Doors: For otherwise inaccessible valves, provide factory-made permanently hinged access doors, 150 x 175 mm minimum size, integral with cabinet.

2.3 UNIT HEATERS

.1 Coils: Seamless copper tubing, 0.6 mm (.025") minimum wall thickness, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

.2 Casing: 1.2 mm (18 gauge) steel with threaded pipe connections for hanger rods.

.3 Finish: Factory applied baked primer coat unless specifically noted otherwise in equipment schedule.

.4 Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.

.5 Air Outlet: Adjustable pattern diffuser on projection models and two way louvres on horizontal throw models.

.6 Motor: Permanently lubricated sleeve bearings on horizontal models, grease lubricated ball bearings on vertical models.

2.4 CABINET UNIT HEATERS

.1 Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes, designed for maximum operating limits of 1380 kPa and 104 degrees C (200 psi and 220 deg.F.)

.2 Cabinet: 1.5 mm (16 gauge) steel with exposed corners and edges rounded, easily removed panels, glass fibre insulation and integral air outlet.

.3 Finish: Factory applied baked primer coat on visible surfaces of enclosure or cabinet.

.4 Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.

.5 Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.

.6 Motor Speed Control: 4 position speed switch factory wired and CSA approved. Located in cabinet where accessible. Provide key operated wall mounted switch where inaccessible

.7 Filter: Easily removed 25 mm thick glass fibre throw-away type, located to filter air before coil.

3 Execution

3.1 PREPARATION

.1 Verify that electric power is available and of the correct characteristics (voltage and phase) prior to ordering pump.

3.2 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.

.3 Protection: Provide finished cabinet units with protective covers during balance of construction.

.4 Maintain sufficient clearance to permit performance of service maintenance.

.5 Check final location with Consultant if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow Consultant's directive.

3.3 HYDRONIC UNITS

.1 Provide with shut-off valve on supply and balancing valve complete with isolation on return piping. Refer to drawings for balancing valve type.

.2 If balancing valve is not indicated, valve shall match type indicated for similar equipment.

.3 Provide each unit at high points with easily accessible manual air vent. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing. For fan-coil units and unit heaters provide float operated automatic air vents with stop valve.

.4 For inaccessible valves, provide factory-made permanently hinged access doors, 150 mm x 175 mm (6" x 7") minimum size, integral with cabinet.

.5 Installation of radiant ceiling panel system to be in strict accordance with manufacturer's instructions and to be supervised by local supplier. Hanger wires shall be installed at minimum 1200 mm O.C., or as recommended by the manufacturer.

.6 Finned Tube Radiation: Locate on outside walls and run cover wall-to-wall unless otherwise indicated. Centre elements under windows. Where multiple windows occur over units, divide element into equal segments centred under each window. Install wall angles where units butt against walls.

.7 Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

.8 Cabinet Unit Heaters: Install as indicated. Coordinate to assure correct recess size for recessed units.

3.4 CLEANING

.1 After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

.2 Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials provided by manufacturer.

.3 Install new filters.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Section covers items common to Sections of Electrical Contractor. This section supplements requirements of Division 00 – Procurement and Contracting Requirements, Division 01 – General Requirements, Division 02 – Existing Conditions.

.2 Provide complete and fully operational electrical systems with facilities and services to meet requirements described herein, as shown on the drawings, and in complete accord with applicable codes and ordinances.

.3 Only those items that are specifically indicated as not in contract (N.I.C.) will be omitted.

.4 Contract documents of Divisions 26, 27, and 28 are diagrammatic and approximately to scale, unless detailed otherwise. They establish scope, material and installation quality, and are not detailed installation instructions.

.5 Follow manufacturers' recommended installation details and procedures for equipment supplemented by details given herein and on plans subject to approval of the Consultant.

.6 Examine all drawings to ensure that work under this Division can be properly installed without interference.

.7 Where discrepancies, ambiguities, obvious omissions or errors have been made in drawings and specifications, it shall be the responsibility of the contractor to clarify same prior to tender closing. No allowance will be made after contract award for any expense incurred by him for having to adjust his work to properly conform.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 CODES AND STANDARDS

.1 The electrical installation shall comply with all SaskPower requirements and regulations.

.2 In the event of any inspection authority requesting deviation from the design, notify the Consultant and obtain approval before proceeding with any change.

.3 In no instance, shall the standard established by the drawings and specification be reduced by any code or ordinance. All references to codes and standards shall be to the latest edition.

1.4 CARE, OPERATION AND START-UP

.1 Instruct operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Connect to equipment furnished in other Divisions and by Owner including start-up and test.

.3 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.4 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.5 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235-83

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.6 PERMITS, FEES AND INSPECTION

.1 Submit to SaskPower necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Notify Consultant of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish Certificates of Acceptance from Electrical Inspection Department and authorities having jurisdiction on completion of work to Consultant.

1.7 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 All goods and materials shall be new and carry CSA approval seal. Equipment and material shall be CSA certified. Where there is no alternative to supplying equipment which is not

CSA certified, obtain special approval from the Consultant and the Electrical Inspection Department.

.3 All fire alarm equipment shall carry ULC approval seal.

.4 No deviation from specified materials shall be allowed, except where alternative materials have been specifically accepted in writing.

.5 Where materials are not directly specified by catalogue number and manufacturer's name, a high industry specification grade product shall be provided. The Consultant shall be the sole judge of whether this standard is being met.

.6 All references to known standard specifications shall mean and intend the latest edition of such specifications.

.7 Each major component of equipment shall have manufacturer's name, address, catalogue and serial number in a conspicuous place.

.8 Upon request, provide a complete list of all materials and their manufacture. The contractor will be required to use the materials indicated. Changes in manufactures at a future date will not be acceptable.

.9 Factory assemble panels and component assemblies.

1.8 WORKMANSHIP

.1 All work under this Division shall be executed in a workmanlike and substantial manner, neat in its mechanical appearance and arrangement.

.2 A competent representative shall constantly supervise the work of this Division from beginning to completion and final acceptance. So far as possible, the same supervisor and workmen shall be employed throughout the project's duration.

.3 Material and workmanship not meeting the standard intended and required by this specification shall, upon instruction from the Consultant, be properly replaced without further charge or consideration.

1.9 ELECTRICAL DRAWINGS

.1 They indicate the general location and route of conduit and cable to be installed. Conduit shall be installed in coordination with other services. These include both new and existing services. Prior to excavation anywhere on site, arrange to have all existing services marked. Where space is indicated for future equipment or plant use, leave space clear.

.2 Install equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment to the satisfaction of the Consultant at no extra cost.

.3 Ceiling and floor outlet symbols are scaled to centre line of symbol; symbol does not indicate the size or shape. Mounting height shall be measured to the lowest point on ceiling mounted equipments, and above finished surface for wall mounted equipment.

.4 Wall outlets are scaled to the perpendicular centre line of the symbol. Mounting heights for all wall mounted outlets shall be measured to the horizontal centre line.

.5 Where outlets are mounted in masonry walls, outlets should be mounted to the nearest coursing line.

1.10 WORK PROVIDED FOR OTHER DIVISIONS

.1 Provide information as to exact size and location of all required, housekeeping pads and roof curbs required for the installation of equipment of Divisions 26, 27, and 28.

.2 Provide information as to the location and exact size of all openings through floors and walls.

.3 Provide information as to the location and exact size of all equipment supports required within walls, and roof support structure.

.4 Provide electrical connections, circuit protection and disconnect devices for all equipment supplied by other Divisions, including the Owners. Provide motor starters, disconnect switches, thermal switches, etc., for motors supplied by mechanical contractor. Special control equipment being supplied by mechanical contractor shall be installed and wired by that contractor.

1.11 WORK PROVIDED BY OTHER DIVISIONS

.1 All housekeeping pads and curbs required for the installation of equipment of Divisions 26, 27, and 28.

.2 Installation and framing of all openings in walls or floors larger than 150 mm diameter, or rectangular, with one dimension greater than 150 mm.

.3 Openings in millwork for electrical outlets and conduits.

.4 Painting of all panelboard and communication panel trims to match colour scheme where exposed in finished areas.

.5 Firestopping shall be the responsibility of the General Contractor.

1.12 WORK NOT PROVIDED BY THIS DIVISION

.1 Control wiring for Mechanical Contractor equipment beyond terminal section of each motor control centre, unless specifically indicated otherwise.

.2 Other work as noted on drawings or specified herein.

1.13 COORDINATION WITH OTHER DIVISIONS

.1 Cooperate fully with the Consultant and other trades of electrically operated equipment to ensure proper arrangement of and provision for all electrical equipment.

.2 Where outlets or equipment may affect architectural or site treatment desired, contact Consultant and for instructions or detailed drawings.

.3 Refer to other Divisions including mechanical, millwork, kitchen equipment, owner supplied equipment, etc, for electrical work in connection with these drawings and specifications.

.4 Location of lighting outlets and receptacles in mechanical or equipment rooms and similar areas shall be finalized during construction to give optimum arrangement. The Consultant shall approve final location before installation.

.5 Supply and install all motor connections, including starters and overload protection and disconnecting devices at motors where required. All motor driven equipment shall be provided with a lockable disconnecting device within line of site of the motor to be disconnected.

.6 Supply and install complete wiring requirements for full voltage in-line devices on single phase equipment such as thermostats, multi-speed switches for unit heaters, force flows, cabinet heaters, etc.

.7 Cutting of openings for electrical outlets in millwork and other similar types of custom-made equipment shall be done by the supplier of this equipment.

.8 Check other Divisions to ensure that suitable provisions have been provided for all motors. It is possible that some motors may vary in size, numbers and characteristics, depending on the equipment manufacturer's specific requirements. Any variations in this regard will not constitute cause for further consideration. The mechanical coordination schedule supplied on the drawings shall be updated with nameplate specifications.

.9 Assume full responsibility for layout of this work and for any damage caused the Owner or other Divisions by improper location or carrying out of this work.

.10 Before commencing work, examine the work of other Divisions, and report at once any defects or interference affecting the work under this Division, or the guarantee of same.

.11 Location of lighting outlets and receptacles in mechanical or equipment rooms and similar areas shall be finalized during construction to give optimum arrangement. The Consultant shall approve final location before installation.

.12 Allow for all hoisting and setting of material and equipment.

1.14 OWNER SUPPLIED EQUIPMENT

.1 Connect all electrically operated equipment supplied by the Owner, as designated on the drawings.

.2 Reconnect all existing electrical services from new and existing electrical sources modified by the work of this contract.

1.15 INSPECTION AND TESTING

.1 During construction and up to final acceptance, make accessible any equipment or wiring for inspection purposes.

.2 All electrically operating equipment shall be left as a complete installation in perfect operating condition, and receive final test in the presence of the Consultant.

.3 Ensure that all power circuitry is properly tested and meets the CSA Ground Resistance Requirements. For any 600 volt systems, a 600 volt megger or hi-pot procedures shall be used for all such tests. Provide documentation for each test within maintenance/commissioning manuals.

.4 On the request of the Consultant, a staff supervisor shall be made available to assist in this inspection work.

.5 At the completion of the installation, voltage tests shall be conducted in the presence of the Consultant. Transformer taps shall be adjusted, and any other corrective measures implemented to assure the proper operation of all electrical equipment. Provide documentation for each test within maintenance/commissioning manuals.

.6 Acceptance tests and commissioning shall be conducted for systems and/or equipment where indicated in the specifications and other standards referenced herein. Acceptance tests shall include, but not be limited to, the following Sections.

.1 26 09 24 – Low Voltage Lighting Control Devices

.2 27 05 14 - Communication Cables Inside Buildings

.3 27 05 28 – Pathways for Communication Systems

.4 27 11 19 - Communications Termination Blocks and Patch Panels

.5 28 31 01 - Fire Alarm System

.7 Acceptance tests shall meet requirements as required by manufacturer, as outlined in ANSI – NETA 2007 and additional requirements described on drawings and specified herein. All tests shall be documented as per ANSI – NETA 2007 standards and shall include testing results, testing date, testing technician and representative present.

.8 Acceptance tests shall be made up of the following:

.1 Shop Drawing Information Sheets

.2 Manufacturer Commissioning and Report

.3 Manufacturer Test Reports, Factory and On Site where required

.4 Test Results not forming part of the Static Review Checks Sheets

.5 Owner / Consultant Demonstration Sheets

.6 Training

.9 Certification of all acceptance tests and commissioning shall be submitted to the Consultant for approval. Tests not conducted to the satisfaction of the Consultant shall be repeated, and no further costs will be considered. Written documentation bearing name and signature of Contractor, Consultant and Owner's personnel present during acceptance tests shall be included in certification reports. Provide for a minimum of six (6) hours across three (3) separate meetings with Consultant and Owner for review of acceptance test sheets.

1.16 SHOP DRAWINGS

.1 Submit shop drawings, where specifically called for, or as requested. Shop drawings shall show detailed dimensional and technical information, and shall properly describe each piece of equipment. Where applicable, shop drawings shall include complete schematics and wiring diagrams. These shop drawings shall be sufficiently detailed to permit the Owner's technicians to trouble-shoot and repair the equipment. Equipment shall not be ordered and/or fabricated until shop drawings have been reviewed by the Consultant. Shop Drawings shall include, but not be limited to the following Sections on systems and equipment:

.1 26 05 36 - Cable Trays
.2 26 23 00 – Low Voltage Switchboards
.3 26 24 17 - Panelboards Breaker Type
.4 26 27 26 - Wiring Devices
.5 26 28 14 - Fuses - Low Voltage
.6 26 28 21 - Moulded Case Circuit Breakers
.7 26 28 23 - Disconnect Switches - Fused and Non-Fused
.8 26 29 10 - Motor Starters
.9 26 50 00 – Lighting
.10 26 52 00 - Emergency Lighting
.11 26 53 00 - Exit Signs
.12 27 00 00 - Communication Requirements
.13 27 05 14 - Communications Cables Inside Buildings
.14 27 05 28 - Pathways for Communication Systems
.15 27 11 19 - Communications Termination Blocks and Patch Panels
.16 28 31 01 - Fire Alarm System

.2 Review of shop drawings shall be for general design, arrangement and appearance only. This Division shall check and correct, if necessary, all manufacturer's drawings before submitting, and shall so indicate on each copy, along with a dated approval stamp. All shop drawings must bear an approval stamp and be signed by the Contractor. This review does not relieve this Division from the responsibility for the final installation being correct in all detail, and fully acceptable to the Consultant. Refer to each section for further shop drawing information.

.3 Refer to General Conditions of the Contract.

.4 Provide nine (9) printed copies and one PDF copy for each Section. Each shop drawing shall be complete with a cover page with the following information:

.1 Specification Section and name
.2 Project name, Owner's name and address
.3 Number of pages in submittal
.4 Contractor and Supplier's name and contact information
.5 Approval stamps with room for Consultant's stamp

.5 Shop drawings for complementary systems and/or equipment shall be submitted at the same time. Partial submittals of related equipment will be rejected or held until all other related

shop drawing information has been submitted (i.e. submit all shop drawings for power equipment at the same time). Submittals of shop drawings that are incomplete will be rejected.

1.17 CHANGES

.1 Refer to General and Supplemental Conditions.

.2 Submit complete itemized breakdowns of all extras, deletions, and changes to the Consultant. Breakdown shall include quantities, unit costs and extensions. If requested, support claim by certified copies of supplier's invoices.

.3 The right is reserved to move equipment 3000 mm from location shown without further charge or consideration, provided that such re-location is requested prior to finish being applied.

1.18 CONSULTANT PRICES

.1 Electrical progress claims shall be made on Contractor Progress Report #ES110 provided by the Consultant. A copy of this Progress Report is attached for reference. The Electrical contract price shall be broken down into thirteen (13) parts to facilitate assessment of work done and material supplied. This progress claim shall be submitted simultaneously to the General Contractor and the Consultant, the latter case in duplicate. Refer to General Conditions.

.2 The breakdown shall indicate labour and material to the nearest dollar. Overhead, profit and job expense shall be apportioned to all parts. The breakdown shall be as follows:

.1 Main services
.2 Distribution/Panels
.3 Conduit and boxes
.4 Wire and cable
.5 Motor control
.6 Wiring devices
.7 Lighting fixtures and lamps
.8 Communications systems
.9 Security Systems
.10 Fire Alarm System
.11 Specials
.12 Miscellaneous - 8% maximum
.13 Extras and credits. (Extras in excess of $1,000 shall be broken down into the above points on a separate ES110 sheet)

1.19 OPERATING INSTRUCTIONS AND SERVICE MANUALS

.1 Upon completion of the installation, provide complete and comprehensive identical sets of operating and maintenance manuals.

.2 The Consultant shall review the operating and maintenance manuals and approve same prior to the manuals being sent to the Owner.

.3 The operating and maintenance manuals shall include but not be limited to the following information when applicable in the project:

.1 Certification reports.
.2 Documentation indicating Owner's receipt of operating instructions.
.3 Complete list of all materials turned over to the Owner c/w receipts for same.
.4 Shop drawings properly indexed and contained in suitably sized binders.
.5 Schematic drawings for all systems indexed and contained in suitably sized envelopes or attached efficiently in the above binders.
.6 Catalogue brochures for light fixtures, panelboards, switches, receptacles, fuses, etc.
.7 All final settings of equipment that has user adjustable settings.
.8 Overcurrent coordination and arc fault study and documentation of associated tests.
.9 Phase rotation confirmation by the Contractor.
.10 Certificate of Owner's training.
.11 Acceptance Testing and Commissioning reports.
.12 Listing of any spare devices turned over to Owner

The above information shall be bound in binders as noted in specifications. Incomplete or poorly reproduced manuals will be rejected.

.4 Maintain, on a daily basis, a complete set of marked-up prints as as-built drawings that show in complete detail the final arrangement and location of all electrical components and the interconnecting wiring.

.5 All riser conduits (size and routing), panel feeds (size and routing), conduit runs (size and routing) and main communications (size and routing) shall be marked on plans. These are to be maintained in a neat and substantial manner, so as to properly and fully illustrate the way in which the installation has been completed.

.6 All equipment locations such as fire alarm signal boosters, cable termination boxes, signal amplifiers, network switches, door controllers, etc shall be identified on the drawings as to their location and quantity (if more than one exists at that particular location).

.7 The Owner's personnel shall be instructed in the operation and maintenance of the following equipment to the satisfaction of the Owner as per the standards referenced herein.

Section No.	Description	Hours
26 09 24	Low Voltage Lighting Control	2
26 29 10	Motor Starters	1
26 50 00	Lighting	1
26 29 10	Motor Starters	1
26 52 00	Emergency Lighting	1
27 00 00	Communication Requirements	1
27 11 19	Communications Termination Blocks and Patch Panels	1
28 31 01	Fire Alarm System	2

.8 The above instructions shall be given by personnel experienced in the operation of the particular system or equipment. Each item or type of equipment, and all controls, shall be operated in the presence of the Owner's personnel to ensure their understanding of equipment function and individual working parts. The Owner reserves the right to set the period or periods during which the instruction shall be given. The contractor shall submit a program of instruction for approval by the Owner.

.9 Operating and maintenance manuals shall include written documentation bearing name and signature of Owner's personnel who received the above instructions. Contractor shall allow for all training to be completed in a minimum of two sessions. One session at substantial completion, and one session within three months of turning over the system.

.10 Operating and maintenance manuals, as well as all Owner instructions, shall be complete before substantial completion (as outlined by the Builders' Lien Act) will be considered. Also, preliminary maintenance manuals must be submitted prior to 70% completion. No further progress payments will be permitted until these preliminary maintenance manuals have been submitted and approved.

1.20 STORAGE AND PROTECTION

.1 Maintain and protect all work provided under this Division. Store all materials within a protected enclosure to prevent exposure to weather or construction dirt.

.2 Protect all finished and unfinished work of this and other divisions from damage during the course of construction. Cover floors and other surfaces, if necessary. Any damaged work or finishes shall be repaired or replaced without further charge to the Owner.

1.21 WARRANTY

.1 All materials and workmanship shall be guaranteed for a period of one year from date of substantial completion.

.2 Properly repair and replace all defective work and other work which becomes defective during the term of warranty.

.3 Service on equipment or systems critical to the Owner's operation shall be provided on an emergency basis which may necessitate overtime and service outside of normal working hours. The contractor shall ensure that all suppliers comply with this requirement.

1.22 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.2 Control wiring and conduit is provided by the Electrical Contractor except for conduit, wiring and connections below 50 V which are related to control systems specified in Mechanical Division and shown on mechanical drawings.

1.23 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint indoor switchboards and distribution enclosures light grey ASA 61.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.24 ABBREVIATIONS

.1 Abbreviations used in this specification are common to and in general use within the related trades.

1.25 EQUIPMENT IDENTIFICATION

.1 Nameplates shall be provided on each new piece of electrical equipment, including, power panels, distribution panels, lighting panels, transformers, disconnect switches, contactors, telephone panels, miscellaneous systems and panels.

.2 Nameplates for each new electrical panel shall indicate panel designation, mains voltage and panel and circuit number from which this panel is fed.

.3 Nameplates for new disconnects and contactors shall indicate equipment being controlled, and voltage.

.4 Nameplates for new terminal cabinets shall indicate system and voltage and load of area served.

.5 Nameplates for Normal Power Equipment shall be made from black-white-black Lamecoid with bevelled edges and white engraved letters. Nameplates shall be fastened with self tapping metal screws to equipment in a conspicuous location. Flush mounted panels shall have nameplate located on front of panel behind hinged door.

.6 Typical identification standards shall be used for new equipment throughout the project as follows:

.1 Lighting, receptacle and power panels shall each be identified with an engraved Lamecoid plate secured to top interior trim as:

Panel 202	10 mm high lettering
120/208 volts	6 mm high lettering
Fed from	6 mm high lettering

.2 Each panel shall be supplied with a directory card holder welded to inside of door, complete with a neatly typewritten list showing information as follows:

Panelboard name	202
Panel voltage	120/208 volts

Circuit Number	Description	Load
1	Room 200	1200W
2	Receptacles Room 200	6-15A
3	Room 220	1/3 H.P. Fan

Spaces and spares shall be left blank so as to facilitate future description. Also, existing panels where adjustments have been made in the circuitry shall be field checked in their entirety and new directory cards shall be provided.

.3 List shall be covered with a 1 mm thick clear plastic sheet to protect it.

.4 Other cabinets and plywood back boards for low voltage systems, such as signals and communications, shall be identified as panelboards with a directory showing circuit numbers and room locations, plus a blank for "Remarks", as well as a Lamecoid plate designation panel name.

EXAMPLE: if cabinet is for telephone

.....TP - 2nd floor

.5 Equipment not listed above, such as incoming service cables, communicating cables, switchgear, transformers, disconnects, motors, instruments, fire alarm and control panels, shall be identified in a similar manner, showing name and number of the equipment, voltage and load information.

.7 Feeder pull boxes and junction boxes shall be identified with waterproof ink, showing feeder or system concerned. Conduit entering junction boxes for communications systems shall be identified with the room number that each conduit serves.

.8 A small dab of paint shall be applied to inside of each outlet box, pull box and panel as it is installed, using colour code as follows:

Red	-	Fire Alarm System
Yellow	-	Security, Alarm Systems, Card Access
Green	-	Telephone/IT Computer Systems

The outside of the box shall also be identified in this way so as to readily determine the system within the conduit system. The cover of each junction box for branch circuits shall describe the voltage being used by means of a waterproof ink.

.9 No colour code is required for regular lighting and power circuits, but voltage class shall be displayed on all pull boxes and panels.

.10 Junction boxes in furred ceilings shall be colour identified on both inside and outside.

.11 Connections in equipment shall be made Phase 'A', 'B', 'C', from left to right when viewing wiring from front or accessible direction.

.12 Colour coding shall be carried through from incoming utility supply down to and including panels, and shall be as follows:

.1 Incoming utility service lines shall be identified by Red - Phase 'A'; Black - Phase 'B'; Blue - Phase 'C'; with colour coded PVC tape.

.2 Switchgear buswork in each switchboard and unit substation cubicle shall be banded with 3M tape identified in accordance with service lines colour coding. In addition, where neutral bus is introduced, it shall be banded white. Ground bus shall be banded green.

.3 Feeder and sub-feeder bus or conductors shall be banded as above.

.4 Lighting and power panels shall conform to the Canadian Electrical Code, and shall have main bus banded with tape as follows:

Red	-	Phase 'A'
Black	-	Phase 'B'
Blue	-	Phase 'C'
White	-	Neutral
Green	-	Ground

.13 Each cover plate shall have an engraved label or riveted Lamecoid approximately 8 mm x 30 mm, and contain the panel and circuit number in 4 mm high lettering. The cover plates for all receptacles designated on the drawings for housekeeping purposes shall also contain the wording “Housekeeping”. The cover plates for all receptacles fed from the ground fault interrupters shall also contain the wording “G.F.I.”

.14 The circuits controlled by all light switches shall be neatly printed with waterproof ink on the side of the switch outlet box so that the panel and circuit number are clearly legible when the coverplate is removed. It shall not be necessary to remove the switch from the outlet box in order to read the panel or circuit number.

1.26 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

.5 All data cables and data jumper cables (minimum 23 gauge), jacks and connector boots installed as part of this project used for Security Systems, whether CAT 6A or fibre optic, shall be BRIGHT GREEN in colour.

.6 All patch cables are to be stranded cable with RJ45 connectors. RJ45 connectors shall not be attached to solid conductor cable.

.7 All installed runs of CAT 6A cable are to be solid conductor cable and terminated into patch panels in equipment racks or faceplates in other locations.

.8 An installed cable is any cable that is run through a conduit, run from one area in a building to another area or any cable that travels farther than the adjacent equipment cabinet in a series of

cabinets. Note: Equipment cabinets must be abutting without side panels to open connection to be considered adjacent.

1.27 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

1.28 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.29 MANUFACTURERS AND CSA LABELS

.1 Visible and legible, after equipment is installed.

1.30 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Owner.

.2 Decal signs, minimum size 175 x 250 mm.

1.31 LOCATION OF OUTLETS

.1 Locate outlets in accordance with drawings and specifications.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and electrical on latch side of door.

1.32 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise or as noted on drawings.

.1 Local switches: 1200 mm.

.2 Wall receptacles:

.1 General: 450 mm.

.2 Above top of counters or counter splash backs: 150 mm.

.3 In mechanical rooms: 1400 mm.

.3 Fire alarm stations: 1200 mm.

.4 Fire alarm horn/strobe: 2100 mm.

1.33 LOAD BALANCE

.1 All lighting panels, distribution centres, motor control centres and main switchboards shall be load balanced such that the maximum variation between the two worst phases does not exceed 5%.

.2 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.3 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.4 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.34 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.4 All conduit and tray sealing shall be the responsibility of the Electrical Contractor.

.5 Wiring and cable shall be installed within EMT or conduit in all areas including the crawlspace. The electrical installation within the crawlspace shall be non-combustible.

1.35 TEMPORARY AND TRIAL USAGE

.1 Temporary and trial usage by the Owner, or the Contractor, of any of the electrical apparatus or equipment, or any work or materials supplied under this Division before final completion and written acceptance, is not to be construed as evidence of acceptance of same by the Owner.

.2 Temporary and trial usage may be made as soon as this Division deems the work sufficiently advanced for making a complete and thorough test of same, and that no claim may be made for the injury to or the breaking of any part of such work which may be so used, whether caused by weakness or inaccuracy of structural parts, or by defective material or workmanship of any kind.

.3 Lighting shall not be used for temporary or trial usage without prior approval of the owner and consultant sign off. If temporary lighting is required for the duration of the project, only construction lamps marked with a permanent ink on the lamp may be used. Evidence of marking will be requested by the consultant. Any fixtures used for temporary or trail usage

shall be relamped and cleaned. Evidence of cleaning and relamping will be required by the consultant.

1.36 EXCAVATION AND BACKFILL

.1 Any excavation and backfilling work that is necessary to accommodate the work under this Division shall be the responsibility of Divisions 26, 27, and 28, in accordance with the requirements of Division 31.

.2 Do not proceed with backfilling operations until completion of following:

.1 Departmental Representative has inspected and approved installations.
.2 Departmental Representative has inspected and approved of construction below finish grade.
.3 Inspection, testing, approval, and recording location of underground utilities.
.4 Removal of concrete formwork.

.3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.4 Do not use backfill material which is frozen or contains ice, snow or debris.

1.37 TEMPORARY LIGHT AND POWER

.1 The General Contractor shall be responsible for all temporary light and power provisions. Refer to General Conditions.

1.38 MATERIAL TO BE TURNED OVER TO THE OWNER

.1 All equipment that is being removed or replaced shall be stockpiled as per Owner's request. The owner may deem that the equipment shall be disposed. All disposal and removal is the responsibility of the contractor.

.2 Materials as indicated in various sections of this specification shall be turned over to the Owner. These materials shall include, but not be limited to the following:

.1 Obtain a signed receipt for each item turned over to the Owner. Include receipts in the operating and maintenance manuals.
.2 One set of three fuses for each fuse type and size for each switchboard distribution centre and motor control centre.
.3 One set of contacts and one holding coil for each size and type of FVNR motor starter.
.4 Spare lighting fixtures.
.5 Spare Fire Alarm Devices.
.6 Data patch cables.

1.39 SITE EXAMINATION AND REVIEW OF WORK

.1 It is recommended that the contractor visit the existing site during the tendering period to familiarize himself with the construction conditions and electrical work provided to date. The

contractor shall thoroughly satisfy himself that the work contained in these drawings and specifications can be carried out and that all costs have been included in the tender submitted.

.2 The Contractor shall review all sets of tender documents associated with the project to ensure that they have an idea as to the scope of work involved in the other trades and to assist with their coordination of required interface procedures and inter-connection requirements.

1.40 SITE WORK

.1 The electrical contractor shall be responsible for all necessary trenching and backfilling for all exterior work in connection with underground feeders. All trenches shall be a minimum 900 mm deep or to top of bedrock. Care must be exercised to ensure a proper grade line is used, and that suitable drainage has been provided.

.2 All excavated material shall be removed from the site.

.3 Trenches shall be filled with granular fill and compacted to 95% proctor. Prior to backfilling, all trenches must be inspected by the Consultant.

.4 Supply and install all cable and conduit in trenches, as described herein or detailed on the drawings.

.5 Electrical contractor shall be responsible for all concrete and reinforcing in connection with site lighting and car parking pedestals. All concrete and reinforcing on the project shall be in accordance with the quality required for reinforced concrete and reinforcing as specified under Division 3, and as detailed on the drawings.

1.41 CUTTING AND PATCHING

.1 Should any cutting or repairing of either unfinished or finished work be required, the contractor shall employ the particular trade whose work is involved, to do such cutting and patching, and shall pay for any resulting costs.

.2 All holes within buildings shall be fire stopped when penetrating a fire rated structure.

.3 Provide re-usable fire stopping sleeves for all locations where data/voice cables penetrate a fire rated structure.

1.42 PAINTING

.1 All iron or steel structures fabricated and installed by Divisions 26, 27, and 28 for supporting panels, starters, conduit or other equipment, shall be wire brushed and given one coat of lead chromate paint primer before being set into place. After all equipment is installed and piping complete, this iron work shall be given two coats of ASA #61 enamel to match the panel or structure being supported or in the colour specified for the product.

.2 All pull boxes, wireways, gutters, etc., fabricated for Divisions 26, 27, and 28, shall be given a coat of lead chromate primer and two coats of ASA #61 enamel before installation to match equipment finish.

.3 All panels and pull boxes that are set in finished walls or ceilings shall have approved flush covers that shall be prime coated with lead chromate paint, and left for the painting division to

paint in with the surrounding wall or ceiling finishes. Panel trims and pull box covers to be painted with the cover removed from the wall so that it can be easily installed or removed without damaging the surrounding paint finish.

.4 All electrical equipment shall be finished with an ASA #61 enamel, the colour of which shall be grey, unless otherwise specified.

.5 When installation is complete, all scratches and defects to the paint finishes shall be properly touched up, and where necessary, entire paint surfaces shall be re-done.

1.43 MATERIAL SAFETY DATA AND HAZARDOUS MATERIALS

.1 The Contractor shall provide material safety data sheets on all materials prior to shipping materials to site. These data sheets shall be submitted in triplicate to the Owner.

.2 The Contractor shall coordinate and provide necessary information for the Owner's "Work Place Hazardous Material Information System".

1.44 SCHEDULING OF WORK AND DEMOLITION

.1 Refer to Division 1 specifications.

.2 Refer to the overall project schedule for further scheduling requirements.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

CONTRACTOR PROGRESS REPORT ES110

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

#200–2222 ALBERT STREET – REGINA, SASK. S4P 2V2
Phone: (306) 569–1303 Fax: (306) 569–1307

ELECTRICAL PROGRESS CLAIM No. _____
DATE _____ 20 ____
PROJECT _____
ELECTRICAL CONTRACTOR _____
GENERAL CONTRACTOR _____
PRIME CONSULTANT _____
SUBMITTED BY _____

REVIEWED BY: _____
DATE: _____ 20 ____

RECOMMENDED PAYMENT AS SHOWN ☐ AS CORRECTED ☐ REJECTED ☐

* Cross out if not applicable	TOTAL CONTRACT		COMPLETE TO DATE		THIS PROGRESS	
	MATERIAL	LABOR	MATERIAL	LABOR	MATERIAL	LABOR
A. MAIN SERVICE *HV, Duct Bank, Transformers, Switchboards						
B. DISTRIBUTION / PANELS *Distribution Centres, Dry Type Transformers, Fuses						
C. CONDUIT AND BOXES *Tray						
D. WIRE AND CABLE *Bus Duct						
E. MOTOR CONTROL						
F. WIRING DEVICES *Dimmers, Pac Poles, Low Voltage Switching, Coverplates						
G. LIGHTING FIXTURES & LAMPS						
H. ALARM SYSTEMS *Fire, Security, Signal, Medical						
I. COMMUNICATIONS SYSTEMS *Intercom, Nurses' Call, Data/Telephones						
J. SPECIALS *Emergency Generator, Lightning Protection CCTV, UPS, Trench Duct						
K. MISCELLANEOUS – 8% Maximium						
L. EXTRAS & CREDITS (List price changes seperately, use separate sheet if necessary)						
TOTAL						

SUMMARY TOTAL			
	Contract $	To Date $	This Progress
	Contract GST $	To Date GST $	This Prog GST $
	Total Amount	Less Holdback	Less Holdback
		Net Amount	Net Amount

% COMPLETE _____

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 Audio Engineering Society (AES).

.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to device types, cable types, and special mounting details.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors #10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for round copper conductors.

.2 Clamp for round copper conductors.

.3 Stud clamp bolts.

.4 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

.4 Install bushing stud connectors in accordance with NEMA.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

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.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.3 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

Part 2 Products

2.1 BUILDING WIRES

.1 All conductors shall be copper, minimum No. 12 gauge, unless specifically noted otherwise.

.2 All conductors shall be rated for minimum 600V RW-90 XLPE. All conductor for motor feeds from variable frequency drives, shall be rated for minimum 1000V RW-90 XLPE. Wiring in channel back of fluorescent fixtures shall be 600 volt Type GTF or TEW. Size, grade of insulation, voltage and manufacturer's name shall be marked at regular intervals.

.3 All wiring shall be rated at 75 Deg C when connected to equipment rated 75 Deg C..

.4 Wiring for major feeders may be NUAL aluminum and shall be installed only where specifically noted on the drawings.

.5 Conductor utilized in conduit run under slab on grade or in conduit underground shall be Type 'RWU-90'.

.6 Wire shall be as manufactured by Nexans, Alcan, Pirelli, BICC General Wire or Superior Essex.

.7 The construction is manufactured using annealed (soft) copper conductors—compressed stranding for the stranded conductors; a 90°C rated thermoplastic polyvinyl chloride (PVC) insulation and a nylon jacket for the individual conductors; and a PVC jacket surrounding the overall construction.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600V to 1000V as noted above.

.4 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.5 Connectors:

.1 Watertight approved for TECK cable.

□

.6 Gasoline Dispensing Station:

.1 Watertight and Hazardous Location Rated (HL) approved for TECK cable.

.2 All Teck90 Cable shall be HL rated.

.3 Provide adequate protection and strain relief for cables between stub-up and devices.

.4 All cables shall include grounding conductor.

Part 3 Execution

3.1 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for the Intercom system for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Manufacture description sheet on each cable type

3.2 INSTALLATION OF WIRES

.1 Termination for #8 AWG and larger shall be by means of approved solderless connector lug. For parallel conductors, a common lug with separate termination for each conductor shall be employed.

.2 Conductor splices shall be made in accordance with specifications. Provide sufficient length for joint remake, and no less than 200 mm spare length. On through wiring, leave 300 mm loop.

.3 Wiring in cabinets, pull boxes, panels and junction boxes shall be neatly trained and held with nylon cable ties.

.4 Conductors shall be tag identified where passing through junction boxes.

.5 The use of BX cabling is required for connections to such equipment as furnace, water heater, etc.

.6 After installation of all cable, wrap connectors having exposed conductive surfaces with plastic electrical tape, applying enough servings to provide uniform covering not thinner than the insulation of the largest conductor connected and overlapping the insulation of each connected conductor by not less than 12mm.

3.3 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

.2 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - 0-1000V.

□

.3 All cables shall be terminated and spliced with suitable compression type connectors, as recommended by the cable manufacturer. The connectors shall satisfy the bonding and grounding requirements at the supply end.

.4 All cables shall be single conductor and copper, unless otherwise specified.

.5 All cable shall be rated for 600 volts (except for VFD output cable), insulated with cross-linked polyethylene and rated for operation at 90 degrees C. Cable shall have a FT4 rated outer jacket.

.6 All cable shall meet the CSA requirements for cold bend and impact testing at minus 40 degrees C.

.7 All cable shall be protected by a corrugated aluminum sheath or by interlocked aluminum armour.PVC jackets shall be required on all metallic sheathed cables.

.8 The jackets shall meet the FT6 flame spread requirements and be identified on the P.V.C. jacket.

.9 All cables shall be installed in accordance with the manufacturers recommendations, in suitable cable tray as specified within the specifications.

.10 The cables shall be terminated at the supply end on a non-ferrous metallic plate and at the load end on a non-metallic rigid fibre board plate. The cable sheaths shall be bonded at the supply end only.

.11 All cable installed in cable tray shall be installed at one diameter spacing.

.12 When single conductor cables are direct earth buried they shall be spaced 150 mm apart.

.13 Cables shall be manufactured by Nexans, Alcan, Superior Essex, General Wire or Pirelli.

3.4 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors 0-1000 V.

.3 Conductors: insulated, copper, size as indicated.

.4 Type: AC90 - Armour: interlocking type fabricated from aluminum strip.

.5 Type: ACWU90 - jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.

.6 Connectors: as required.

.7 Multi conductor cables shall be color coded during manufacture. Single conductor cables shall be color coded with adhesive colour coding tape. The tape shall be applied for a minimum of 75 mm at all terminations. Cables shall not be painted under any condition. Color coding shall be as follows:

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Phase 'A' - Red
Phase 'B' - Black
Phase 'C' – Blue
Neutral - White
Ground - Green or Bare

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

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.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to connectors used, specialty ground bars, etc.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 All ground rods shall be 20 mm diameter by 3000 mm long, copper clad.

.3 Plate electrodes: galvanized steel surface area 0.2 m2, minimum 6 mm thick.

.4 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.5 Insulated grounding conductors: green

.6 Ground bus: copper, complete with insulated supports, fastenings, connectors.

.7 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

- .1 Grounding and bonding bushings.
- .2 Protective type clamps.
- .3 Bolted type conductor connectors.
- .4 Thermit welded type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

.8 All ground conductors shall be bare or insulated, stranded, medium hard drawn copper wire. All insulated ground wires shall be green.

.9 Exposed copper shall be cleaned to a bright surface, and shall be finished with two coats of clean, insulating varnish.

.10 Connect ground conductor to copper water pipe at least twice (minimum 40 mm diameter), utilizing a Burndy Type GAR pipe clamp. Provide jumper across water meter.

.11 All connections to the ground bus or risers shall be thermowelded, or shall utilize the Burndy Hy-Ground compression connections. Clamp type connections shall only be allowed to individual pieces of equipment.

.12 Where bonds are covered with soil, the conductors are to be coated with anti-corrosion compound "Kopr-Shield" (Thomas & Betts Co.) before compression connector is applied. All bonding shall be done with 'C' tap and lug compression connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Electrical equipment and wiring shall be grounded in accordance with the Canadian Electrical Code, and local inspection authority's rules and regulations.

□

.2 All metallic raceways and conduits for communications, cable and conductors shall be grounded.

.3 All motors with flexible connections shall have separate ground wire run bridging the flexible connections. This ground wire shall be run from the motor back to the nearest junction box or motor control centre where the termination can be readily inspected. Insulation for this wire shall be green.

.4 Lay-in trays and feeder conduits shall be connected to the ground bus.

.5 All panel feeds (208 volt and 600 Volt) shall include a building network ground conductor.

.6 All grounding conductors outside the electrical rooms and closets shall be insulated and installed in conduits, unless otherwise noted.

.7 Install connectors in accordance with manufacturer's instructions.

.8 Protect exposed grounding conductors from mechanical injury.

.9 Use mechanical connectors for grounding connections to equipment provided with lugs.

.10 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.11 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.12 Structural steel and metal siding to ground by welding copper to steel.

.13 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections unless indicated otherwise.

.14 Use mechanical connectors for grounding connections to equipment provided with lugs.

.15 Soldered joints not permitted.

.16 Install separate ground conductor to outdoor lighting standards.

.17 Make grounding connections in radial configuration only. Avoid loop connections.

.18 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

.19 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.2 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary systems.

□

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, duct systems, frames of motors, starters, control panels, structure steel work, and distribution panels.

3.4 MAINTENANCE HOLES

.1 Install conveniently located grounding stud, electrode, size as indicated stranded copper conductor in each manhole.

.2 Install ground rod in each manhole so that top projects through bottom of manhole.

.3 Provide with lug to which grounding connection can be made. Confirm ground resistance meets or exceeds Canadian Electrical Code minimum requirements.

3.5 COMMUNICATION SYSTEMS

.1 Install grounding connections for all communication and security systems as per manufacturer’s recommendations

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Perform tests before energizing electrical system.

.3 All grounding conductors outside the electrical rooms and closets shall be insulated and installed in conduits, unless otherwise noted.

.4 Connections to equipment shall be made with, bronze or copper bolts and connectors.

.5 Equipment grounds shall be connected to the building grounding network. All non-current carrying metallic parts of equipment shall be connected to the ground network.

.6 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

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.2 Submit shop drawings in accordance with:

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.3 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

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.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended or set in poured concrete walls and ceilings.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to poured concrete with expandable inserts.

.2 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.3 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits, use channels spaced as required by C22.1.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

□

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for the Intercom system for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions

.2 Description of system operation

.3 Description of each subsystem operation

.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

.1 Sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

Part 3 Execution

3.1 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.2 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.2 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.3 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal / bix block where indicated in cabinets.

□

.4 Only main junction and pull boxes are indicated. Provide others as required by code. Install pull boxes so as not to exceed 30m of conduit run between pull boxes.

3.4 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase, Emergency, or Normal power.

3.5 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Provide blank cover plates for boxes without wiring devices.

.5 Provide combination boxes with barriers where outlets for more than one system are grouped.

.6 Each outlet box installed in steel stud and gyproc walls shall be mounted on Caddy #BHA, series SGB or TSGB screw gun brackets. Wood strapping with steel studs shall not be utilized for supporting outlet boxes

.7 Use condulets where 90° turn required on wall mounted conduit. They shall be of the type where cover screws do not enter the wire chamber and covers are left accessible.

.8 Each outlet box installed in acoustic tile ceilings shall be mounted on double Caddy "Tee Bar Hanger" #512 in such a manner that the outlet box will not twist in any direction.

.9 Where boxes are surface mounted in unfinished areas, such as furnace or boiler rooms, stamped galvanized steel 100 mm square box to accept #8300 series raised covers shall be used.

.10 Where surface wiring methods are allowed and approved in finished areas, use Hubbell or Wiremold boxes as per drawings c/w suitable adapter for wireway entrance.

.11 Outdoors or damp locations, boxes shall be cast Feraloy or aluminum type 'FS', with threaded hubs and vapourproof covers.

.12 Indoors, stamped zinc cadmium plated steel boxes shall be provided and set for each fixture, switch, wall receptacle or other types of outlets, adapted to suit its respective location and designed to accept its particular components.

.13 Standard octagon boxes shall be 100 mm diameter, 53 mm deep minimum. Increase depth where area fill requires. Equip each box used for fixture hanging with a fixture stud.

.14 Two gang or larger shall be solid type with raised cover for tile, block or gyproc finish.

.15 Wood strapping with steel studs shall not be utilized for supporting outlet boxes.

.16 Set boxes plumb and level within 6 mm of finished surface. Mats not permitted.

.17 Where required, provide voltage separation barriers.

□

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 Standard octagon boxes shall be 100 mm diameter, 53 mm deep minimum. Increase depth where area fill requires. Equip each box used for fixture hanging with a fixture stud.

.3 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 CONCRETE BOXES

.1 Electro-glavanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.4 CONDUIT BOXES

.1 Outdoors or damp locations, boxes shall be cast Feraloy or aluminum type 'FS', with threaded hubs and vapourproof covers.

.2 Indoors, stamped zinc cadmium plated steel boxes shall be provided and set for each fixture, switch, wall receptacle or other types of outlets, adapted to suit its respective location and designed to accept its particular components.

.3 Standard octagon boxes shall be 100 mm diameter, 53 mm deep minimum. Increase depth where area fill requires. Equip each box used for fixture hanging with a fixture stud.

.4 Two gang or larger shall be solid type with raised cover for tile, block or gyproc finish.

.5 Wood strapping with steel studs shall not be utilized for supporting outlet boxes.

.6 Set boxes plumb and level within 6 mm of finished surface. Mats not permitted.

.7 Where required, provide voltage separation barriers.

2.5 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

□

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.5 Outlet boxes shall be supported independently of conduit capable of supporting weight of fixture or other device. Conduit entering the back of a box shall not enter the centre knockout.

.6 For recessed fixtures in suspended ceilings, outlet box shall be accessible when fixture is removed.

.7 Flexible conduit to fixture shall be minimum 12 mm diameter, and shall not emanate from outlet box cover. Maximum length of flexible conduit from outlet box to fixture shall be 3000 mm. Outlet box for fixture shall not be located above ducts, pipes, etc. Outlet box shall be within 750 mm (vertically) of the fixture.

.8 Provide and set all special communications type back boxes associated with systems specified under Electrical Divisions.

.9 In placing outlets, allow for overhead pipes, ducts, etc., and for variation in wall and ceiling finishes, door and window trim, panelling, etc.

.10 Location of receptacle outlets in equipment rooms shall be finalized during construction to give optimum arrangement. Consultant to approve locations before installation.

.11 Multigang boxes shall have each gang fully barriered from the next, or multiple single gang boxes may be used, provided they are installed in a neat, orderly fashion. Barriers shall be steel and shall be firmly held in place.

Attention is directed to special outlet box locations for switches requiring wider mount spacing rejection feature.

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions

□

.2 Description of system operation

.3 Description of each subsystem operation

.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

Part 2 Products

2.1 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.2 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

.4 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3

.5 Conduit for use in corrosive atmospheres shall be rigid PVC or rigid steel with extruded PVC jacketed. Refer to drawings for areas requiring PVC.

.6 Condulets shall be of a type wherein cover screws do not enter the wire chamber.

.7 Flexible conduit connections to all mechanical equipment shall be of 'Sealtite' manufacture.

.8 Flexible conduit connectors shall be of the insulated throat type.

.9 Condulets with suitable covers shall be used where condulets are exposed. Each conduit fitting shall be of a type suitable to its particular use, and of a type which will allow installation of future conduits without blocking covers of existing condulets.

.10 Expansion joints shall be installed with ground jumper.

.11 All conduits shall be terminated with a suitable bushing.

.12 Flexible conduit and Rigid conduit entering boxes or enclosures shall be terminated with nylon insulated steel threaded bushings, grounded type.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1.5 m oc.

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit / raceway specified. Coating: same as conduit / raceway.

.2 Factory "ells" where 90º bends are required for 25 mm and larger conduits / raceways.

□

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conduits and cables shall be supported, at regular intervals, with corrosion resisting clamps. Lead anchors or expansion bolts shall be used to attach clamps to masonry walls.

.3 Conduit and cables shall be installed to avoid proximity to water and heating pipes. They shall not run within 150 mm of such pipes, except where crossings are unavoidable, in which case they shall be kept at least 25 mm from covering of pipe crossed.

.4 Cap ends of all conduits to prevent entrance of foreign matter during construction. Manufactured caps shall be employed.

.5 Conduit shall be installed as close to building structure as possible so that where concealed, necessary furring can be kept to a minimum.

.6 Empty conduits, installed under this Division but in which wiring will be installed by others, shall be swabbed out with "Jet Line" foam packs, and be c/w Polypropylene pull wire or polytwine.

.7 Conduits shall be installed at right angles or parallel to building lines, accurate in line and level.

.8 Conduit shall not be bent over sharp objects. Improperly formed bends and running threads will not be accepted. Bends and fittings shall not be used together. Proper supports of manufactured channels shall be provided where exposed conduits and cable runs are grouped.

.9 Under no condition will EMT be allowed exposed within 1200 mm of floor, outdoors, or in areas where explosive, corrosive or moist atmosphere exists.

.10 Not more than four (4) 90 degree bends or equivalent offsets will be permitted between pull boxes. When maximum number of bends are used, the total run between pull boxes shall not exceed 18000 mm.

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.11 PVC conduit shall not pass through a fire partition or floor separation. Where it is necessary for PVC conduits to pass through a fire barrier, a transition to rigid steel conduit shall be provided for 2000 mm on either side of the fire barrier.

.12 Surface mount conduits except where noted otherwise.

.13 Use rigid PVC conduit in corrosive areas or as indicated on plans.

.14 Use flexible metal conduit or Teck90 for connection to motors.

.15 Use liquid tight flexible metal conduit or Teck90 for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.16 Use explosion proof flexible connection for connection to explosion proof motors.

.17 Minimum conduit size for lighting and power circuits: 19 mm.

.18 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter. Mechanically bend steel conduit over 19 mm dia.

.19 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.20 Install pulltwine in all empty conduits / raceways and conduits / raceways that are less than 40% filled.

.21 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.22 Dry conduits out before installing wire.

.23 Conduits/Cabling/raceways are not to be run within concrete floors/ceilings. Any conduits/cabling/raceways required to be run along the concrete slabs shall be surface run and not recessed into the concrete. Any instances where cabling is required to be run vertically within concrete poured walls, coreline may be used as the raceway but it shall be transitioned to EMT or Rigid Steel (where required) with interfacing connectors or junction boxes being provided as required. This specification contains references to cast in place conduits. This is only applicable where specifically called for in certain locations within the documents.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

□

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.2 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.6 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

.3 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES AND CODES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2No.126-M91(R1997), Cable Tray Systems.

.2 National Electrical Manufacturers Association (NEMA) standards

.1 NEMA FG 1-1993, Fibreglass and Cable Tray Systems.

.2 NEMA VE 1-1998, Metal Cable Tray Systems.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with section 01 33 00 - Submittal Procedures.

.2 Identify types of cabletroughs used.

.3 Show actual cabletrough installation details and suspension system.

Part 2 Products

1.4 CABLETROUGH

.1 Cable trays shall be complete with necessary factory elbows, fittings, joiner plates, radius turns, supports, etc., as necessary for the total installation.

.2 Cable tray shall be provided for communications conductors where shown on the drawings. The cable tray shall be used for the running of data/voice communications cables, coax cable.

.3 The cable tray shall not be used for the running of low-voltage Class 2 control wiring.

.4 Cable tray indicated on the drawings for the purpose of running base building Data / communications conductors shall be a basket tray cable support system, electroplated welded wire-mesh, minimum of 50 x 100mm mesh size, 105mm deep, in standard 3048mm lengths. Tray width shall be 300mm unless otherwise noted on the drawings.

□

.5 Increase try size if necessary to accommodate cables and spacing specified on the drawings AND to meet the maximum fill requirements of 60% (the cable tray fill shall not be more than 60% at project completion).

.6 Where required, provide framed cable or conduit drops.

.7 Provide cable clamps or ties at 1000 mm intervals to maintain alignment of cable in tray.

.8 All hanger rods and supports shall be galvanized.

.9 Cable tray shall be manufactured by Cooper B-Line Systems, Cablofil, Canstrut, Code Manufacturing Ltd., or Thomas and Betts 'Express' Tray.

1.5 SUPPORTS

.1 Provide supports as required.

Part 3 Execution

1.6 INSTALLATION

.1 Install complete cabletrough system. The basket tray shall be run suspended from the LAN room's ceiling around the perimeter of the room in a 'U' or 'J' shape from where the cabling enters the room to directly above the equipment racks.

.2 The trays shall be installed at a minimum height of 2300mm A.F.F and a maximum of 2740mm A.F.F (measured from the bottom of the tray).

.3 Do not run tray within 300 mm of steam or hot water lines. Cable tray shall not be in contact of any sprinkler piping or laboratory gas lines.

.4 Cuts shall be filed smooth and treated with a galvanizing compound where cutting of certain sections is required.

.5 Cable tray shall be supported on 1500 mm centres, and shall be adequately braced to withstand loads due to pulling in of cables.

.6 Check routing and field dimensions to ensure there is absolutely no interference with work and equipment of other divisions.

.7 Cable tray shall be grounded every 15 meters with AWG #6 bare copper unless otherwise noted.

.8 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 CSAC22.2No.26, Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.

.3 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.4 National Electrical Manufacturers Association (NEMA).

.5 National Building Code 2010 (NBC 2010)

.6 National Fire Protection Association (NFPA)

.7 Institute of Electrical and Electronic Engineers (IEEE).

.8 Audio Engineering Society (AES).

.9 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

Part 2 Products

2.1 WIREWAYS

.1 Wireways and fittings: to CSA C22No.26.

.2 Sheet steel with hinged cover to give uninterrupted access with baked grey enamel finish

.3 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

Part 3 Execution

3.1 INSTALLATION

.1 Install wireways and auxiliary gutters.

.2 Keep number of elbows, offsets, connections to minimum.

.3 Install supports, elbows, tees, connectors, fittings.

.4 Install barriers where required.

.5 Install gutter to full length of equipment.

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.2 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts.

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END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 23 00 – Alternates.

.2 Section 26 05 01 - Common Work Results - Electrical.

.3 Section 26 27 26 - Wiring Devices.

.4 Section 26 50 00 - Lighting.

1.2 SYSTEM DESCRIPTION

.1 Provide occupancy sensors and photocell control as shown on the drawings and as described herein.

.2 Stand alone control system designed to provide switching of lighting zones by use of:

- .1 Low voltage power supplies
- .2 Low voltage relays
- .3 Line voltage wall switches (keyed where noted)
- .4 Low voltage occupancy sensors
- .5 Low voltage exterior discrete photocells
- .6 Low voltage interior discrete photocells

.3 The lighting control system shall control the building's exterior lighting as noted on the panel schematics and on drawings.

.4 Any low voltage relays required shall be mounted in surface enclosures adjacent the lighting electrical panels, as located on the floor plans.

.5 Individual rooms lighting shall be controlled only by low voltage sensors and line voltage switches located in that room.

.6 Common areas shall be controlled by local low voltage sensors with a master switch located in the staff office area.

.7 Photocell sensors and occupancy / vacancy sensors shall operate in a "slave" mode unless noted otherwise. Wall switches shall operate in "master" mode unless noted otherwise. That is, sensors shall operate only when the low voltage power supplies are energized. Refer to drawings.

1.3 PRODUCT DATA AND SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop drawings shall include a fully detailed description of the system, control schematics, wiring diagrams, component equipment and operating instructions. Component equipment shall include relay or contactor control panel, transformers and power supplies, rectifiers,

override switches, occupancy and photo-sensors, etc. Each component shall be identified as to the manufacturer, type, description and catalogue number.

.3 Provide labeling of system components with shop drawings.

1.4 CLOSEOUT SUBMITTALS

.1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

1.1 MATERIALS

.1 Low voltage class 2 wiring shall be #18 gauge copper with 30 volt insulation, type LVT, installed within conduit systems unless otherwise noted.

.2 All catalogue numbers shown are approximate and are intended to assist in providing the current features. Coordinate all catalogue numbers with the manufacturer to ensure a fully operable system. The catalogue numbers shown shall not reduce or amend the requirements of the specifications.

.3 All equipment shall be manufactured by Hubbell, Douglas Lighting Controls, Watt Stopper, Leviton or Sensor Switch.

1.2 DEVICES

.1 Relays shall be momentary-pulsed mechanically latching contactors with plug in connector. Relays shall have mechanically latching contacts with single moving part design.

.2 Contacts of low voltage relays and power supplies shall be rated at 20 amp tungsten, 120/277 volt rated for ballast loads. Coils shall be mechanically held, momentary coil activation, operate on 24 volt, 60 Hz. Relays shall be equipped with pilot light switch operation. Provide for each relay, a varistor between line and neutral.

.3 Next to each relay mounted in the low voltage panel shall be an individual override button and a bi-colour LED to indicate status.

.4 Power Supply Units: The power supply units shall provide 24 volt DC power to the control devices and have a control feedback from these devices to control its dry contact. Input voltage for the power supply shall be 120 volt or 347 volt AC, depending on the load. The power supplies shall include internal over-current protection, and voltage spike protection. Power supply relay contacts shall be rated at 20A. In cases where multiple loads are fed from a single power supply unit, power supply unit shall have a secondary 120V relay.

.5 Wall Switch/ occupancy / vacancy Sensors: shall be specification grade passive infrared (PIR) or Dual Technology, wall sensor switch, ivory finish. Manual ON/OFF switch with automatic time delay off operation (adjustable from 30 seconds to 30 minutes) set at 5 minutes after momentary occupancy. Adjustable PIR unit sensitivity from 20% to 100%. Coverage limited to 180° field of view, 900 square feet, rated for minimum 800 watt for fluorescent ballast load at 120-volt. Wall occupancy / vacancy sensor switch shall be compatible with all electronic

fluorescent non-dimming ballasts and shall mount in a standard 120-volt single gang switch box.

.6 Occupancy / vacancy Sensors: Provide where indicated and as described on lighting plans. The sensor shall be easy to adjust with a 5-minute time delay setting (adjustable from 30 seconds to 20 minutes), LED status indicator and push button programmable. Occupancy sensors shall be white in finish. Provide two (2) devices not shown on drawings of each type for Owner stockpile. See drawings for type of occupancy sensors required.

- OC – wall switch decorator sensor, line voltage, dual technology.
- OC1 – passive dual technology, 360 degree sensor, standard range, ceiling mounted, low voltage.
- OC2 – passive dual technology, 360 degree sensor, extended range, ceiling mounted, low voltage.

.7 Interior Photocell (Discrete): Provide where indicated on the lighting plans, indoor day-light sensors for applications that harvest daylight by 50/100% control of the designated lighting circuit or designated lighting fixtures. The sensor shall switch the ballast to 100% when natural light is insufficient and step down to 50% when the sufficient. The sensors shall be ceiling mounted and shall measure light reflected upward from the surface below. The sensor shall be easy to adjust with a range setting and a set-point at the device. The day-light sensor shall have an adjustable dead-band and 5-minute time delay setting so that cycling effects can be eliminated, adjustable setpoints 100 – 2000 lux, and adjustable time delay 3 seconds to 5 minutes, LED status indicator. Provide two (1) devices not shown on drawings for Owner stockpile.

.8 Outdoor photocells: Surface exterior wall mounted with weatherproof plate, range between 10 – 160 lux. Photocells may be installed with one exterior fixture to control the remained of that zone.

Part 3 Execution

1.3 INSTALLATION

.1 All low voltage wiring shall be installed in conduit. Confirm with the manufacturer of this system all wiring and cable requirements.

.2 Switches shall be ganged where more than one occurs in the same location.

.3 All relays and switches shall be tested after installation to confirm proper operation, and all connected loads shall be recorded on the relay schedule for each panel.

.4 Refer to manufacturer's literature for typical methods of installation and connection of components. The contractor shall be responsible for coordinating the actual components and equipment utilized so as to provide a fully operational and reliable system.

.5 Locate and install equipment in accordance with manufacturer's recommendations and as indicated.

1.4 IDENTIFICATION AND DOCUMENTATION

.1 Provide unique identification for all low voltage control devices and power supplies.

.2 Each low voltage wire shall be labelled clearly indicating which device the cable is connected to. Use only proper colour coded, stranded #18 AWG, or as recommended by the manufacturer.

.3 Labelling shall be applied to ganged switches to identify the areas the switches control.

.4 Include in the Electrical Operating Manuals, the system installation and operating manuals for the lighting control system, including the installation and operation of each unique configuration.

1.5 SYSTEM START-UP AND TRAINING

.1 Provide trained factory authorized technician to confirm proper installation, programming and operation of the system.

.2 Perform tests described herein and in accordance with Section 26 05 01 – Common Work Results – Electrical and Electrical Commissioning Specifications.

.3 Actuate control units in the presence of Engineer to demonstrate lighting circuits are controlled as designated.

.4 The Owner's operating and maintenance personnel shall be instructed in the operation and maintenance of the lighting control system by a trained factory authorized technician. The minimum training period shall be (4) six hours of instruction. Training shall be completed in two parts. The first training shall be four hours and shall be completed prior to substantial completion. The second training session shall be two months following completion to ensure owner understands system and requirements. Written documentation bearing name and signature of Owner's personnel who received the above instruction shall be included in the operating Electrical Operating and Maintenance manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 CAN/CSA-C22.2 No.31-M89(R2000), Switchboard Assemblies.
.3 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.4 National Electrical Manufacturers Association (NEMA).
.5 National Building Code 2010 (NBC 2010)
.6 National Fire Protection Association (NFPA)
.7 Institute of Electrical and Electronic Engineers (IEEE).
.8 Audio Engineering Society (AES).
.9 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to layout, devices installed, withstand ratings, lug and torque tables, Time-current characteristic curves for circuit breakers and fuses, and special mounting details.

.3 Submit shop drawings for review prior to fabrication of equipment. The following drawings of the switchboard shall be provided prior to commencing manufacture:

.1 Channel base plan
.2 Single line diagrams showing necessary details of electrical components and connections.
.3 Elevation plan and section views with dimensions and all component details.
.4 Weight of complete structure, size and weight of each shipping section, and manufacturer's data sheets of all major components.
.5 Complete wiring schematics.

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.4 Include schematic, wiring and interconnection diagrams, which shall include component identification.

.5 Each component shall be identified as to manufacturer, type, description, and catalogue number.

.6 Drawing details show all stations, control modules, cabling and field terminations.

.7 Include a statement of warranty hardware from the manufacturer.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for secondary switchboard for incorporation into manual in accordance with Section 01 78 00 - Closeout Submittals.

.2 3 copies maintenance data for complete switchboard assembly including components.

1.2 STORAGE AND PROTECTION

.1 Store switchboard on site in protected, dry location. Cover with plastic to keep off dust.

1.3 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Include:

.1 3 sets of Type L fuses for each type above 600 A.

.2 6 sets of Type J fuses for each type up to and including 600 A.

Part 2 Products

2.1 MATERIALS

.1 Switchboard assembly: to CAN/CSA-C22.2 No.31.

.2 Size, arrangement and extent of equipment shall be as shown on the drawings.

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.3 Switchboard construction shall consist of a 3 mm sheet steel enclosure dead front, self-supporting unit.

.4 Phasing shall conform to CSA and CEMA standards. Colour code all three phases on main bus and on the load terminals of all feeders.

.5 Re-arrangement of components will not be permitted. Equipment shall be constructed to fit space allocated and shall be mounted on a concrete pad. Arrangement and space allocation as shown on drawings shall be maintained, unless an alternate method, suggested by the contractor under this Division and the successful manufacturer, is approved in writing by the Consultant.

.6 Equipment shall be designed, factory assembled and tested in accordance with latest applicable CEMA and CSA standards.

.7 Equipment shall be complete with required Arc Flash warning labels as required by CEC and this specification.

.8 All switchboard enclosures including covers and lids shall be made with 3mm. (#12 gauge) steel.

2.2 RATING

.1 Secondary switchboard: indoor, voltage as shown on drawing, ampacity as shown on drawings, 3 phase, 4 wire, 60 hz, minimum short circuit capacity 22 ka (rms symmetrical) for 120/208V.

2.3 ENCLOSURE

.1 Distribution sections to contain:

.2 Fusible disconnects sized as indicated.

.3 Main bus work, extending through every section, shall be tin plated copper rated as shown on the drawings, and shall be full size throughout length of switchboard.

.4 Copper ground bus 6 mm x 50 mm, bolted to the structure and extending the full length of the switchboards. Cable clamps shall be provided at convenient locations for making the station ground connection.

.5 Blanked off spaces for future units.

.6 Switchboard shall be fitted with two permanent channels, minimum 100 mm across the bottom of each section, to permit rolling or jacking of board. A permanent channel or angle shall also be provided across top of each section substantial enough to carry weight of section for hoisting purposes. Two other channels, minimum 150 mm width, shall be provided by switchboard manufacturer along with floor plan, and shall be grouted into floor for levelling purposes. Floor channels shall run full length of board, and shall line up with 100 mm channel on switchboard.

.7 All panelboard enclosures shall be 2300 mm high. All unused panel spaces shall be made available for future switch fuse units.

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.8 Provide sprinkler guards on top of all switchboards. All conduit entering top of switchboards shall be c/w water tight connectors. Seal all conduit connectors with silicone based caulking to provide a degree of water tightness in the event of a sprinkler system failure.

.9 The entire enclosure shall be cleaned and phosphated, then painted with one coat of alkyd type primer, and one coat of low gloss light grey (ASA 61) baked on polyester powder coat.

.10 Before leaving the factory, switchboards shall be touched up to present a smooth, even, clean finish inside and outside. Interiors shall be cleaned of debris and dirt. Before shipment, movable components shall be carefully blocked.

.11 The switchboard shall be completely assembled, wired, adjusted and tested at the factory. After assembly, the complete switchboard will be tested for operation under simulated service conditions to ensure the accuracy of the wiring and the functioning of the equipment.

.12 All switchboards shall be manufactured by General Electric, Eaton, Siemens or Schneider Electric

2.4 BUSBARS

.1 Three phase and full capacity neutral, insulated busbars, continuous current rating as noted on drawing, self-cooled, extending full width of cubicle(s), suitably supported on insulators.

.2 Main connections between bus and major switching components to have continuous current rating to match major switching components.

.3 Busbars and main connections: Tin Plated Copper

.4 Provision for extension of bus on both sides of unit without need for further drilling or preparation in field.

.5 Tin plated joints, secured with non-corrosive bolts and Belleville washers.

.6 Identify phases of busbars by suitable marking.

.7 Busbar connectors, when switchboard shipped in more than one section.

.8 Bus section shall house interconnecting bus, instrument transformers, connections to incoming feeders and control wiring.

.9 Main bus work, extending through every section, shall be rated as shown on drawings, and shall be full size throughout length of switchboard.

.10 Where space has been provided for future switches or air circuit breakers on the drawings, bus and stationary elements shall be provided to facilitate future additions.

2.5 GROUNDING

.1 Lugs at each end for size #3/0 AWG grounding cable.

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.2 Copper ground bus 6 mm x 50 mm shall be provided at bottom, bolted to the structure and extending the full length of the switchboards.

.3 Cable clamps shall be provided at convenient locations for making the station ground connection.

2.6 FUSIBLE DISCONNECTS AND FUSES

.1 As per Specification Section 26 28 23 Disconnect Switches – Fused and Non Fused

2.7 INSTRUMENTS

.1 Refer to Section 26 09 02 – Metering and Switchboard Instruments.

2.8 FINISHES

.1 The entire enclosure shall be cleaned and phosphated, then painted with one coat of alkyd type primer, and one coat of low gloss light grey (ASA 61) baked on polyester powder coat.

2.9 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Lamecoid nameplates, approximately 75 mm x 25 mm, shall be provided on front doors of each switch for identification, showing the name and rating. Also, a 150 mm x 50 mm nameplate shall be provided on top portion of switchboard for identification.

.3 Lamecoid nameplates shall be Black with white lettering for Normal Power switchboards.

Part 3 Execution

3.1 INSTALLATION

.1 Locate switchboard assembly as indicated and bolt to floor.

.2 Check factory made connections for mechanical security and electrical continuity.

.3 Size and weight of the sections into which the assembly shall be divided for shipment to ensure that they can easily be moved into or out of the electrical room, as shown on the drawings.

.4 The ground bus shall be connected to the ground network. Refer to specifications and the drawings for full grounding requirements.

.5 All switchboards shall carry the required arc flash warning labels.

.6 Service on equipment or systems critical to the Owner's operation shall be provided on an emergency basis which may necessitate overtime and service outside of normal working hours.

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.7 Set on 100 mm high concrete housekeeping pad.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 CSA C22.2No.29-M1989(R2000), Panelboards and enclosed Panelboards.
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

.3 Include time-current characteristic curves for breakers with ampacity of 50 A and over or with interrupting capacity of 18,000 A symmetrical (rms) or greater.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval,

as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 PANELBOARDS

.1 All panels shall be of the dead front, molded case circuit breaker type, as shown, sized and located on the drawings.

.2 Panel trim shall be furnished for flush or surface mounting as indicated on the drawings. Panel trim shall be removed for painting, and allowed to dry before final placement.

.3 Surface mounted panels shall have manufacturer's standard trim, and shall be finished with two coats of grey ASA #61.

.4 Panels shall be equipped with a flush type combination lock-latch. Two keys shall be provided for each panel, and all locks shall be keyed alike.

.5 Panels shall have mains of voltage and capacity and shall be complete with branch breakers, spares and spaces, as shown on the drawings. "Spaces" shall be understood to include necessary bus work such that Owners, at a later date, need buy only breakers.

.6 Panelboards: to CSA C22.2No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.7 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.8 Each panel shall be complete with a typed directory, which shall be mounted inside the door in a metal frame with clear plastic cover.

.9 Flush panels shall have concealed hinges and flush type combination lock-latch. Doors shall open minimum 135 degrees. Trims shall have fasteners concealed.

.10 Cabinets shall be fabricated of code gauge steel, with ample wiring gutters for all wiring connections.

.11 All panels shall have main bus bar equipped with solderless lug and be capable of accepting any arrangement of single, two or three pole breakers.

.12 Branch circuit breaker shall have quick-make, quick-break toggle mechanism with single, two or three pole common trip thermal magnetic units in ampere ratings as designated on the drawings. Breaker handles shall have three positions: 'on', 'off' and 'tripped'. All circuit breakers and panel bus shall have an interrupting capacity of 10,000 amps symmetrical.

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.13 Panels for 120/208 volt, 3 phase, 4 wire systems, shall be complete with bolt-in type breakers, with a minimum nominal width of 20 mm per pole, and a bus of sufficient capacity to feed the number of branch circuit breakers indicated.

.14 All panels shall be specification grade and of the same manufacture. Load centres are not acceptable.

.15 All branch circuit spaces shall be fitted with filler plates.

.16 All panels serving bedrooms shall be equipped with arc fault circuit interrupters where shown on the drawings.

.17 Each panel shall be equipped with a ground bus suitable for terminating one ground conductor per load circuit.

.18 Panels shall be General Electric, Siemens, Eaton or Schneider Electric.

.19 Refer to attached breaker panel schematic detail sheets attached at the end of this specification section.

2.2 BREAKERS

.1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

.2 Lock-on devices for fire alarm circuits.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results – Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on painted plywood backboards. Where practical, group panelboards on common backboard.

.3 Electrical panels shall, where possible, be mounted with top of trim at uniform height of 2000 mm.

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.4 Panels, shown adjacent to other panels, shall have adjacent edges of different panels mounted parallel to each other with a gap of 75 mm.

.5 For panels recessed in a finished wall, provide for every six branch circuit spaces and spares, or fractions thereof, one 20 mm empty conduit up to furred ceiling space, and one (1) 20 mm empty conduit down to ceiling space of floor below, and cap for future wiring.

.6 Connect neutral conductors to common neutral bus.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
.8 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
.9 CSA-C22.2 No.55, Special Use Switches.
.10 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

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.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 SWITCHES

.1 15 A, 120 V, single pole, three-way switches where required on drawings.

.2 Manually-operated general purpose ac switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.
.2 Silver alloy contacts.
.3 Urea or melamine molding for parts subject to carbon tracking.
.4 Suitable for back and side wiring.
.5 Ivory toggle.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps.

.4 All wiring devices specified shall be of the same manufacture throughout the project.

.5 Switches controlling motors shall be K.W. (H.P.) rated and approved for motor control service.

.6 Set switches flush in all finished areas, or in surface box where conduit or wireway is exposed.

.7 Refer to drawing symbol schedule for further requirements.

.8 Switches and receptacles shall comply with requirements of CSA and NEMA Standards.

.9 Switches shall be specification grade from one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

.1 White high impact chemical resistant molded nylon or polycarbonate face.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.
.6 Specification grade from one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 White high impact chemical resistant molded nylon or polycarbonate face.
.2 Suitable for No. 10 AWG for back and side wiring.

□

.3 Four back wired entrances, 2 side wiring screws.

.4 Specification grade from one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Set receptacles flush in all finished areas, or in surface box where conduit or wireway is exposed

.6 Provide ten (10) 20 amp and ten (10) 15 amp specification grade receptacles c/w installation, 10 meters of wire and required raceway, etc for each of these receptacles so that they may be installed where required during the construction and commissioning stages of this project. .

2.3 SPECIAL WIRING DEVICES

.1 **Ground Fault Circuit Interrupter** - shall have a nylon face and a thermoplastic backbody. They must have a feed-through capability for protecting receptacles downstream on the same circuit. They must be Class A rated with a 5 milliampere ground fault trip level and a 20 ampere feed through rating. GFCI receptacles shall have 'Safe Lock' protection such if critical components are damaged and ground fault protection is lost, power to the receptacle is disconnected. GFCI receptacles shall be equipped with LED trip indicator light, NEMA configuration 5-15R, side wired and one of the following manufacturers: Cooper #XGF15-V, Leviton #8599-I or Pass & Seymour #1594-I, Hubbell 'Autoguard' GFR Series

.2 **Pilot Light Switches** - shall be quiet specification grade and rated 15A, 120 volts, back and side wiring with toggle lit red in the "ON" position, accepting up to #10 copper conductor and of one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

.3 **Fractional HP/KW Manual Starters** - to be non-reversing, toggle operated, suitable for mounting in a surface or flush box, single or two pole to suit 120 or 208 volt application, c/w pilot light and thermal overload to adequately protect motor. Flush mount to have stainless steel or ivory cover plates to match other flush mount wiring devices. To be of one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

.4 **Illuminated Switches** - shall be quiet specification grade, 120 volts, back and side wiring with toggle lit in the "OFF" position, accepting up to #10 copper conductor and of one of the following: Cooper, Leviton, Hubbell or Pass & Seymour.

.5 **Wall Occupancy / Vacancy Sensor Switch, 120-Volt:** Wall occupancy / vacancy sensor switches shall be specification grade passive infrared (PIR) or dual technology (PIR/Microphonics) wall sensor switch, white finish. Manual ON/OFF switch with automatic time delay off operation (adjustable from 30 seconds to 30 minutes) after momentary occupancy and user adjustable switch to convert unit to Vacancy mode. Adjustable PIR unit sensitivity from 20% to 100%. Coverage limited to 180° field of view, 900 square feet, rated for minimum 800 watt for ballast load at 120-volt. Wall occupancy / vacancy sensor switch shall be compatible with all electronic fluorescent non-dimming ballasts and LED fixtures and shall mount in a standard single 120-volt single gang switch box. Set delay off to 5 minutes after momentary occupancy. Wall occupancy / vacancy sensors shall be of one of the following manufacturers:

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Hubbell, Leviton, Sensorswitch, Wattstopper, Cooper

.6 **Wall Occupancy / Vacancy Sensor Dimmer, 120-Volt:** Wall occupancy / vacancy sensor dimmer shall be specification grade passive infrared (PIR) or dual technology (PIR/Microphonics) and 0-10V dimming sensor, white finish. Manual ON/OFF switch with automatic time delay off operation (adjustable from 1 minute to 30 minutes) after momentary occupancy and user adjustable switch to convert unit to Vacancy mode. Adjustable PIR unit sensitivity, adjustable high and low end trim and fade time . Coverage limited to 180° field of view. Wall occupancy / vacancy sensor dimmer shall be compatible with all LED fixtures and shall mount in a standard single 120-volt single gang switch box. Set delay off to 5 minutes after momentary occupancy. Wall occupancy / vacancy sensors dimmer shall be of one of the following manufacturers:

Lutron Maestro MS-Z101

.7 **Ceiling Occupancy / Vacancy Sensors, 120-Volt:** Designated as 'OC1' on drawings - Ceiling occupancy / vacancy sensors for controlling the room lighting shall be multi-technology occupancy / vacancy sensor switch, passive infrared (PIR/Microphonics) and ultrasonic sensor (40kHz ultrasonic frequency), 360° coverage within a 92.9 square meter area. Automatic ON/OFF control, Occupancy / Vacancy mode switch, with delay off set at 5 minutes after momentary occupancy.

Hubbell, Leviton, Sensorswitch, Wattstopper, Cooper

2.4 COVER PLATES

.1 Cover plates for wiring devices shall be from one manufacturer throughout the project.

.2 Wall plates shall be designed and manufactured in accordance with performance and dimensional requirements of the following industry standards:

CSA Standard C22-2 No. 42

U.S. Federal Specification WP455

NEMA Standard WD-1

.3 Wall plates shall be manufactured by one of the following:

Cooper, Arrow Hart, Eagle, Hubbell, Leviton or Pass & Seymour.

.4 Blank cover plates in finished ceiling areas shall be Columbia Electric #9002 baked white enamel for white ceilings, or painted to match colored finishes.

.5 Stainless Steel wall plates shall be provided for all devices including switches, receptacles, blanks, telephone and special purpose outlets. The wall plates shall be of suitable configuration for the device for which it is to cover with colour matched mounting screws. Use ganged plate where more than one device occurs at one location. Any specific locations calling for Metal wall plates shall be stainless steel.

.6 Where surface wiring methods need to be employed in a high finish area because of renovations to existing structure, wall plates shall be used in conjunction with Wiremold surface box to suit the device.

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.7 Where outlets occur in an unfinished area such as boiler or furnace room and surface conduit and boxes are specified, stamped galvanized steel wall plates shall be used to suit configuration.

.8 Exterior outlets shall be fitted with weatherproof “while in use” covers. Refer to symbol schedule on drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Switches shall be as located on the drawings, mounted up 1200 mm, and ganged where more than one occurs in the same location.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Convenience outlets shall be as located on the drawings, and mounted up 450 mm, unless otherwise noted.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Outlets over counter tops shall be mounted 150 mm above counter, or immediately above backsplash. Coordinate with architectural drawings for location of all counter tops, millwork and feature walls, to ensure proper location and mounting height.

.5 Coordinate with the location of all mechanical convectors and mount convenience outlets up 100 mm above heating convectors.

.6 All convenience outlets shall meet tension tests as per CSA requirements, and will be subjected to 'on site' tests during final inspection.

.3 All plug-in type receptacles shall be identified by means of a Lamecoid label fixed with self tapping screws on the cover plate or engraved stainless steel cover plates. Each cover plate shall contain the panel and circuit number. Those receptacles fed from ground fault interrupters shall have 'GFI' labeled adjacent to the panel and circuit number. Those receptacles designated for housekeeping purposes shall have ‘HOUSEKEEPING’ labeled adjacent to the panel and circuit number.

.4 The circuits controlled by all switches on all levels, shall be neatly printed with waterproof ink on the side of the switch outlet box so that the panel and circuit number are clearly legible when the cover plate is removed. It shall not be necessary to remove the switch from the outlet box in order to read the panel or circuit number.

.5 Cover plates:

.1 Protect cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Submit fuse performance data characteristics for each fuse type and size above 40 A. Performance data to include: average melting time-current characteristics.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

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1.5 DELIVERY AND STORAGE

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Provide a typed list of all spare fuses

.4 Provide three (3) spare fuses of each type and size installed.

Part 2 Products

1.2 FUSES GENERAL

.1 Fuses: product of one manufacturer for entire project.

.2 Fuse interrupting rating shall be 200,000 amperes RMS symmetrical, unless otherwise noted.

.3 Time delay fuses shall carry 500% of rated current for a minimum of 10 seconds and shall be labeled "Time Delay" by the manufacturer.

1.3 FUSE TYPES

.1 HRC fuses rated 600 amperes and smaller shall be CSA certified HRC1-J time delay and shall be in accordance with CSA Specification C22-2 No. 106-M92. HRC-1 fuse dimensions and current limiting performance shall be in accordance with the UL Standard 198C

Part 3 Execution

1.4 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.3 Ensure correct fuses fitted to assigned electrical circuit.

.4 Application of all fuses shall comply with the Canadian Electrical Code - Part 1 and local inspection authority regulations.

.5 Unless otherwise noted on the drawings, Time Delay fuses for overcurrent protection of motor circuits shall be rated at 150% of full-load current and

.6 Time Delay fuses for overcurrent protection of transformer circuits shall be rated at 125% of full-load current.

.7 All fuses shall be manufactured by Littlefuse, Buss, Ferraz Shawmut**,** or Edison.

1.5 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly

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authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Include time-current characteristic curves for breakers with ampacity of 50 A and over or with interrupting capacity of 18,000 A symmetrical (rms) and over at system voltage.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

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.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg C ambient.

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips.

.4 Circuit breakers with interchangeable trips as indicated.

.5 Circuit breakers to have minimum of 10,000 A symmetrical rms interrupting capacity rating in breaker panelboards.

.6 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers to have adjustable trips.

2.2 THERMAL MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 SOLID STATE TRIP BREAKERS

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous, tripping for ground fault short circuit protection.

.2 The main service breaker for the building main service shall have solid state trip unit. All other breakers shown shall be thermal magnetic breakers unless otherwise noted.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's

standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.
.8 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.
.9 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

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.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible and non-fusible disconnect switch in CSA Enclosure , size as indicated.

.2 Mechanically interlocked door to prevent opening when handle in ON position.

.3 Fuses: size as indicated, in accordance with Section 26 28 14 - Fuses - Low Voltage. Switch fuse units shall be available in 30 through 1200 amp standard industry sizes. They shall be readily removable and interchangeable without modification to bus work or mounting rails

.4 Fuseholders: suitable without adaptors, for type and size of fuse indicated.

.5 Quick-make, quick-break action.

.6 Fusible switches shall be quick-make, quick-break, visible blades, integral handle mechanism, deionizing arc quenchers, front operation, high pressure fuse clips and recessed live parts.

.7 Operating handles to have provision for padlocking in either 'on' or 'off' position.

.8 Handle to be marked to clearly indicate switch contact positions.

.9 Switch fuse units shall be available in 30 through 1200 amp standard industry sizes.

.10 Shall be readily removable and interchangeable without modification to bus work or mounting rails.

.11 All switches shall be manufactured by General Electric, Eaton, Siemens, or Schneider Electric.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Lamecoid nameplates, approximately 75 mm x 25 mm, shall be provided on front doors of each switch for identification, showing the name and rating.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly

authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

.3 Coordinate all control requirements prior to ordering equipment.

.4 All motor control and ancillary components shall be supplied by one manufacturer in order to assure an integrated system and one point of contact for service with the exception of the VFD requirements. Each manufacturer shall still have a local Saskatchewan service capability. All motor control equipment shall be manufactured by one of the following:

Eaton, Schneider Electric, General Electric, Toshiba

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Indicate:

.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout of identified internal and front panel components.
.4 Enclosure types.
.5 Wiring diagram for each type of starter.

.6 Interconnection diagrams.

.7 All Fuse types for all starters

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 GENERAL REQUIREMENTS EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide listed spare parts for each different size and type of starter:

.1 2 contacts, auxiliary.

.2 1 operating coil.

.3 2 fuses.

Part 2 Products

2.1 MATERIALS

.1 For all motors, provide circuit and thermal protection on all lines except neutral.

.2 For all pumps not controlled by VFD's, provide hour meters for each visible on the motor control centre doors. All magnetic starters located outside of motor control centres shall contain hour meters.

.3 All contactors shall be NEMA rated contactors.

2.2 MANUAL MOTOR STARTERS

.1 Single or Three phase manual motor starters as shown of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.

.2 Overload heater(s) for each phase, manual reset, trip indicating handle.

.3 Thermal switches for small fractional KW motors shall be single or 2 pole as required.

.4 In all cases, locate within 9000 mm and in sight of motor

.2 Accessories:

.1 Toggle switch: industrial standard type labelled as indicated.

.2 Indicating light: standard neon type and colour as indicated.

.3 Locking tab to permit padlocking in "ON" or "OFF" position.

.4 thermal relay

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.5 All starters shall be combination starters c/w quick-make, quick-break, switch, fuse and magnetic starter c/w red and green indicator lights

.6 H.O.A. switch operator controls

.7 Provide primary fuse for control transformer.

.8 Starters shall not be equipped with an automatic thermal overload reset.

.9 Tin plated stab on connectors are acceptable.

.2 Combination type starters to include fused disconnect switch with operating lever on outside of enclosure to control disconnect, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

.4 Fusing shall be Form I, NEMA "J", HRC, 200,000 amps current limiting type.

.3 Accessories:

.1 Pushbuttons and Selector switches: standard labelled as indicated.

.2 Indicating lights: standard type and color as indicated.

.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

.4 The overload relays shall be the ambient temperature compensated type, and the trip rating of a specific heater element shall be field adjustable over a range of approximately 85% + 115% of its respective rating.

2.4 FULL VOLTAGE REVERSING MAGNETIC STARTERS

.1 Full voltage reversing magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.5 All combination starters shall be quick-make, quick-break, switch, fuse and magnetic starter c/w red and green indicator lights

.6 H.O.A. switch operator controls

.7 Provide primary fuse for control transformer.

.8 Starters shall not be equipped with an automatic thermal overload reset.

.2 Combination type starters to include fused disconnect switch with operating lever on outside of enclosure to control disconnect, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

.4 Fusing shall be Form I, NEMA "J", HRC, 200,000 amps current limiting type.

.3 Accessories:

.1 Pushbuttons and Selector switches: standard labelled as indicated.

.2 Indicating lights: standard type and color as indicated.

.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

.4 The overload relays shall be the ambient temperature compensated type, and the trip rating of a specific heater element shall be field adjustable over a range of approximately 85% + 115% of its respective rating.

2.5 VARIABLE FREQUENCY DRIVES

.1 All VFDs shall be remotely mounted outside of motor control centres and shall be located as close as possible to the motor unit being controlled. Unistrut supports shall be provided for mounting the VFD units. All remote controllable parameters shall be wired within the VFD assembly. The VFD assembly shall be rated for Nema 12.

.2 All VFDs shall be provided with a connected bypass mounted to the VFD unit. Space is limited so the bypass may be provided as a separate attached unit or integral to a larger VFD assembly in a common cabinet.

.3 Provide variable frequency drives (VFD) where designated by the motor control schedule and drawings. These drives shall have the following features:

.1 The drives shall be capable of continuously operating any standard squirrel cage induction motor, NEMA design A, B, or C self-ventilated or force ventilated and inverter duty motors without derating within ambient temperatures up to 40°C. Coordinate final type with Mechanical Contractor.

.4 It is required that the variable speed drive models for the fans be the HVAC applicable type drives that have accessories and functions typical for requirements of motors used in HVAC applications.

.5 It is required that the variable speed drive models for the pumps be the Pump applicable type drives that have accessories and functions typical for requirements of motors used in Pumping applications.

.6 The variable speed drive shall be the pulse width modulated (PWM sinusoidal) output type with adjustable carrier frequencies.

.7 Unless otherwise noted, all horsepower/Kilowatt drive ratings are to be based on a variable torque load and FLA of motor being controlled.

.8 The drive shall maintain a minimum line side power factor of 0.95 throughout the entire speed range and the drive shall be capable of an overload of 115% for 1 minute.

.9 Provide surge arrestors (internal or external) with a minimum 250 Joule (line-ground) rating shall be used to protect the drive from AC line transients. Surge arrestors shall not to be part of the bridge circuit.

.10 Provide separate Input line reactors in separate enclosure rated a minimum impedance of 3%. Ensure adequate ventilation is provided for proper heat dissipation.

.11 Ensure drives have EMI and RFI filtering (internal or external). Equipment shall be designed that use of communication equipment adjacent to VFD units is permissible. The VFD shall not be susceptible to interference from communications equipment operated adjacent to it.

.12 The output inverter section shall utilize insulated gate bipolar transistors and diodes to provide a sine coded pulse width modulated output to the motor. The carrier frequency of the pulse width modulation shall be asynchronous to control harmonic distortion in the 3rd to 7th bandwidths to less than 1%. Total voltage harmonic distortion on the input shall be less than 3%.

.13 Control power input terminals shall be separate from the input power terminals to facilitate start-up, trouble-shooting, and diagnostics without power to the DC bus.

.14 The VFD shall not be sensitive to incoming power feeder phase sequence.

.1 Operator controls shall consist of:

.1 "Hand / Off / Auto" selector switch

.1 "Hand" for local control of VFD. VFD is operated by panel mounted keypad pushbuttons, speed controlled by the keypad. LCD Keypad Display. LCD Display to be full English Word.

.2 Motor cannot be started or remain running in Off position through Power Removal Function.

.3 in "AUTO" position, the VFD operates by remote start/stop command, the speed is controlled by a programmable analogue input selectable isolated input signal 0 to 10 Vdc from the BMS.

.2 Input disconnect switches and fuses shall be mounted in the existing motor control centres. In the event that the motor protection such as the overloads or thermistor tripping unit senses a motor fault, the starter shall lock out and the motor shall be de-energized.

.15 Each VFD shall be provided with an integral disconnect switch to minimize area consumed.

.16 All control wiring shall be run in separate raceway away from any line voltage or motor feeder power wiring. Motor cables shall be separated from the supply cables at a minimum distance of 600mm and from signal / control cables at a minimum distance of 400mm. The signal / control cables shall be separated from the motor cables at a minimum distance of 900mm.

Where signal / control cables must cross power or motor cables, the crossover angle shall be 90 degrees.

.17 The drive shall be designed and constructed to operate at a maximum altitude of 1000 m without derating and an ambient temperature between 0o C and 40o C. The drive shall operate in an environment with a relative humidity up to 90% with no condensation.

.18 The drives shall operate at 208 Volts or 600 Volts (as noted on mechanical schedule) as applicable plus 10% 60Hz, 3ph. Drives which require isolation transformers or are rated at 200 Volt or 575 Volt are not acceptable.

.19 The drive shall accept an analog signal of 0-10Vdc for use as a fan motor speed reset.

.20 All VFD set-up operations and adjustments shall be digital and stored in nonvolatile memory (EEPROM).

.21 The drive shall also have a fault log that stores several last occurring fault conditions within its internal memory.

.22 The VFD shall have a “momentary Power Loss” ride through capability.

.23 The VFD shall be capable of operating with the VFD output open circuited (no motor connected) with no fault or damage to any part of the drive.

.24 The drive shall have the capability to energize and control a currently ‘spinning’ load regardless of the direction of rotation of the load.

.25 Provide a bump-less speed transfer from remote control to local control or local control to remote control without setting the motor to zero.

.26 Provide a display that shall show, when the drive is running the motor, electronic setspeed, motor current and motor thermal state (if RTD’s or thermistors are installed in motor).

.27 The setting controls shall be accessible from the front of the control board, from a commissioning terminal. The drive shall contain the required communications card to communicate with the BMS.

.1 The following functions shall be independently field adjustable:
- .1 Acceleration rate
- .2 De-acceleration rate
- .3 Adjustable minimum speed of 0 to maximum speed.
- .4 Adjustable maximum speed of minimum speed to max. frequency.
- .5 Automatic restart.
- .6 Catching a spinning load in either direction.

.2 The following conditions shall result in a drive fault and orderly shutdown. The mode of the fault shall be displayed on the electronic display on the front of the drive.
- .1 Phase failure on the input line
- .2 Drive over temperature
- .3 Motor phase failure
- .4 Over current for short-circuit or grounding of the drive output or excessive transient operation.

.3 The drive shall include a self-diagnostic system to test all main functions and identify any failed elements.

.4 Provide an Operations and Maintenance manual with the following:
- .1 Preliminary checks and start up check sheet with list with outline
- .2 Design and Operation
- .3 Technical characteristics
- .4 Installation
- .5 Connections
- .6 Troubleshooting charts for all device faults.
- .7 An instruction manual for programming and hardware provided with the equipment at time of shipment.
- .8 A listing of authorized service depots, spare parts lists and recommended spare parts
- .9 Final settings of all parameters
- .10 Input and output filter type and size
- .11 Specified environmental conditions
- .12 Voltage and current wave form printout taken from the motor terminals

.5 Provide a trouble shooting guide with the following features:
- .1 Observation, fault code
- .2 Possible causes
- .3 Checks to be made
- .4 Result
- .5 Remedial action
- .6 Comments

.6 The starter shall be equipped with an automatic start mode that shall restart the motor after a power failure without operator intervention. This option shall be controlled by the internal parameter settings. Drives that lock out in a fault condition due to power outage or transfer from and to emergency power shall not be accepted. The drive shall resume to the last known frequency.

.7 The starter shall be equipped with a programmable automatic reset/restart after any individual trip condition resulting from either overcurrent, over voltage, under voltage, or an over temperature. This parameter shall initially be set to disabled.

.8 The drives are to be set for two (2) only restarts, set for a 30 second delay following the return of essential power to the drive. Failure of the drive to restart the motor following these two (2) restarts will necessitate a manual acknowledgement of the fault at the actual drive control panel.

.9 Prior to any motor control equipment ordering, the Electrical contractor shall coordinate with successful controls contractor and determine the required control, i.e. ‘2 wire’ or ‘3 wire’ control. Equipment shall be ordered as such upon written confirmation from the controls contractor.

.10 Coordinate all control requirements prior to ordering equipment.

.11 Each VFD shall be provided with a minimum of 2 dry contacts assignable to alarm conditions such as a VFD fault. Both contacts shall be wired to the nearest BMS control panel.

.28 The Contractor shall co-ordinate with the VFD manufacturer regarding all motor sizes, motor types and motor feeder lengths. Provide Load dv/dt filters for all motors equipped with VFD's where the feeder distance exceeds the limits for the pulse rise times shown in the following table:

Pulse Rise Time (Microseconds)	**Critical Lead Length** (Meters)
1 or greater	45
0.5	20
0.1 and less	Always

Coordinate with manufacturer to ensure proper mounting of all output filters (when required). Filters shall be connected to the drive via bus bars. If bus bar connection not available with drive manufacturer, connect filter to drive with 105°C RW90 rated cable. All filters shall be placed in their own enclosure mounted beneath the drive. Ensure enclosure is adequately vented as per manufacturer recommendations. Ensure clearances are made within filter enclosure as per filter manufacturer recommendations. Ensure filters and enclosures are bonded to ground connections of drive.

.29 The manufacturer in co-ordination with the Contractor shall have voltage and current waveforms taken at the time of final commissioning from the motor terminals of each motor controlled to ensure that the waveforms are within the tolerance limit of the motor and drives. The settings of the waveform capture shall be such that the pulse rise time of the waveform shall be visible and easily evaluated for voltage reflection amplification. Any documentation not meeting this requirement shall be rejected and resubmitted until it is satisfactory to the Consultant.

.30 Co-ordinate with the motors supplied to site and ensure the proper filter protection is provided for all motors served by the VFD's. The electrical contractor shall assume full responsibility for ensuring a complete and fully operational system in regards to output and input filtering for the motors and VFD's supplied.

.31 The manufacturer shall provide all necessary assistance, including on-site support, to both mechanical and electrical contractors to determine final drive parameter settings. The VFD manufacturer shall adjust the drive parameter settings to suit on-site conditions prior to commissioning.

.32 Setting of all drive parameters, commissioning, testing and certification of all VFD's shall be completed by the VFD Manufacturer Certified VFD Service Technicians. Third party commissioning agents will not be accepted.

.33 Coordinate all control requirements prior to ordering equipment.

.34 All VFDs and ancillary components shall be supplied by one manufacturer in order to assure an integrated system and one point of contact for service. Each manufacturer shall have a local Saskatchewan service capability. All motor control equipment shall be of the same manufacture, and shall be manufactured by one of the following:

Schneider Electric, Eaton, General Electric, Toshiba, Siemens

2.6 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120V secondary, complete with secondary fuse, installed in with starter as indicated.

2.7 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 01 - Common Work Results - Electrical.

2.8 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

.3 The plates shall be attached with two self-tapping metal screws.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload devices elements installed.

.3 Each manufacturer shall have a local Saskatchewan service capability.

.4 All motor control equipment shall be of the same manufacture.

.5 Install starters, connect power and control as indicated.

.6 Ensure correct fuses and overload devices elements installed.

.7 The motor starters shall be cleared of all ambient construction dust prior to commissioning or the energizing of the starters.

.8 Provide a disconnect for each motor within the room or area that the motor is located. All disconnects shall be sized in accordance with kilowatt ratings of the motor being isolated and shall be quick-make, quick-break type, equipped with lock-off feature.

.9 Within 900 mm of each motor, provide flexible Sealtite conduit. Provide a separate ground wire bridging the flexible connections.

.10 All conduit / cabling entering top of motor starter shall be c/w water tight connectors with silicone based caulking.

.11 Use shielded twisted pair (STP) wiring for control and signal wiring that connects externally to the VFD.

.12 Provide separate conduits for VFD control wiring from input and output power wiring.

.13 Provide #6 bare copper ground from each VFD grounding point to the building ground grid. DO NOT loop or series connect multiple VFD ground cables.

.14 Control wiring shall be stranded TEW 105°C (220°F) rise.

.15 Terminal blocks for remote interface shall be Weidmueller SAK6N or approved equal.

.16 Provide wire markers at both ends of all control wires, Electrovert Type Z or approved equal

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions
.2 Description of system operation
.3 Description of each subsystem operation
.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.
.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.
.6 Include operation and maintenance data for each type and style of starter.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical and manufacturer's instructions.

.2 Provide factory certified copies of production test results to the Consultant prior to shipment of the equipment.

.3 Operate switches, contactors to verify correct functioning.

.4 Perform starting and stopping sequences of contactors and relays.

.5 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

.6 Calibrate VFD display values with Building Management System display output. Verify motor RPM values.

.7 Ensure that voltage waveforms are taken at the motor terminals at a time span that shows the relative rise times of output waveform from drive and that the waveforms are within the tolerance limit of the motor and drives.

3.4 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer’s standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours’ notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects

for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

3.5 VERIFICATION

.1 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer’s best recommendations

.2 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer’s representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.6 TRAINING

.1 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.2 American National Standards Institute (ANSI)

.1 ANSI C82.1, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 ANSI C82.4, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

.3 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.4 ANSI/IEEE C62.41, Surge Voltages in Low-Voltage AC Power Circuits.

.5 American Society for Testing and Materials (ASTM)

.6 ASTM F1137, Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.7 United States of America, Federal Communications Commission (FCC)

.8 FCC (CFR47) EM and RF Interference Suppression.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Shop drawings for each fixture shall include but not be limited to, lamps, ballasts, fixture cuts, custom colors, and special mounting details. All pertinent information for each fixture shall be stapled separately from other fixtures.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 10 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide detailed lighting calculation drawings for fixtures that are submitted for approval for closed office areas, open office areas, training rooms or as requested by the consultant. These shall be submitted no later than 10 working days before tender close.

.4 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 LAMPS

.1 Provide in wattages and types to properly suit the specified fixtures.

.2 T5 Linear Fluorescent Lamps:

.1 Miniature Bi-pin, slim 5/8" diameter for operating with high frequency electronic programmed start ballasts

.2 Colour Rendering Index (CRI) of 85

.3 Colour Temperature: 3500°K

.4 Nominal Life Rating: 20,000 hours

.3 Lamps for T5 linear fluorescent lighting fixtures shall be manufactured by Osram-Sylvania or Philips.

2.2 BALLASTS

.1 Ballasts for fluorescent fixtures shall be supplied with the fixtures, pre-wired for operation with the compatible lamps and quantity of lamps specified for the fixture. Provide ballasts in the voltage noted with the fixture specification.

.2 Fluorescent ballast systems shall include:

.1 Operate lamps for maximum efficacy, high lumen output operation and operate for full lamp life

.2 Eliminate lamp flicker

.3 UL Listed Class P, Type 1 Outdoor
.4 CSA Certified
.5 70°C Maximum Case Temperature
.6 FCC 47CFR Part 18 Non-Consumer for EMI and RFI filtering
.7 Class A Sound Rating
.8 ANSI C62.41 Category A Transient Protection
.9 CFCI Compatible

.3 Ballasts for Linear T5 Lamps

.1 Starting Method: Programmed Rapid Start
.2 Stepped Switching Ballast System where indicated bi-level 100% and 50% stepped output
.3 Ballast Factor (BF): 1.00
.4 Circuit Type: Series
.5 Lamp Frequency: >40kHz to reduce potential interference with infrared control systems
.6 Lamp Current Crest Factor (CCF): less than 1.6
.7 Total Harmonic Distortion: <10% THD
.8 Power Factor: >98%
.9 End of Lamp Life Sensing
.10 Manufacturer:

Sylvania 'Quicktronic PROStart T5 Professional Series
Advance 'Optanium Step Dim EL' series, available in 120-volt only

.4 Dimming Fluorescent Ballasts for T5 Lamps

.1 Starting Method: Programmed Rapid Start System
.2 Ballast Factor (BF): 1.00 – Normal Ballast Factor
.3 Circuit Type: Series
.4 Lamp Frequency: >40kHz to reduce potential interference with infrared control systems
.5 Lamp Current Crest Factor (CCF): less than 1.7
.6 Total Harmonic Distortion: <10% THD
.7 Power Factor: >98%
.8 Dimming Range: 100 to 10%
.9 1 – 10 Volt Control
.10 Anti-Flash Circuitry turns on in dimmed mode
.11 End of Lamp Life Sensing for T4 and T5 lamps
.12 Compatible with 4-pin compact fluorescent lamp types
.13 Manufacturers (unless noted otherwise):

Lutron 'Hi-Lume' series
Sylvania 'Quicktronic – Powersense' series

Advance Mark 10

.5 Fluorescent ballasts shall have inrush current limiting capability to assure compatibility with all lighting systems controls.

.6 Ballast Warranty: All fluorescent ballasts shall include a written manufacturer's warranty against defects in materials and workmanship for 60 months from date of substantial completion and include a nominal replacement labour allowance.

2.3 LED LIGHTING – LAMP MODULES AND DRIVERS

.1 Solid-State Lighting (LED luminaires) shall comply with ENERGY STAR® SSL test standards for the following qualification requirements:

.1 Testing: SSL testing standards including IES LM-79-2008 and LM-80-2008 as performed by an independent test lab.

.2 Efficacy: The luminaire test data and submitted report shall demonstrate a minimum of 35 lumens per watt and 575 lumens for the least efficient LED for apertures ≥ 4.5" (345 lumens for apertures ≤ 4.5"), lowest efficient optic, and hottest luminaire configuration for the product group submitted for qualification.

.3 Colour: LED luminaire shall demonstrate colour uniformity across the aperture.

.4 Power: The driver/power supply must have a power factor of > 0.90 for all non-residential products, meet FCC requirements, sound rating of A and provide transient protection.

.5 Reliability: The LED luminaire shall demonstrate 70% lumen maintenance at 35,000 hours for non-residential products, as calculated using the DOE's linear extrapolation model.

.2 Tight chromaticity specification and LED colour binning process shall ensure LED colour uniformity, sustainable Colour Rendering Index (CRI) and Correlated Colour Temperature (CCT) consistency over the useful life of the LED. Consistent colour uniformity and tight colour control shall be maintained even during dimming.

.3 LED modules shall be InGaN (Indium Gallium Nitride) semiconductor material, absent of UV and minimal IR wavelengths. The conglomeration of diodes covered with remote phosphor technology shall provide consistent colour uniformity and tight colour control.

.4 LED Light Engine (Driver)

.1 Over-voltage, over-current and short-circuit protected

.2 Thermal management of the LED system shall be designed to yield 70% lumen maintenance after 50,000 hours of operation

.3 Total Harmonic Distortion: < 20% THD

.5 LED fixtures where specified as dimmable, shall have a dimming range of 100% to 10% unless otherwise noted.

.6 Warranty: The light engine and power components of LED luminaires installed for indoor applications shall be free from defects in material and workmanship for a minimum period of three (3) years from date of original purchase. Warranty shall cover only product failure due

to defective material or workmanship, and does not include labour to remove or install fixtures. Defective LED's shall be considered if a minimum of 5% of LEDs per luminaire are non-operative in the fixture or module.

.7 Screw-in LED lamps shall have A19 medium base. 10 watt, 800 minimum lumen output with 2700K color temperature.

Manufacturer:

Sylvania Ultra LED A-line series
Sylvania A-line series
Cree A19P series

2.4 LUMINAIRES

.1 Contractor is responsible for all required mounting details for all lighting fixtures. If mounting of fixture is uncertain, contractor shall confirm prior to finalising pricing.

.2 Lighting fixtures shall be of the makes indicated. Similar types of fixtures shall be by one manufacturer.

.3 Only clean luminaires and lamps will be accepted at time of final inspection.

.4 Recessed fixtures shall generally be supplied complete with trim, plaster frame or ring and mounting brackets where installed in plaster, or without plaster frame in acoustic ceilings.

.5 Fixtures shall bear appropriate CSA labels.

.6 Cooperate with all other trades for the proper installation of all lighting fixtures.

.7 Verify the quantity of fixtures before placing orders.

.8 Verify all ceiling types with architectural drawings and the General Contractor before ordering fixtures.

.9 Fluorescent lighting fixtures shall be so designed that the temperature on the ballast case shall not exceed a maximum of 70°C in an ambient temperature of 25°C.

.10 Co-ordinate with drawings to ensure that all fluorescent fixtures are equipped with ballasts of a suitable voltage to match branch circuitry.

.11 All fluorescent fixtures such as troffers, specified as being equipped with flat acrylic lens, shall be provided with lens not less than 3.175 mm thick, regardless of catalogue numbers specified.

.12 All fluorescent troffers specified as being installed in inverted T-bar ceilings shall be painted on bottom face of fixture to match the T-bar splines unless otherwise noted.

.13 A self adhesive small circular label coloured blue shall be placed on a T-bar spline adjacent to each fixture housing the ballast to facilitate its location.

.14 All fluorescent luminaires installed on branch circuits with voltages exceeding 150 volts-to-ground shall be provided with a disconnecting means integral with the luminaire that simultaneously opens all circuit conductors between the branch circuit conductors and the conductors supplying the ballast(s), and shall be marked in a conspicuous and permanent manner adjacent to the disconnecting means so as to identify the disconnect.

.15 The new light fixture lamps shall not be used during construction. The contractor may use their own temporary lamps during construction at their own expense with the Owner's approval. The contractor shall replace temporary lamps with new lamps upon completion of work. All fixtures shall be cleaned inside and outside prior to substantial completion.

.16 Provide lighting fixtures of type and quality as specified in the following schedule. Fixtures shall be complete with necessary accessories, lamps and ballasts. The contractor shall advise of any restrictions on providing luminaire, lamp and ballast as specified during tender period.

.17 The lighting fixtures shall be as specified in the following schedule, and the manufacturer's numbers shown shall not reduce or amend the requirements as outlined under the description of each fixture type.

2.5 LUMINAIRE SCHEDULE (NON-HOUSING BUILDING)

.1 Fixture type 'AA'

.1 Luminaire: Vandal proof corner mounted fluorescent, 1220 length,14 gauge cold rolled steel construction, seam welded, smooth finish with one piece piano hinged door frame, 1/4" thick polycarbonate outer lens, K12 internal lens, two 28 watt T5 fluorescent lamps and one 9 or 13 watt compact fluorescent lamp for night lite, two ballasts one for T5 lamps and one for compact fluorescent lamp.

.2 Lamps: 2 x F28 watt T5 lamps, 2600 initial lumens per lamp @ 25°C and one PL 9 or PL13 compact fluorescent lamp.

.3 Ballasts: Programmed rapid start electronic ballasts, **120 volt**

.4 Manufacturer:

Lighting Dimensions #LTMS-3324-12-12-THP-FNL or LCMS Series
Cooper Lighting #FMC Corner Luminair with 0.250" Clear Polycarbonate Outer Lens, Prismatic Acrylic Diffuser, 14 Gauge Steel Housing, Fluorescent Night Light
Or approved equal.

.2 Fixture type 'BB'

.1 Luminaire: Surface mounted LED , 1219mm length x 219mm wide, die formed cold rolled steel housing and end plates in white finish, acrylic prismatic wrap-around lens.

.2 Lamps: LED, 3500K, 4800 Lumens minimum

.3 Driver: 120 Volt input, 0 – 10 Volt dimming, 53 Watts

.4 Manufacturer:
Cooper Metalux # WNLED Series
Philips Day-Brite #OWL LED Wraparound Series
Lithonia #SBL4 Series
Or approved equal

.3 Fixture type ‘CC’

.1 Luminaire: Suspended mounted LED strip light, 1219mm length c/w wire guard, frosted lens, suspended to 2700mm with chain hanger, steel housing, white finish. Coordinate final mounting height and locations with mechanical equipment and ductwork on site. Row mounted as shown on drawings.
.2 Lamps: LED, 3500K, 3000 Lumens minimum
.3 Driver: 120 Volt input, 0 – 10 Volt dimming, 31 Watts
.4 Manufacturer:
Cooper Metalux #SNLED Series
Philips Day-Brite #LF FluxStream Series
Or approved equal.

.4 Fixture type ‘DD’

.1 Luminaire: Recessed LED fixture suitable for inverted t-bar ceiling, 610 x 1220mm, painted white steel frame, acrylic lens with angles sides and flat dropped centre.
.2 Lamps: LED, 3500K, 5000 Lumens minimum
.3 Driver: 120 Volt input, 0 – 10 Volt dimming, 52 Watts
.4 Manufacturer:
Philips Day-Brite #2CA “ClearAppeal” Series
Axis “DIA LED” Series
Metalumen ‘Carlisle TC4’ Series
Or approved equal.

.5 Fixture type ‘EE’

.1 Luminaire: Surface mounted fluorescent fixture, 1250mm length x 305mm width, 16 ga. continuous steel housing. Nominal .125 prismatic acrylic inner lens, .125 UV stabilized injection molded clear polycarbonate vandal proof outer lens, stainless steel Torx head screws to prevent unauthorized access. Fixture shall include radio interference suppressor option. Provide matching Torx screw driver tool.
.2 Lamps: 2 x F28 watt T5 lamps
.3 Ballast: Programmed rapid start electronic ballast, 120-volt.
.4 Manufacturer:
Cooper Lighting Fail-Safe #FMS-D12-T5-UNV-80/84-EB51-LNL series
Kenall Mighty Mac #SDA-4-2/2-2-28-RS-1-120-1/G-1-DLN Series
Or approved equal.

.6 Fixture type ‘FF’

.1 Luminaire: Fluorescent wall mount , 1219mm length, fixture frame in white finish, smooth opalescent acrylic diffuser. Mount up 150mm above vanity mirror.
.2 Lamps: LED, 3500K, 4000 Lumens minimum
.3 Driver: 347 Volt input, 0 – 10 Volt dimming, 51 Watts
.4 Manufacturer:
Cooper Metalux #BCLED series
Lithonia #WL4 series

Philips Day-Brite #CSW series
Or approved equal.

.7 Fixture type 'A'

.1 Luminaire: Keyless ceramic socket c/w screw-in type 10 watt LED lamp. Ceiling mounted or wall mounted 150mm above door header.

.8 Fixture type 'C'

.1 Luminaire: Recessed LED fixture suitable for wet location, fully gasketed with lens, 150mm diameter aperture, aluminum reflector with white trim.

.2 Lamp: 20 watt, 1100 lumen LED module with remote phosphor technology, 4100K, 80 CR1, 50000 hours at 70% lumen maintenance,

.3 Driver: over-voltage, over-current and short-circuit protected, 120 volt, < 20% THD, dimmable.

.4 Manufacturers:

Prescolite "LF6LED" Series

Conventry "6VLED" Series

Maxilume "HV6 LED" Series

Or approved equal.

.9 Fixture type 'D'

.1 Illuminated "Room In Use" sign shall be wall mounted LED (Lighting Emitting Diodes), solid state design with high output LED's for a maximum 2 watts per sign, 120 volt. Aluminum housing in white finish, acrylic barrier, Red "ROOM IN USE" custom special wording - confirm wording with owner prior to shop drawings. Universal mounting, minimum five year warranty. Wall mount above door. Sign shall be one of the following manufacturers:
Ready-Lite 'RA' Series,
Beghelli 'Quadra' #RM series,
Emergi-Lite #EA series,

.10 Fixture type 'F'

.1 Luminaire: Recessed LED downlight suitable for mounting in inverted T-bar or drywall ceiling, 127mm diameter aperture, specular reflector with white trim, soft focus diffused lens.

.2 Lamps: 1200 lumen LED module, 3,500K, 80 CRI, 50000 hours at 70% lumen maintenance.

.3 Driver: over-voltage, over-current and short-circuit protected, 120-volt, <20% THD, dimmable.

.4 Manufacturers:
Cooper Lighting Halo # ML56 LED Series
Elite "B5 LED" Series
Prescolite "LC6LED' Series
Or approved equal.

.11 Fixture type 'G'

.1 Luminaire: Exterior surface mounted LED suitable for wet locations, extruded aluminum driver enclosure, die cast aluminum housing in powder coat grey finish, vandal resistant one-piece injection molded clear polycarbonate lens. Type III cut-off lighting distribution pattern, 120 volt LED driver with 0-10V dimming, <20% total harmonic distortion, >0.9 power factor, start-up operation -40 degree C to 40 degree C, 90% lumen maintenance at 60,000 hours, 56 input watts, 5,374 delivered lumens, 4000°K, c/w c/w integral photocell control. Fixture shall be mounted up 4,200 A.F.G. c/w 178mm length wall bracket. Five year warranty. Refer to lighting plan drawings and details.

.2 Manufacturers:
Cooper Lighting # GLEON series
Philips Gardco # ECOFORM series
Beacon #Viper Small 22NB series
Or approved equal.

.12 Fixture type 'H'

.1 Luminaire: Surface fluorescent fixture suitable for wet location, 16 gauge CRS backplate, gasketed for wet locations, UV stabilized injection molded polycarbonate tamper resistant gasketed lens, stainless steel Torx Head security screws. Fixture shall be GFCI protected.

.2 Lamp: 2 - 13 watt, triple tube fluorescent , 3500K, 80 CR1, 40000 hours at 70% lumen maintenance,

.3 Ballasts: Rapid Start HPF electronic ballasts, <10% THD, **120 volt**

.4 Manufacturers:
Cooper Lighting #Fail-Safe VR2000 Series, flat configuration
Canlyte Keene Model GR c/w opal lens & open bezel, shallow depth
Kenall Model Millenium Round MR13FL c/w pearlescent polycarbonate lens
RAB Lighting VAN1I
Or approved equal.

.13 Fixture type 'K'

.1 Luminaire: Recessed LED downlight suitable for mounting in inverted T-bar or drywall ceiling, 86mm diameter aperture, white reflector with die-cast aluminum white trim ring, diffuse dome polymer lens. Five year warranty.

.2 Lamps: 700 lumen LED module, 3,500K, 80 CRI, 50000 hours at 70% lumen maintenance.

.3 **Driver: over-voltage, over-current and short-circuit protected, 120-volt, <20% THD, dimmable.**

.4 Manufacturers:
Cooper Lighting # Halo H4 Series
Elite "LED2-4" Series
Intense "ICRLS4" Series
Or approved equal.

.14 Fixture type ‘PL1’

.1 Luminaire: Exterior pole with single mounted LED luminaire suitable for wet locations, extruded aluminum driver enclosure, die cast aluminum housing in powder coat grey finish, vandal resistant one-piece injection molded clear polycarbonate lens. Type III cut-off lighting distribution pattern, 120 volt LED driver with 0-10V dimming, <20% total harmonic distortion, >0.9 power factor, start-up operation -40 degree C to 40 degree C, 90% lumen maintenance at 60,000 hours. 157 input watts, 15,669 delivered lumens, 4000°K, c/w integral photocell control. Luminaire shall have five year warranty. Poles shall be 155mm square painted steel, 9144 mm (30 foot) and shall include anchor bolts, full base cover, hand hole, ground lug, top cap and all necessary accessories as required. Post top luminaire and lamp pole standard shall be grey finish. Refer to site plan drawings and details.

.2 Manufacturers:
Cooper Lighting # GLEON series
Philips Gardco # ECOFORM series
Beacon #Viper Large 64NB series
Valmont Pole ‘6SS-(20-40) series
Keene SR2 series
Or approved equal

.15 Fixture type ‘PL2’

.1 Luminaire: Exterior pole with two mounted LED luminaires each suitable for wet locations, extruded aluminum driver enclosure, die cast aluminum housing in powder coat grey finish, vandal resistant one-piece injection molded clear polycarbonate lens. Type III cut-off lighting distribution pattern, 120 volt LED driver with 0-10V dimming, <20% total harmonic distortion, >0.9 power factor, start-up operation -40 degree C to 40 degree C, 90% lumen maintenance at 60,000 hours. 157 input watts, 15,669 delivered lumens, 4000°K, c/w c/w integral photocell control. Luminaire shall have five year warranty. Poles shall be 155mm square painted steel, 9144 mm (30 foot) and shall include anchor bolts, full base cover, hand hole, ground lug, top cap and all necessary accessories as required. Post top luminaires and lamp pole standard shall be grey finish. Refer to site plan drawings and details.

.2 Manufacturers:
Cooper Lighting # GLEON series
Philips Gardco # ECOFORM series
Beacon #Viper Large 64NB series
Valmont Pole ‘6SS-(20-40) series
Keene SR2 series
Or approved equal.

2.6 ADDITIONAL MATERIALS

.1 In addition to the materials specified and the quantity of materials as determined on the plans, provide for the supply and installation of the following additional materials, which shall be turned over to the owner if not installed during construction:

.1 Lamps:

.1 28 watt T5 Fluorescent Lamps: 30 lamps
.2 13 watt medium base LED lamps

.2 Ballasts:
.1 Instant Start Electronic ballasts for T5 lamps, 120 volt: 3 x ballasts

.3 Fixtures:
.1 Fixture type 'BB' : 2 x additional fixtures
.2 Fixture type 'CC': 2 x additional fixtures
.3 Fixture type 'DD': 2 x additional fixtures
.4 Fixture type 'C' : 1 x additional fixtures
.5 Fixture type 'F' : 1 x additional fixtures
.6 Fixture type 'K' : 1 x additional fixtures

Part 3 Execution

3.1 INSTALLATION

.1 The contractor under this Division shall be responsible for expediting the delivery and installation of the fixtures to suite the construction schedule and the work of other trades.

.2 Remove packing material and debris from the job site immediately after installation of fixtures and lamps. Debris shall not be allowed to accumulate more than a reasonable amount.

.3 Industrial fixtures where suspended shall have 12 mm conduit hangers and ball aligners, the length and location shall clear equipment ducts and pipes.

.4 Lighting fixture diffusers are not to be installed until the area is completely finished in order to minimize the amount of dirt collection on these units.

.5 Exit signs shall be wired in a separate conduit system.

.6 Conduit installation shall conform to the specifications.

.7 Emergency battery lighting units shall be connected to the room's 120-volt lighting circuit, non-switched leg.

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions
.2 Description of system operation
.3 Description of each subsystem operation
.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WIRING

.1 Each fixture shall be fed with a separate flex or AC-90 drop. Looping between fixtures or wiring rows through ballast channel will not be accepted.

3.4 LUMINAIRE SUPPORTS

.1 Lighting fixtures shall be supported independent of plasterboard or acoustic tile. Support from structural members of the building or ceiling.

.2 Fixtures installed in exposed ceilings may require plywood backing behind the acoustical panels. Confirm support requirements with manufacturer.

3.5 LUMINAIRE ALIGNMENT

.1 Luminaires shown in continuous lines or rows shall be carefully aligned so that all rows appear as straight lines.

.2 Fixtures shall be installed accurately in line and level. Any fixtures which are not installed properly shall be taken down and re-installed at no change to the contract sum. Plaster frames and rings required for recessed fixtures shall be supplied under this section, and installed under the lathing and plaster or acoustic ceiling divisions. The work of the electrical division shall include the necessary co-ordination with the above divisions in regard to the correct location and installation of the plaster frame and rings.

3.6 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

3.7 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.8 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 CSA C22.2 No. 141, Unit Equipment for Emergency Lighting

.3 National Building Code 2010 (NBC 2010)

.4 National Fire Code 2010

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Shop drawings for each fixture shall include but not be limited to, lamps, ballasts, fixture cuts, custom colors, and special mounting details. All pertinent information for each fixture shall be stapled separately from other fixtures.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions

.2 Description of system operation

.3 Description of each subsystem operation

.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

1.6 WARRANTY

.1 The warranty period for the supply and installation of emergency battery units and remote emergency lighting fixtures shall commence on the date of substantial completion regardless of the manufacturer's specific warranty disclaimers with respect to date of shipment or date of installation of the equipment. The warranty period from date of substantial completion is one full year.

.2 Provide a full replacement warranty of the emergency lighting equipment free of defects in material and workmanship for a period of (1) one year from date of substantial completion. In addition to this requirement:

.1 Batteries shall include a pro-rated warranty for a minimum (5) five years shall commence the date the full warranty period ends.

.2 Integral and remote MR16 LED lamps shall have a (5) year warranty from date of substantial completion.

.3 A battery determined to be defective during the pro-rated warranty period shall be repaired or replaced at a cost equal to the net price in effect at the time, reduced by the percentage obtained in multiplying 10% by the number of full years remaining in the total warranty period. Such repair or replacement at this adjusted price shall be the purchaser's exclusive remedy.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No. 141.

.2 Supply voltage: 120 V, ac.

.3 Output voltage: 12 V, dc.

.4 Operating time: 60 minutes

.5 Battery: sealed long-life, maintenance free lead acid battery with 10-year life expectancy.

.6 Charger: solid state, pulse type charger, current limited, temperature-compensated, short-circuit proof, reverse-polarity protected. Unit standard with electronic lockout and brownout circuits. Complete battery recharge in 24 hours.

.7 Solid state transfer circuit.

.8 Low voltage battery circuit protection to disconnect the battery form the fused output circuit at the end of discharge.

.9 Non-audible LED diagnostic display to identify source of failure: battery, charger circuitry or lamps.

.10 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.11 Automatic self-test system: 1 minute every 30 days; 10 minutes on the 6th month and 30 minutes every 12 months.

.12 Lamp heads: Integral to battery unit unless otherwise noted, 345° horizontal and 180° vertical adjustment without need for tools to adjust aim. Lamp type: 6 watt 12-volt MR16 LED.

.13 Emergency lighting units and remote fixtures shall be as specified in the following schedule, and the manufacturer's numbers shown shall not reduce or amend the requirements as outlined under the description of each fixture type.

Fixture type 'E-MA': Emergency lighting battery contained unit with two integral lighting heads equipped with 2 x 6 watt, 12-volt MR16 LED lamps. The emergency battery unit shall have a minimum **108 watt** capacity for 30 minutes (63 watt capacity for 60 minutes). Fully gasketed cast aluminum back plate in white finish with clear polycarbonate cover, NEMA 4X certified. Equipped with tamper-proof screws.
Beghelli – Bravado BRV series
Emergi-Lite - #Survive-All NXM series
Lumacell #RG-NX series
Ready-Lite - #LDX-NM series

Fixture type 'E-MB': Emergency lighting battery contained unit with two integral lighting heads, 6 watt, 12-volt MR16 LED lamps. The emergency battery unit shall have minimum 144 watt capacity for 30 minutes (84 watt capacity for 60 minutes). Steel cabinet with removable front cover, equipped with test switch and LED indicator lights.
Beghelli – Nova NV series
Emergi-Lite – ESL series
Lumacell – RGS series
Ready-Lite – LDX series

Fixture type 'E-MC': Emergency lighting central battery unit with no integral heads. The battery unit shall have a minimum 144 watt capacity for 30 minutes (84 watt capacity for 60 minutes) to operate remote emergency lighting fixtures and DC terminal connection to exit signs. Steel cabinet with removable front cover, equipped with test switch and LED indicator lights.
Beghelli – Nova NV series
Emergi-Lite – ESL series
Lumacell – RGS series
Ready-Lite – LDX series

Fixture type 'E-R2' – Emergency remote light fixture powered from fixture type 'E-MA', 'E-MB' or 'E-MC' battery units as indicated, 2 x 6 watt 12-volt MR16 LED lamps, fully gasketed cast aluminium back plate in white finish, clear polycarbonate cover, NEMA 4X certified. Equipped with tamper-proof screws.
Beghelli – Bravado BRV-R series
Emergi-Lite – EF40 series
Lumacell – MQMP-NX series
Ready-Lite – TUF NM series

2.2 ADDITIONAL MATERIALS

.1 In addition to the materials specified and the quantity of materials as determined on the plans, provide for the supply and installation of the following additional materials, which shall be turned over to the owner if not installed during construction:

Fixture type 'E-MA' : 1 fixture
Fixture type 'E-R2': 3 fixtures

.2 For each spare emergency light fixture listed, include in the base pricing the supply and installation of 2 # 10 RW90 and insulated ground in 10 meter length of 16mm conduit (including fittings).

Part 3 Execution

3.1 INSTALLATION

.1 The contractor under this Division shall be responsible for expediting the delivery and installation of the fixtures to suite the construction schedule and the work of other trades.

.2 Batteries for lighting units if placed in storage prior to installation shall be placed in an environment protected from cold and extreme heat. Store batteries in accordance with the manufacturer's recommendations. Batteries shall have a maximum storage life (shelf life) of 6 months. Batteries must be recharged or placed in service within the 6 months of storage life.

.3 Remove packing material and debris from the job site immediately after installation of fixtures and lamps. Debris shall not be allowed to accumulate more than a reasonable amount.

.4 Lighting fixtures installed in any area that is not completely finished shall be cleaned at the end of the construction.

.5 Emergency battery lighting units shall be direct connected to the room's 120-volt light circuit (non-switched leg). Branch circuit as indicated on the drawings.

.6 Battery units shall be labeled with identification numbers to match the owner's existing numbering system. Contractor shall coordinate with the owner.

.7 Mounting heights: The minimum mounting height of emergency lighting battery units and remote emergency light fixtures shall be as noted herein, unless otherwise noted on drawings:

.1 Emergency battery units: 2100mm above finished floor.

.2 Emergency remote fixtures: Ceiling mounted or wall mounted as indicated on the floor plans. Wall mounted fixtures shall be a minimum 2100mm above finished.

.8 Lighting heads shall be adjusted on site to provide optimum lighting within the area with an emphasis directed at illuminating means of egress towards the exits.

3.2 WIRING

.1 Conduit: in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

.2 Conductors: In accordance with Section 26 05 21 – Wires and Cables 0 – 1000 V

.1 In accordance with Section 26 05 21 – Wires and Cables 0 – 1000 V

.2 Minimum #12 AWG Copper up to maximum 5% voltage drop.

.3 Each fixture shall be fed with a separate flex or AC-90 drop.

.4 Providing wiring from the battery unit emergency dc circuit to the exit sign DC terminal block.

3.3 LUMINAIRE SUPPORTS

.1 Lighting fixtures shall be supported independent of plasterboard or acoustic tile. Support from structural members of the building or ceiling.

.2 Fixtures installed in exposed ceilings may require plywood backing behind the acoustical panels. Confirm support requirements with manufacturer.

3.4 LUMINAIRE ALIGNMENT

.1 Fixtures shall be installed accurately in line and level. Any fixtures which are not installed properly shall be taken down and re-installed at no change to the contract sum.

3.5 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer’s best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer’s representative. The contractor shall also provide any required

equipment such as ladders, scaffolding, etc.

3.6 TRAINING

.1 Perform training in accordance with section 26 05 01 - Common Works Results – Electrical.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 National Building Code 2010 (NBC 2010)

.3 National Fire Protection Association (NFPA)

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Shop drawings for each fixture shall include but not be limited to, lamps, ballasts, fixture cuts, custom colors, and special mounting details. All pertinent information for each fixture shall be stapled separately from other fixtures.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 STANDARD UNITS

.1 Exit signs: NBC 2010 compliant. NRCAN/CSA C860 compliant. CSA C22.2 No.141 for self-powered exit signs.

.2 Exit light fixtures shall have the following:

- .1 LED (Lighting Emitting Diodes), high output or ultra-bright LED's.
- .2 Solid state design.
- .3 Voltage: Universal input voltage of **120**, 277 or 347 volt ac.
- .4 Power consumption: Maximum 2 watts single or double face.
- .5 Aluminum housing in white finish.
- .6 Acrylic barrier
- .7 Three green 'RUNNING MAN' pictogram for direction selection (straight, left and right).
- .8 Universal mounting: ceiling, wall or end wall mounting.
- .9 DC terminal block.

.3 Exit signs shall be one of the following manufacturers:

AimLite 'RPALW' series
Beghelli 'Quandra' #RM series
Emergi-Lite #EA series
Lumacell #
Ready-Lite 'RA' Series,
Beghelli 'Quadra' #RM series

2.2 Fixture Type 'X1'

Exit sign, ceiling mounted, single face, direction indicators as shown on drawings.

2.3 Fixture Type 'X2'

Exit sign, ceiling mounted, double face, direction indicators as shown on drawings.

2.4 Fixture Type 'X3'

Exit sign, surface wall mounted, single face, bottom of fixture mounted 100mm above door, direction indicators as shown on drawings.

2.5 ADDITIONAL MATERIALS

.1 In addition to the materials specified and the quantity of materials as determined on the plans, supply and install the following additional exit sign fixtures:

Fixture type 'X1': 2 exit sign fixtures
Fixture type 'X3': 2 exit sign fixtures

.2 For each additional exit sign fixture listed, include supply and installation conduit/wire for connection of the additional exit fixtures:

.1 120 Volt AC: 10 meters of 2 # 12 RW90 plus insulated ground wire in 10 meters of 16mm conduit per fixture

.2 12 Volt DC: 10 meters of 2 # 10 RW90 in 10 meters of 16mm conduit per fixture.

.3 Location of the additional exit sign fixtures to be confirmed on site with the Consultant.

Part 3 Execution

3.1 INSTALLATION

.1 The contractor under this Division shall be responsible for expediting the delivery and installation of the exit fixtures to suit the construction schedule and work of other trades.

.2 Install exit signs so as to be visible from the exit approach.

.3 Exit signs shall be wired in a separate conduit system.

.4 Interconnect exit fixtures to the emergency lighting battery unit emergency dc circuit.

.5 Ensure the exit sign circuit breaker is locked in the 'ON' position.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

3.3 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.4 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.2 Canadian Standards Association, (CSA International)

.1 CSA-T529, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/EIA TIA 568A with modifications).

.2 CSA-C22.2 No. 214, Communications Cables (Bi-national Standard, with UL 444).

.3 CAN/CSA-C22.2 No. 182.4, Plugs, Receptacles, and Connectors for Communication Systems.

.3 Telecommunications Industry Association (TIA)

.1 TIA/EIA/ANSI – 568B.1/2/3 latest revision Commercial Building Telecommunications Cabling Standards for Telecommunications Pathways and Spaces;

.2 TIA/EIA/ANSI – 515000 Generic Specification for Optical Fibre and Cable Splices

.3 TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises;

.4 TIA-568-C Series Commercial Building Telecommunications Cabling Standard;

.5 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces;

.6 TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building;

.7 TIA/EIA-607-A Commercial Building Ground (Earthing) and Bonding Requirements for Telecommunications;

.8 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision

□

.9 TIA/EIA T568-A UTP wiring/pinout

.4 The structured communication wiring system shall comply with Treasury Boards Information Technology Standard for wiring as described in the TBITS 6.9 document. TBITS 6.9 – Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings – Technical Specifications) shall be as per Information and Technology Standards:

http://www.tbs-sct.gc.ca/it-ti/itp-pti/its-nit-eng.asp

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 SYSTEM DESCRIPTION

.1 The data and voice cable installation, shall include all cable, connectors, patch panels, patch cords, racks, BIX blocks, etc., as specified and shown on the drawings

.2 The cabling system shall meet or exceed the minimum characteristics as outlined TIA Standards Category 6A. In addition, the testing method and parameters shall be as per the TIA recommendations.

.3 The cabling installer shall be a Belden Certified System Vender installing Belden components. Once completed, the installation must be a Belden Certified System. The data system and components shall be guaranteed for a period of twenty (20) years from the date of installation against defects in materials and workmanship.

1.6 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures and 26 05 01 – Common Work Results, Electrical.

.2 Submit shop drawings for review prior to ordering equipment. Shop drawings shall include but not be limited to, photocopies of accredited installers, cabling, hardware and components, patch cords, tester information, and labeling.

□

.3 Submit manufacturer's certification documentation that guarantees installation techniques, cable and cabling components and carry a minimum 20 year certification from the manufacturer for the capability to support gigabit applications such as 1000 Base-T, 622MB/s and 2.4 Gb/s ATM and work case channel performance based on the values indicated. The term channel performance incorporates manufacturer certified patch cords.

.4 Upon request and at no cost, the contractor shall provide a manufacturer's technical representative to conduct an onsite visit to ensure complete technical compliance.

.5 The manufacturer's certification must guarantee that design or installation negligence on the part of the certified contractor will not negate or void any portion of the certified system. The manufacturer must guarantee that all material, components and labour are covered for the full certification period. It must also guarantee that in the event a contractor is no longer in business, the full certification remains valid.

1.7 CONTRACTOR QUALIFICATIONS

.1 The Installer (Firm and Employees) conducting the installation shall have full working knowledge of cabling low voltage applications such as, but not limited to data/voice communications cabling systems. The Installer shall have at least five years of continuous recent experience on similar projects. The Installer shall hold recent, up-to-date licenses, certifications and training certificates in the area the project is located and for the equipment to be installed. The Installer shall:

.1 Provide references of the type of installation provided for this specification;

.2 Be a Belden Certified System Vendor.

.3 Have a knowledge of all applicable Telecommunication standards such as but not limited to CSA, TIA/EIA, IEEEE and ANSI;

.4 Have a experience in the installation of pathways and support for horizontal and backbone cabling;

.5 Be experienced in the installation and testing of telecommunication network cabling system, including the use of light meter and OTDR.

.6 Provide proof of being a manufacturer certified installer for all cable network components being installed such as but not limited to cables, connectors and end termination equipment. The use of non-manufacture certified installer is not permitted.

1.8 PROJECT CLOSEOUT

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures and 26 05 01 – Common Work Results, Electrical.

.2 Operating and Maintenance Manuals at project closeout shall include

.1 List of cables, hardware and components;

.2 Copies of approved shop drawings;

.3 Record drawings.

.4 Warranty certification from the Manufacturer

□

.5 Receipts that include the listing of spare parts, materials and supplies, including patch cables and equipment cords.

.6 Test and verification reports (may be submitted on CD Disk inserted in an appropriate envelope page in the manual).

Part 2 Products

2.1 COMMUNICATION CABLES, PATHWAYS AND TERMINATION BLOCKS

.1 Refer to Section 27 05 14 - Communication Cables Inside Buildings

.2 Refer to Section 27 05 28 – Pathways for Communications Systems

.3 Refer to Section 27 11 19 – Communications Termination Blocks

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 The communications cabling system and testing shall comply with the following standards. All standards shall be as per the latest revision at the time of tendering this project.

.1 TIA/EIA/ANSI – 568B.1/2/3 latest revision

.2 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision

.3 TIA/EIA T568-A UTP wiring/pinout

.4 BICSI, TDMM Telecommunications Distribution Methods Manual (latest edition)

.5 CAN/CSA-T529-M91

.6 CAN/CSA-T530-M90

.7 CAN/CSA-T527-94, EIA/TIA-607

.8 CAN/CSA-T528-93, EIA/TIA-606

.9 EIA/TIA-TSB 40-A

.10 EIA/TIA-TSB 67

.11 EIA/TIA-569

.12 EIA/TIA-606

.3 The total installation shall be completed by the cable Installer who is certified by the manufacturer for Category 6A cable installations. The Installer shall submit photocopies of accreditation certificates with the shop drawings. Submit testing method and tester with shop drawings.

.4 The contractor shall submit the verified test result on each cable, connector, and connection for the total installation, including back-bone and horizontal cabling. The model number and manufacturer of the Category 6A cable shall be documented. The type of tester used for testing the Category 6A cabling must also be documented.

□

.5 Test results shall be evaluated by the test equipment using the most up-to-date criteria from the TIA/EIA Standard. This information shall be supplied in electronic format.

.1 Room number of installation

.2 Wall plate ID

.3 Test Results with an identification of type of test used and whether the result was PASS or FAIL

.6 Category 6A cable tests shall provide results for the following tests:

.1 Near End Crosstalk (NEXT)

.2 Attenuation

.3 Ambient Noise

.4 Attenuation to Crosstalk Ration (ACR)

.5 Far End Crosstalk (FEXT)

.7 Provide with maintenance manuals, a marked set of prints illustrating the network drop name for each drop location. No other as-built information shall be provided on these prints unless it relates to the data or voice network.

.8 The consultant will spot test this testing following test completion. Contractor shall provide the testing technician for (2) hours, and the completed test charts, for spot check verifications.

3.2 GROUNDING AND BONDING FOR COMMUNICATION SYSTEM

.1 Bonding Backbone shall consist of green jacketed stranded copper conductors and insulated ground bars.

.2 Install a #6 AWG insulated ground connection directly to each equipment rack in LAN Rooms. Each ground connection shall be terminated at the building ground system.

.3 Bus bars shall be an insulated pre-drilled, electro tin plated copper busbar, minimum 6mm thigh x 100mm wide x 305mm long (or length that is determined by the number of required connections including space for additional bond connections). Mount up 300mm above finished floor near the equipment rack location.

.4 Aluminum wires, clamps or terminal connectors will not be accepted for grounding and bonding.

.5 Terminations to the telecommunication ground bus bars shall be installed without splices where possible. If splices are necessary, they shall be as few as possible. Use irreversible compression-type connectors, exothermic welding, or equivalent. The connection to the ground bus bar shall be done using 2-hole compression connectors.

3.3 WARRANTY

.1 Testing and certification of the building network distribution cable installation shall be by the Installer and shall include the provision of a full Manufacturer's and Vendor's Warranty covering performance, products and installation. The Warranties shall cover the full repair and/or replacement of any component failing or failure to meet the design requirements within

one (1) year. Warranties shall be delivered to the Project Manager with the Testing and Certification documentation.

.2 Within ten (10) days after testing, the Installer shall submit the cable test results, and a marked up record drawing(s) of the as-built cable network. The record drawing(s) shall include the cable/jack identification at the outlet locations.

.3 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.4 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts

3.4 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.5 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results – Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 Audio Engineering Society (AES).

.8 Other Applicable CSA and UL approvals.

.2 Telecommunications Industry Association (TIA)

.1 TIA/EIA/ANSI – 568B.1/2/3 latest revision Commercial Building Telecommunications Cabling Standards for Telecommunications Pathways and Spaces;

.2 TIA/EIA/ANSI – 515000 Generic Specification for Optical Fibre and Cable Splices

.3 TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises;

.4 TIA-568-C Series Commercial Building Telecommunications Cabling Standard;

.5 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces;

.6 TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building;

.7 TIA/EIA-607-A Commercial Building Ground (Earthing) and Bonding Requirements for Telecommunications;

.8 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision

.9 TIA/EIA T568-A UTP wiring/pinout

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

□

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 SYSTEM DESCRIPTION

.1 The data and voice cable installation, shall include all cable, connectors, patch panels, patch cords, racks, bix blocks, etc., as specified and shown on drawings.

.2 The cabling system shall meet or exceed the minimum characteristics as outlined TIA Standards Category 6A. In addition, the testing method and parameters shall be as per the TIA recommendations and meet requirements for testing Category 6A installations.

.3 The cabling system shall use matched components from a single manufacturer certified to deliver system performance over the lifetime of the applications which the cabling system was originally designed to support. The data system and components to be certified by the manufacturer and shall be guaranteed for a period of twenty-five (25) years from the date of installation against defects in materials and workmanship. The manufacturer shall be Belden.

.4 Each cable shall be equipped with connectors on each end and connected to wall jacks or cable connectors. All field communications cabling to be terminated on patch panels located on the drawings.

.5 The data cabling channel shall not exceed four (4) connections and shall not exceed 90m.

Part 2 Products

2.1 HORIZONTAL COMMUNICATIONS BUILDING CABLE (CBC)

.1 All communication cable (data and voice) shall be unshielded twisted pair, Category 6A four (4) pair #23 AWG, CMP (FT6) rated and meet TIA/EIA/ANSI – 568-C.2, latest revision unless noted otherwise. Data and Voice cable shall be blue.

.2 Each cable shall be equipped with connectors on each end at the wall jacks and patch panels at the data equipment racks.

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.3 The data cabling channel shall not exceed four (4) connections and overall length shall not exceed 90m. The maximum distance shall include an allowance of 3 meters from the outlet to the workstation and 6 meters for patch cords.

.4 Data and Voice may be installed in a common box.

.5 A minimum of two (2) Category 6A UTP cables shall be installed at each workstation unless otherwise noted on the drawings.

2.2 NETWORK PATCH CORDS

.1 Pre-terminated, factory tested patch cords shall be of the same manufacturer as the installed system and shall be part of the certified system. Patch cables shall be labeled at both ends.

.2 Patch cords for data and voice cables shall have stranded conductors and meets the requirements of TIA/EIA 568B (latest revision). Patch cords shall meet Category 6A criteria when tested with the components of the system. Patch cords at workstations shall be Category 6A cable terminated with 8 pin modular male jacks, TIA T568A pinout. Patch cords for data shall be blue.

.3 Provide two patch cords for each cable drop located on the plans.

.4 Provide cords in the following lengths: 50% (data total) shall be 1.2m length; 30% (data total) shall be 1.8m length; 20% (data total) shall be 2.1m length.

.5 Fiber patch cords: All fibre cable shall be multimode tight buffered, multi-fibre building cable unless noted otherwise.

.6 Provide one (1) 1220mm length WHITE in colour patch cords for each Telephone cable that enters the building to allow for the cross connection of all installed and future telephone connections on the network equipment rack.

Part 3 Execution

3.1 INSTALLATION OF COMMUNICATION CABLES

.1 All cable shall be pulled using proper wire grips. Pulling force and bend radius shall not exceed manufacturer's specifications.

.2 Velcro straps shall be used in all locations, cable ties are unacceptable.

.3 Parts of cables not in cable management trays shall be strapped at least every 250mm along cable.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

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.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

.4 During the warranty period, provide three (3) separate site visits of four (4) hours each on site for owner revisions and additional training.

3.3 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer’s best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer’s representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.4 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 Audio Engineering Society (AES).

.8 Other Applicable CSA and UL approvals.

.2 Telecommunications Industry Association (TIA)

.1 TIA/EIA/ANSI – 568B.1/2/3 latest revision Commercial Building Telecommunications Cabling Standards for Telecommunications Pathways and Spaces;

.2 TIA/EIA/ANSI – 515000 Generic Specification for Optical Fibre and Cable Splices

.3 TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises;

.4 TIA-568-C Series Commercial Building Telecommunications Cabling Standard;

.5 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces;

.6 TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building;

.7 TIA/EIA-607-A Commercial Building Ground (Earthing) and Bonding Requirements for Telecommunications;

.8 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision

.9 TIA/EIA T568-A UTP wiring/pinout

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

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.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Submit shop drawings for review prior to ordering equipment. Shop drawings shall include but not be limited to, photocopies of accredited installers, outlets, coverplates, “water fall kits”, cable management.

1.4 PRODUCT APPROVALS

.1 Manufacturers’ and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 SYSTEM DESCRIPTION

.1 Telecommunications raceways system consists of outlet boxes, cover plates, cabinets, conduits, cable troughs, pull boxes, sleeves and caps, fish wires, service poles, service fittings, concrete encased ducts.

Part 2 Products

2.1 MATERIAL

.1 Conduits: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings

.2 Cable troughs: type, in accordance with Section 26 05 36 - Cable Trays

.3 Junction boxes, in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets

2.2 OUTLET BOXES

.1 Outlet boxes shall be 100mm square boxes. Multiple boxes shall not be ganged unless noted otherwise.

.2 Wall plates for communication cable systems shall have integral self label. The wall plates must support up to four (4) network drops and be run in a minimum of **27mm** conduit to the nearest equipment rack or stub at the basket tray in the accessible ceiling. Provide blank filler plates for unused drops. Wall plates shall be white.

.3 Wall plates shall be modular and in ‘Keystone’ format opening to allow the possibility of changing connector types in the future without replacing the wall plate. Faceplates shall be

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equipped with small form factor terminating connectors to fit the individual outlet's requirements (RJ45 and or Dual LC and or CATV bulkheads).

.4 Wall plates shall be equipped with a minimum of four (4) angled keystone openings. The installer shall equip the wall plate with the required amount of blank inserts as required. The minimum standard of acceptance for wallplates are Corning WLL-PL-AP or Panduit NK4VSFWH.

.5 When the wall plates are equipped with fibre optic port, it must be placed in the bottom keystone port position. Install 'Keystone' fibre 'SC' adapter for frame-station connector.

2.3 CABLE MANAGEMENT

.1 Velcro ties shall be used. Each cable type shall be bundled separately; that is data bundle, voice bundle, and fibre bundle. Cable ties wraps are unacceptable.

Part 3 Execution

3.1 SECURITY

.1 All cabling shall be installed in conduit in areas deemed unsecured. Unsecured areas, unless otherwise noted include the following:

.1 Any area accessible by more than one tenant or the public.

.2 Any area where cabling crosses from one tenant space to another tenant space.

.2 No communication (data, voice or fibre) cabling shall share same raceway or junction boxes with any other pathway system.

3.2 INSTALLATION

.1 All horizontal cables shall be run in conduit. All raceways shall be grounded. All conduits shall have suitable bushings.

.2 Backbone/riser cables (fibre, copper) and horizontal cables shall be run in EMT conduit, minimum 27mm diameter unless otherwise noted on drawings. Maximum allowable percentage conduit fill shall not exceed 40%.

.3 EMT conduit shall be reamed and bushed at both ends and bonded to the distribution system. Rigid PVC or flexible metallic or PVC conduits are not acceptable.

.4 Inside radius bend in EMT conduit shall not be less than 6 times the internal diameter for conduit sizes up to 41mm inside diameter; 10 times the internal diameter for conduit sizes 53mm diameter and larger.

.5 Pull boxes shall be installed in conduit runs where the total number bends exceed 180 degrees; where the overall length of the conduit run is more than 30m, or if there is a reverse bend in the run.

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.6 Pull boxes shall be installed in the straight sections of the conduit run and shall not be used lieu of a bend. Corresponding ends of conduit shall be aligned with each other. Conduit fittings shall not be used in place of pull boxes or bends.

.7 Use of LL, LR and LL conduit fittings is not permitted.

.8 The use of J-Hooks, brackets, cable ties and other attachments to support cabling **is not** permitted. Meshed-basket Data Cable tray is required.

.9 In all wall outlet boxes, the contractor shall leave 400mm length of cable in each box.

.10 In all wall workstation drops, leave 300mm of cable slack before entering wall or workstation in suspended ceiling.

3.3 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

.4 During the warranty period, provide three (3) separate site visits of four (4) hours each on site for owner revisions and additional training.

3.4 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required

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equipment such as ladders, scaffolding, etc.

3.5 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 Institute of Electrical and Electronic Engineers (IEEE).

.2 Canadian Standards Association (CSA) International

.1 CAN/CSA-C22.2 No.182.4, Plugs, Receptacles and Connectors for Communication Systems.

.2 CSA T529, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/EIA TIA 568a with modifications).

.3 Telecommunications Industry Association (TIA)

.1 TIA/EIA/ANSI – 568-B.1/2/3 latest revision Commercial Building Telecommunications Cabling Standards for Telecommunications Pathways and Spaces;

.2 TIA/EIA/ANSI – 515000 Generic Specification for Optical Fibre and Cable Splices

.3 TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises;

.4 TIA-568-C Series Commercial Building Telecommunications Cabling Standard;

.5 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces;

.6 TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building;

.7 TIA/EIA-607-A Commercial Building Ground (Earthing) and Bonding Requirements for Telecommunications;

.8 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision

.9 TIA/EIA T568-A UTP wiring/pinout

.4 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Submit shop drawings for review prior to ordering equipment. Shop drawings shall include but not be limited to, photocopies of accredited installers, copper patch panels, copper termination jacks, coax jacks, communication racks, cable management, and sample labeling.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.7 SYSTEM DESCRIPTION

.1 Termination, patch cords, and cross-connection equipment installed inside building for voice and data for telecommunications systems employing unshielded-twisted-pair (UTP), coaxial (CXC), and future optical fibre (OFC) cables. Refer to drawings for special details.

Part 2 Products

2.1 PATCH PANELS, CONNECTORS AND ADAPTORS

.1 Data and voice patch panels shall be 24 or 48-port panels mounted in the communication equipment racks, as indicated in rack diagrams. A minimum of 12 ports shall be spare for future. Patch panels shall be compatible with Category 6A installations, and shall accept snap-in non keyed modular 8-pin jacks with T568-A pinout.

.2 Connectors shall be modular 8 PIN jacks, rated Category 6A – TIA/EIA T568-A UTP wiring/pinout. All data jacks shall be white and all voice jacks shall be blue.

2.2 NETWORK COMMUNICATION RACKS

.1 Contractor to supply rack as specified.

.2 Communication equipment racks shall be 2 post style free standing with floor mounting kit, 2108mm (83 inch) high x 546mm (21.5-inch) wide x 381mm (15-inch) deep providing 44U rack units. The equipment rack shall be in black finish. Racks shall be RF MOTE Ltd Series RFM-1944-RB-TBS or approved equal.

.3 Racks shall be equipped with 19" mounting rails and full length vertical management trough.

.4 Provide a 1U cable management between each patch panel.

.5 Racks shall have a minimum clearance as follows: front – 914mm, rear – 1067mm, one side – 762mm. Refer to drawings

.6 Provide two (2) 6-outlet power bars per rack with 12-foot shielded cord set, integral on/off switch, 15-amp breaker reset, EMI/RFI filtering and surge protection. Mounting within the equipment rack at the base, facing the rear.

.7 All racks shall be grounded with a minimum #6 AWG insulated ground wire connected to the building ground bus within the data/com room.

.8 Provide electrical circuits installed into each rack as follows:

.1 2 x 120V 20A

.9 Provide cable tray and "waterfall" kit above each equipment rack.

Part 3 Execution

3.1 LABELLING

.1 Cable labels shall be self laminating labels as manufactured by Burndy or Panduit.

.2 Bix Blocks, patch panels, and wall plates shall have integral labeling; self-adhesive labels will not be acceptable. Wall plates shall have self-adhesive icons adjacent to each jack of either a telephone or workstation to illustrate type of jack.

.3 Cable labels shall be self laminating labels as manufactured by Burndy or Panduit.

.4 Labeling shall be neatly typewritten and be in accordance with TIA 660. Cabling shall be labeled with the drop ID number at both termination points. Cable labeling shall be a logical numbering system. Confirm if owner has special labeling system prior to installation. If owner has no set labeling system, confirm contractor suggested labeling with owner or consultant prior to any installation. The owner or consultant must sign off on labeling prior to installation; this sign-off shall be included in the maintenance manuals.

.5 Bix Blocks, Patch panels, and wall plates shall have integral labeling; self-adhesive labels will not be acceptable. Wall plates shall have self-adhesive numbering label adjacent to each jack jack.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects

for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

.4 During the warranty period, provide three (3) separate site visits of four (4) hours each on site for owner revisions and additional training.

3.3 VERIFICATION

.1 Perform tests in accordance with:

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.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer’s best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer’s representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.4 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 Wherever practical and reasonable, all cabinets and electrical boxes shall be installed in the locations shown on the attached floor plans.

.2 Drawings show conduit connection requirements. Actual conduit runs shall run parallel to building lines.

.3 Unless specified otherwise, all conduits shall be sized according to the number of cables in the run. Maximum conduit fill is 50%.

.4 Unless specified otherwise, all junction boxes (J1, J3, J4, etc.) shall be steel and sized according to the number of conduits they must accommodate.

.5 Backboard space below the A4 and A5 splitter trough(s) is reserved for PTSS equipment, see A4 and A5 backboard descriptions.

.6 Unless noted otherwise, all cables pulled to an A4 or A5 backboard shall have no less than **6000mm** of cable slack in the splitter trough.

.7 Unless noted otherwise, all cables terminating in a device or outlet box shall have no less than **610mm** of cable slack at the device/outlet box.

.8 All cables terminating in a cabinet, a splitter trough, a device box, a utility box or an outlet box shall be labelled.

.9 The contractor shall test all cables installed as part of this contract for opens, grounds and shorts. The contractor shall replace any cables found to be defective by the owner.

Part 2 Materials & Products

.1 Conduit

.1 Unless specified otherwise, all conduits shall be EMT.

.2 Junction, Outlet and Pull Boxes

.1 Unless specified otherwise, all outlet, device and pull boxes shall be steel.

.3 Splitter Troughs

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.4 Ground Bar

.1 Hoffman ASG8

.5 Cable

.1 All 4 pair Telephone Type (Cat3) cables shall be Belden DIW4 D-Inside Cable, **24 AWG**, CMR, Category 3 solid copper with a grey jacket (or equivalent).

.2 All Category 5e (Cat5e) cables shall be Belden 1583A cable (or equivalent).

.3 All LVT cables shall be four (4) conductor #18 solid AWG Standard Control LVT cable.

.4 All RG59 coaxial cable shall be Belden 8221cable (or equivalent).

.5 All single pair shielded Low-Impedance cable shall be Belden 8422 (or equivalent).

.6 All 8 conductor overall shielded cable shall be General/Carol C0764A cable (or equivalent).

.7 All 15 conductor overall shielded cable shall be General/Carol C0766A cable (or equivalent).

.8 All two pair shielded cable shall be General/Carol C1352A (or equivalent).

.6 Pull Cord/Tape

.1 Polypropylene type, 200 lb tensile strength minimum.

Part 3 Execution

.1 **A4** Backboard

.1 Supply and install 19mm G1S plywood backboard to cover all of the appropriate wall in Room 140 floor to ceiling (as per floor plans).

.2 Plywood backboard to be primed and painted to match adjacent walls.

.3 Supply and install one Hoffman AST4223R 1219W X 210H X 114Dmm Splitter Trough centered 2300mm A.F.F..

.4 Supply and install a Hoffman ASG8 Ground Bar near, but not inside, the splitter trough. Bond to main building ground with a #6 AWG stranded, bare copper conductor.

.5 All conduits to the A4 backboard shall connect to the splitter trough on the A4 backboard.

.6 **The plywood backboard space below the splitter trough is reserved for PTSS equipment. Do not run surface conduit in this area.**

.2 **A5** Backboard

.1 Supply and install 19mm G1S plywood backboard to cover all of the appropriate wall in Room 140 floor to ceiling (as per floor plans).

.2 Plywood backboard to be primed and painted to match adjacent walls.

.3 Supply and install one Hoffman AST4223R 1219W X 210H X 114Dmm Splitter Trough centered 2300mm A.F.F..

.4 Supply and install a Hoffman ASG8 Ground Bar near, but not inside, the splitter trough. Connect this ground bar to the ground bar on the A4 backboard.

.5 All conduits to the A5 backboard shall connect to the splitter trough on the A5 backboard.

.6 Supply and install one 32mm conduit between this splitter trough and the splitter trough on the A4 backboard.

.7 **The plywood backboard space below the splitter trough is reserved for PTSS equipment. Do not run surface conduit in this area.**

.3 **F1** Fire Alarm Connection

.1 Supply and install conduit from the main fire alarm control panel to a junction box in the area (as per floor plans).

.2 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from the main fire alarm control panel to the splitter trough on the A4 backboard.

.3 Leave 1200mm of cable slack inside the main fire alarm control panel.

.4 **GA** Garage/Overhead Door Interface

.1 Supply and install 13mm conduit from the overhead garage door operator to a T2 cabinet in the area (as per floor plans).

.2 Supply and install one four position barrier terminal strip (Curtis 2002) in the T2 cabinet.

.3 Supply **one** 4 conductor **18 AWG** solid copper LVT cable in the conduit from the overhead door operator to the T2 cabinet and terminate on the barrier terminal strip in the T2 cabinet.

.4 Terminate two conductors in the overhead door operator in a manner that will cause the overhead door to open when the conductors are shorted. Label this pair of conductors inside the T2 cabinet.

.5 Terminate the other two conductors in the overhead door operator in a manner that will cause the overhead door to close when the conductors are shorted. Label this pair of conductors inside the T2 cabinet.

.5 **J1** Junction Box

.1 Supply and install one junction box above the suspended ceiling. If the ceiling is finished the junction box should be recessed on a wall 100mm below finished ceiling but no higher than 2400mm A.F.F.. Junction box shall be sized according to the number of conduits that must be accommodated.

.2 Supply and install conduit, sized to fit cables, from this junction box to another junction box in the area **OR** to the splitter trough on the A4 backboard (as per floor plans).

.6 **J3** Junction Box (200H X 200W X 100D)

.1 Supply and install one 200H X 200W X 100Dmm junction box 150mm above the suspended ceiling. If the ceiling is finished the junction box should be recessed on a wall 100mm below finished ceiling but no higher than 2400mm A.F.F..

.2 Junction box must be accessible and serviceable.

.3 Supply and install conduit, sized to fit cables, from this junction box to another junction box in the area OR to the splitter trough on the A4 backboard.

.7 **J4** Junction Box

.1 Supply and install one junction box above the suspended ceiling. If the ceiling is finished the junction box should be recessed on a wall 100mm below finished ceiling but no higher than 2400mm A.F.F.. Junction box shall be sized according to the number of conduits that must be accommodated.

.2 Supply and install conduit, sized to fit cables, from this junction box to another junction box in the area **OR** to the splitter trough on the A5 backboard (as per floor plans).

.8 **J5** Junction Box

.1 Supply and install one junction box in the mechanical/service area of the cell block. Junction box shall be sized according to the number of conduits that must be accommodated.

.2 Supply and install conduit, sized to fit cables, from this junction box to another junction box in the area **OR** to the splitter trough on the A5 backboard (as per floor plan).

.9 **J6** Junction Box (450H X 450W X 150D)

.1 Supply and install one 450H X 450W X 150Dmm junction box in the mechanical/service area above/below the monitoring console(s) in the Guardroom.

.2 **Junction box must be accessible and serviceable**.

.3 Supply and install four 38mm conduits from this junction box to the splitter trough on the A5 backboard in Room 140 (as per floor plan).

.10 **J7** Junction Box

.1 Supply and install one junction box above the suspended ceiling. If the ceiling is finished the junction box should be recessed on a wall 100mm below finished ceiling but no higher than 2400mm A.F.F.. Junction box shall be sized according to the number of conduits that must be accommodated.

.2 Supply and install conduit, sized to fit cables, from this junction box to the T3 cabinet in Room 140.

.11 **J8** Junction Box (305H X 305W X 100D)

.1 Supply and install one recessed 305H X 305W X 100Dmm Type 1 Telephone cabinet (BEL Products TCFKO12124) **mounted 150mm above the suspended ceiling**. If the ceiling is finished, the cabinet should be recessed on the wall 100mm below finished ceiling but **no higher than 2400mm A.F.F.**.

.2 Supply and install conduit, sized to fit cables, from this junction box to another junction box in the area **OR** to the A5 splitter trough (as per floor plans).

.12 **T2** "T" Cabinet (305H X 305W X 100D)

.1 Supply and install one 305H X 305W X 100Dmm Type 1 Telephone cabinet with wood back (BEL Products TCFKO12124WB or equivalent) **mounted 150mm above the suspended ceiling on the protected side of the wall**. If the ceiling is finished, the cabinet should be recess mounted 225mm above the strike side of the frame on the protected side of the wall. See attached detail drawings for Access Controlled doors.

.2 **Cabinet must be accessible and serviceable**.

.3 Supply and install conduit, sized to fit cables, from this cabinet to another T2 in the area **OR** to a J3 junction box in the area **OR** to the splitter trough on the A4 backboard (as per floor plans).

.4 Supply, install and label **one** General C0764A cable (or equivalent) and **one** 4 conductor **18 AWG** solid copper LVT cable in the conduit from the T2 cabinet to the splitter trough on the A4 backboard in Room 140.

Note: Supply no less than 6000mm of cable slack at the A4 splitter trough.

.13 **T3** "T" Cabinet (450H X 450W X 100D)

.1 Supply and install one surface mounted 450H X 450W X 100Dmm Type "T" cabinet, complete with 3/4" wood back, centered 305mm A.F.F..

.14 **T4** "T" Cabinet (450H X 450W X 100D)

.1 Supply and install one 450H X 450W X 100Dmm Type 1 Telephone cabinet surface mounted 150mm A.F.F.. Surface mount the cabinet so that it remains accessible yet concealed by the Guard / Matron's console.

.2 Supply and install a duplex 120VAC receptacle in the top left corner inside this cabinet (mount receptacle on the side of the cabinet not the back). This duplex receptacle shall be wired to a separate 120VAC circuit, on its own breaker, which is connected to emergency backup power (when available).

.3 Supply and install two 32mm conduits from this cabinet to the J6 junction box.

.4 Supply, install and label five Belden 8221 co-ax video cables (or equivalent) in each conduit from this cabinet to the splitter trough on the A5 backboard (total of 10 cables from each T4).

.5 Supply, install and label two Category 5e (Cat5e) cables in each conduit from this cabinet to the splitter trough on the A5 backboard (total of 4 cables from each T4).

Note: Supply no less than 6000mm of cable slack at the T4 cabinet.
Supply no less than 6000mm of cable slack at the A5 splitter trough.

.15 **T7** "T" Cabinet (450H X 305W X 100D)

.1 Supply and install one recessed 450H X 305W X 100Dmm Type 1 Telephone cabinet, complete with 3/4" wood back (BEL Products TCFKO18124WB or equivalent) centered 2250mm A.F.F..

.2 Supply and install one duplex 120VAC receptacle in the top left corner inside this cabinet (mount receptacle on the side of the cabinet not the back). This duplex receptacle shall be wired to a separate 120VAC circuit, on its own breaker, which is connected to emergency backup power (when available).

.3 Supply, install and connect one 24VAC 75VA transformer and one RELECO C3-A30X/24VAC 3PDT relay (or equivalent) inside this cabinet.

.4 Connect Riot Alarm Panic pushbuttons (see device 53), Riot Alarm horns (see device 04) and the Riot Alarm RESET pushbutton (see device 73) to the 3PDT relay inside the T7 cabinet as per attached detail drawing "SCHEMATIC - CELL BLOCK RIOT ALARM" and as per floor plans.

.5 Supply and install one 19mm conduit from the T7 cabinet to the splitter trough on the A4 backboard (as per floor plans).

.6 Supply, install and label **three** 4 pair telephone (Cat3) cable(s) in the conduit from the T7 cabinet to the splitter trough on the A4 backboard in Room 140.

.7 Test **each** Riot Alarm Panic pushbutton for proper operation. The panic pushbuttons latch the horn(s) and the Reset pushbutton silences the horn(s).

.16 **01** Device Box

.1 Supply and install one recessed 76H X 100W X 63Dmm **double** gang device box c/w blank cover plate 150mm below finished ceiling but no higher than 2400mm A.F.F..

.2 Supply and install conduit from this device box to another device/junction box in the area **OR** to the splitter trough on the A4 backboard (as per floor plans).

.3 Supply, install and label **two** 4 pair telephone (Cat3) cables in the conduit from this device box to the splitter trough on the A4 backboard.

.17 **02** Device Box

.1 Supply and install one recessed **double** gang 2-5/8" deep weatherproof device box c/w blank weatherproof cover plate. Mount device box 3050mm above ground level on the exterior side of the building. This recessed device box can be wall or soffit mounted and flush with the cladding or soffit.

.2 Supply and install conduit from this device box to another device/junction box in the area **OR** to the splitter trough on the A4 backboard (as per floor plans).

.3 Supply, install and label **two** 4 pair telephone (Cat3) cables in the conduit from this device box to the splitter trough on the A4 backboard.

.18 **04** Riot Alarm Horn

.1 Supply, install and connect one Edwards 874-G5 24VAC vibrating alarm horn (or equivalent) in a recessed 4" square outlet box mounted 100mm below finished ceiling but no higher than 2400mm A.F.F..

.2 Supply and install conduit from this outlet box to a Riot Alarm Reset Pushbutton outlet box in the area **OR** to the T7 cabinet (as per floor plan).

.3 Supply, install and label **one** 4 conductor **18 AWG** solid copper LVT cable in the conduit from this outlet box to the T7 cabinet.

.4 Connect vibrating alarm horn to the 3PDT relay in the T7 cabinet as per attached detail drawing “SCHEMATIC - CELL BLOCK RIOT ALARM”.

.19 **11** Square Outlet Box

.1 Supply and have door-frame fabricator spot weld one 100H X 100W X **40**Dmm square outlet box on top of the frame as per attached detail drawing “PROTECTED DOOR - ELEVATION OF SINGLE DOOR WITH DOOR CONTACT”.

.2 Drill a 19mm hole 75mm (center point) from the edge of the door casing to allow for door switch installation and access to frame mounted outlet box.

.3 Supply and install conduit from the outlet box in the door frame to a 76H X 50W X 63Dmm single gang pull box mounted above the door on the protected side of the wall. This pull box shall have a blank cover plate installed and shall be mounted above the suspended ceiling **OR** 100mm below the ceiling if the ceiling is finished.

.4 Supply and install conduit from the pull box to a device/junction box in the area **OR** to the splitter trough on the A4 backboard (as per floor plans).

.5 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from the outlet box in the door frame to the splitter trough on the A4 backboard.

.6 The cable slack at the outlet box in the door frame shall be tucked into the outlet box to protect the cable from damage.

.20 **12** Square Outlet Box

.1 Supply and have door-frame fabricator spot weld one 100H X 100W X **40**Dmm square outlet box on top of the door frame as per attached detail drawing(s) for access controlled doors.

.2 Drill a 19mm hole 75mm (center point) from the edge of the door casing to allow for door switch installation and access to frame mounted outlet box.

.3 Supply and install conduit from the outlet box in the door frame to a T2 cabinet in the area (as per floor plan).

.4 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from the outlet box in the door frame **to the T2 cabinet**.

.5 The cable slack at the outlet box in the door frame shall be tucked into the outlet box to protect the cable from damage.

.21 **13** Device Box

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate. Mount device box 50mm from the edge of the overhead door track and level with the top of the door.

.2 Supply and install conduit from this device box to another device/junction box in the area **OR** to the splitter trough on the A4 backboard (as per floor plans).

.3 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from this device box to the splitter trough on the A4 backboard.

.4 The cable slack at the device box shall be tucked into the device box to protect the cable from damage.

.22 **14** Square Outlet Box

.1 Supply and have door-frame fabricator spot weld one 100H X 100W X **40**Dmm square outlet box on top of the door frame as per attached detail drawing(s) for access controlled doors.

.2 Drill a 19mm hole 75mm (center point) from the edge of the door casing to allow for door switch installation and access to frame mounted outlet box.

.3 Supply and install conduit from the outlet box in the door frame to a T2 cabinet in the area (as per floor plan).

.4 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from the outlet box in the door frame to the splitter trough on the A4 backboard.

.5 Supply, install and label a second 4 pair telephone (Cat3) cable in the conduit from this outlet box in the door frame **to the T2 cabinet**.

.6 The cable slack at the outlet box in the door frame shall be tucked into the outlet box to protect the cable from damage.

.23 **21** Device Box

.1 Supply and install one recessed 76H X 150W X 63Dmm **three** gang device box c/w blank cover plate centered 1500mm A.F.F..

.2 Supply and install conduit from this device box to another device/junction box in the area **OR** to the splitter trough on the A4 backboard (as per floor plans).

.3 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from this device box to the splitter trough on the A4 backboard.

.24 **31** Conduit to Electric Strike

.1 Supply and install conduit from a point 25mm above the strike plate inside the door frame to a T2 cabinet in the area (as per floor plans).

.2 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from the door frame **to the T2 cabinet**. Leave 610mm of slack inside the door frame.

Note: For more information, see attached detail drawing(s) for access controlled doors.

.25 **41** Octagon Outlet Box

.1 Supply and install one 4" octagon outlet box **located no more than 305mm above** the suspended ceiling. If the ceiling is finished, the outlet box should be recess mounted and supplied with a cover plate.

.2 Supply and install conduit from this outlet box to a device/junction box in the area **OR** to the splitter trough on the A4 backboard (as per floor plans).

.3 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from this outlet box to the splitter trough on the A4 backboard.

Note: Supply no less than 3600mm of cable slack at the outlet box.

.26 **44** Device Box

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate centered 100mm above the top of the door frame on the protected side of the wall as per attached detail drawing(s) for access controlled doors.

.2 Supply and install conduit from this device box to a T2 cabinet in the area (as per floor plans).

.3 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from this device box **to the T2 cabinet**.

Note: For more information, see attached detail drawing(s) for access controlled doors.

.27 **52** Device Box

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate. Mount device box below the finished counter top in a location which is accessible. Installation on a wall below a removable drawer or at the rear or side of the installed millwork is acceptable.

.2 Supply and install conduit from this device box to another device/junction box in the area **OR** to the splitter trough on the A4 backboard (as per floor plans).

.3 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from this device box to the splitter trough on the A4 backboard.

Note: Supply no less than 3600mm of cable slack at the device box.

.28 **53** Riot Alarm Panic Pushbutton

.1 Supply, install and connect one **red** 57mm mushroom head “Square D” 9001KR25R momentary pushbutton with **two** “Square D” 9001KA2 normally open contact blocks and **one** “Square D” 9001K25 Flush Plate in a recessed 76H X 50W X 63Dmm single gang device box centered 1350mm A.F.F..

.2 Supply and install conduit from this device box to another device box in the area **OR** to the T7 cabinet (as per floor plans).

.3 Supply, install and label **one** 4 conductor **18 AWG** solid copper LVT cable in the conduit from this device box thru all junction/device boxes and terminate at the T7 cabinet.

.4 Connect the panic switch to the 3PDT relay in the T7 cabinet as per attached detail drawing "SCHEMATIC - CELL BLOCK RIOT ALARM".

.29 **61** Device Box

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate centered 1300mm A.F.F. **on the unprotected side of the wall** as per attached detail drawing(s) for access controlled doors.

.2 Supply and install conduit from this device box to a T2 cabinet in the area (as per floor plans).

.3 Supply, install and label **one** General C0764A cable (or equivalent) in the conduit from this device box **to the T2 cabinet**.

Note: For more information, see attached detail drawing(s) for access control on doors with wall mounted readers.

.30 **73** Riot Alarm Reset Pushbutton

.1 Supply, install and connect one **green** 57mm mushroom head "Square D" 9001KR25G momentary pushbutton with **one** "Square D" 9001KA3 normally closed contact block and **one** "Square D" 9001K25 Flush Plate in a recessed 76H X 50W X 63Dmm single gang device box centered 1500mm A.F.F..

.2 Supply and install conduit from this device box to the T7 cabinet (as per floor plans).

.3 Supply, install and label **one** 4 conductor **18 AWG** solid copper LVT cable in the conduit from this device box to the T7 cabinet.

.4 Connect reset pushbutton to the 3PDT relay in the T7 cabinet as per attached detail drawing "SCHEMATIC - CELL BLOCK RIOT ALARM".

.5 Label pushbutton:

RIOT ALARM
RESET

.31 **80** Outlet Box (two or three wall mounted monitors)

.1 Supply and install 450mm x 1800mm G1S plywood backing centered 2467mm A.F.F.. See attached detail drawing titled DETAIL DRAWING - CCVE - PLYWOOD BACKING FOR WALL MOUNTED MONITORS for examples of typical installations.

.2 Supply and install one 4" octagon outlet box, 2-1/8" deep, c/w blank cover plate 100mm below the top of the plywood backing.

.3 Supply and install conduit from this outlet box to a device/junction box in the area **OR** to the A5 splitter trough in Room 140 (as per floor plans).

.4 Supply, install and label **four** Belden 8221 co-ax video cables and one Category 5e cable in the conduit from this outlet box to the A5 splitter trough in Room 140.

.5 Supply and install one recessed quad 120VAC receptacle 150mm to the right of the outlet box.

Note: Supply no less than 6000mm of cable slack at the outlet box.
Supply no less than 6000mm of cable slack at the A5 splitter trough.

.32 **81** Octagon Ceiling Mounted Outlet Box (2-1/8" Deep)

.1 Supply and install one recessed 4" octagon outlet box, 2-1/8" deep, c/w blank cover plate in the ceiling. If ceiling is suspended, the octagon outlet box shall be located 305mm **above** the suspended ceiling.

.2 Supply and install conduit from this outlet box to a device/junction box in the area **OR** to the A5 splitter trough (as per floor plans).

.3 Supply, install and label **one** Category 5e (Cat5e) cable in the conduit from the outlet box to the A5 splitter trough.

Note: Supply no less than 2400mm of cable slack at the outlet box.
Supply no less than 6000mm of cable slack at the A5 splitter trough.

.33 **82** Octagon Ceiling Mounted Outlet Box (2-1/8" Deep)

.1 Supply and install one recessed 4" octagon outlet box, 2-1/8" deep, corner mounted in the ceiling (as per floor plan). See attached detail drawing titled DETAIL DRAWING - CELL BLOCK CCVE - OCTAGON BOX FOR CORNER MOUNT DOME CAMERA for more information regarding exact location in the corner of the ceiling.

.2 Supply and install conduit from this outlet box to a device/junction box in the area **OR** to the A5 splitter trough (as per floor plans).

.3 Supply, install and label **two** Category 5e (Cat5e) cable in the conduit from the outlet box to the A5 splitter trough.

Note: Supply no less than 610mm of cable slack at the camera housing.
Supply no less than 6000mm of cable slack at the A5 splitter trough.

.34 **83** Device Box

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate. Mount device box 305mm below finished ceiling but no higher than 2400mm A.F.F..

.2 Supply and install conduit from this device box to another device/junction box in the area **OR** to the A5 splitter trough (as per floor plans).

.3 Supply, install and label **one** Category 5e (Cat5e) cable in the conduit from this outlet box to the A5 splitter trough.

Note: Supply no less than 1200mm of cable slack at the outlet box.
Supply no less than 6000mm of cable slack at the A5 splitter trough.

.35 **84** Octagon Ceiling Mounted Outlet Box (2-1/8" Deep)

.1 Supply and install one recessed 4" octagon outlet box, 2-1/8" deep, c/w blank cover plate in the ceiling. If ceiling is suspended, the octagon outlet box shall be located 305mm **above** the suspended ceiling.

.2 Supply and install conduit from this outlet box to a J7 junction box in the area (as per floor plan).

.3 Supply, install and label **one** Belden 8221 co-ax video cable, **one** Category 5e (Cat5e) cable and **one** 4 conductor **18 AWG** solid copper LVT cable in the conduit from this outlet box to the T3 cabinet in Room 140.

Note: Supply no less than 2400mm of cable slack at the outlet box.
Supply no less than **6000mm of cable slack at the T3 Cabinet**.

.36 **85** Octagon Ceiling Mounted Outlet Box (2-1/8" Deep)

.1 Supply and install one recessed 4" octagon outlet box, 2-1/8" deep, c/w blank cover plate in the ceiling. If ceiling is suspended, the octagon outlet box shall be located 305mm **above** the suspended ceiling.

.2 Supply and install conduit from this outlet box to a J8 junction box in the area (as per floor plan).

.3 Supply, install and label **one** Category 5e (Cat5e) cable in the conduit from this outlet box thru all junction boxes to the A5 splitter trough.

Note: Supply no less than 2400mm of cable slack at the outlet box.
Supply no less than 6000mm of cable slack at the A5 splitter trough.

.37 **86** Device Box

.1 Supply and install one **single** gang 2-5/8" deep weatherproof device box c/w blank weatherproof cover plate. Mount 3000mm above concrete sidewalk or above ground level on the exterior side of the building.

.2 Supply and install conduit from this device box to another device/junction box in the area **OR** to the A5 splitter trough (as per floor plans).

.3 Supply, install and label **three** Category 5e (Cat5e) cables in the conduit from this device box to the A5 splitter trough.

Note: Supply no less than 1200mm of cable slack at the device box.
Supply no less than 6000mm of cable slack at the A5 splitter trough.

.38 **91** Device Box

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate centered 1400mm A.F.F..

.2 Supply and install conduit from this device box to a J7 junction box in the area (as per floor plan).

.3 Supply, install and label **one** Belden 8422 cable and **one** Category 5e (Cat5e) cable in the conduit from this device box to the T3 cabinet in Room 140.

Note: Supply no less than **6000mm of cable slack at the T3 cabinet**.

.39 **92** Device Box

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate centered 1400mm A.F.F..

.2 Supply and install conduit from this device box to a J8 junction box in the area (as per floor plan).

.3 Supply, install and label **one** Belden 8422 cable (or equivalent) in the conduit from this device box to the J8 junction box.

Note: Supply no less than 4500mm of cable slack at the J8 junction box.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 – Common Work Results – Electrical

1.2 REFERENCES

.1 NBC-2010, National Building Code of Canada.

.2 All equipment shall be listed by Underwriters' Laboratory of Canada. The entire installation shall be in full compliance with the 2010 National Building Code, 2012 Canadian Electrical Code, National Standard of Canada/Underwriters' Laboratory of Canada Standards, and the Saskatchewan Human Rights Commission, Accessibility Standard.

.3 The system design, installation and verification, shall comply with the following National Standard of Canada/Underwriters' Laboratories of Canada Standards:

.1 CAN/ULC-S524-M06 "Standard for the Installation of Fire Alarm Systems".

.2 CAN/ULC-S536-M04 "Standard for the Inspection and Testing of Fire Alarm Systems".

.3 CAN/ULC-S537-M04 "Standard for the Verification of Fire Alarm System Installations".

1.3 DESCRIPTION OF SYSTEM

.1 Provide a complete micro processor based, supervised, non-coded, closed circuit, annunciated, single stage and addressable fire alarm system as shown on the drawings and as herein specified.

.2 The system design, installation and verification shall comply with the United States ADA Accessibility Guidelines.

.3 Addressable fire alarm system includes:

.1 Control panel programming revisions to carry out fire alarm and protection functions including receiving alarm signals, initiating alarm, supervising system continuously, and initiating trouble signals.

.2 Trouble signal indication.

.3 Manual alarm stations.

.4 Automatic alarm initiating devices.

.5 Audible signal devices.

.6 Visual alarm signal devices.

.7 End-of-line devices

.8 Ancillary devices.

1.4 SYSTEM OPERATION

.1 Single-stage addressable operation.

.2 If an alarm is caused by activation of any of the following devices:

.1 Pulling a manual station;

.2 Operation of an automatic fire alarm thermal detector;

.3 Operation of a smoke detector (ceiling or duct mounted); or

.4 Operation of a sprinkler flow valve

The following shall occur:

.1 The evacuation alarm shall sound on all audible signal appliances throughout the building. All strobe lights installed as visual alarms shall flash.

.2 The main control panel shall record the alarm location and address alarm type (pull station, smoke detector, thermal detector, etc.), location description along with time. The control panel and remote annunciator panel LCD shall indicate a priority alarm and will also advise of location, type and time.

.3 The evacuation alarm shall continue until the alarm is acknowledged and the system is silenced. The device causing the alarm shall cause the system to remain in alarm until the device is cleared or reset, and the system alarm is acknowledged.

.4 The system shall automatically send a signal to the fire department. The fire alarm system shall be interconnected to the new building security alarm panel, which provides a signal to the Owner's off-site central monitoring agency. The fire department connection to the security alarm panel shall be the responsibility of the Owner to maintain.

.5 Signals shall be sent to the building management system for the shut down of all ventilation systems in the correct sequence for shut-down. Control relay modules shall be provided for each mechanical ventilation unit to shut-down. Shut-downs shall be direct to each unit and not through any building management system.

.6 The fire alarm system shall release all electromagnetic locks at egress doors by providing a fire alarm module to open the magnetic lock power circuit at the door location.

.7 A subsequent alarm from any receiving circuit (device) shall cause the audible signals to sound again. Subsequent alarms shall be recorded by the system in order of priority and then in the order in which they occur. Subsequent alarms may occur prior to acknowledgement of the initial alarm.

.8 All alarms shall be recorded by the main fire alarm panel.

.3 The entire system shall be electrically supervised against opens, shorts and grounds on any wire on the alarm initiating circuits or any wire on the signal circuits. Trouble conditions shall display as a lower priority than an alarm. Fault isolators shall be provided for all initiating circuits which pass through each floor and each fire barrier and shall be provided every twenty five (25) devices minimum.

.4 Coordinate with the Mechanical Contractor to ensure that all necessary wiring and controls have been provided to accommodate fire alarm interconnections with the sprinkler and mechanical control systems.

.5 Ensure that all necessary wiring and controls have been provided to accommodate fire alarm interconnections to shut down the make-up air, exhaust fans, central air conditioning units, and

release of all door hold open devices. Provide separate fire alarm control modules for all mechanical shut down points and/or starters.

.6 There shall be a capability provided in the fire alarm control panel and remote annunciator panel that permits the operator to bypass or disable the shutdown of the mechanical ventilation system during testing of the fire alarm systems; for testing purposes only. The Electrical Contractor with the Mechanical Contractor shall confirm the ventilation units to be controlled on site the ventilation units to be bypassed during the testing. Activation of this bypass shall initiate a trouble condition on the fire alarm system.

.7 Sprinkler and fire hose cabinet shut-off valves equipped with tamper switches shall be connected to the fire alarm system and each assigned a separate address point. Tamper switches shall cause a trouble indication when the shut-off valve is closed or partially closed. Coordinate final location and quantity with the Sprinkler Contractor and Mechanical Contractor.

.8 Provide a control relay module at the door access control panel to release and reset all electric locks simultaneously.

.9 All new points shall be included into the computer software program, and the software program shall be regenerated twice. The first regeneration shall be provided during the completion of the fire alarm system. The second regeneration shall be provided approximately three months after the first regeneration and shall reflect any contract changes and any owner initiated changes.

.10 All new fire alarm equipment shall be powered from a single source as shown on the drawings.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 01 – Common Work Results – Electrical.

.2 Shop drawings shall include but not be limited to complete floor plans, riser, equipment, control schematics and wiring diagrams. Each component shall be identified as to manufacture, type, description and catalogue number.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for Fire Alarm System for incorporation into electrical maintenance and operating manual specified in Section 16050 – Basic Electrical Materials and Methods.

.2 Include:

.1 Overall system riser wiring diagram identifying control equipment, initiating addresses, signalling circuit; identifying terminations, terminal numbers, conductors and raceways.

.2 Details and performance specification of devices added for control, annunciation and peripherals with item by item cross reference to specification for compliance.

.3 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.

.4 Technical data - illustrated parts lists with parts catalogue numbers.

.5 Copy of approved shop drawings.

.6 List of recommended spare parts for system.

.7 Certification of tests, upon completion, shall be issued in writing to the Consultant by the manufacturer's representative.

.8 Certification shall include audibility test results of the fire alarm system measured within each room affected by the project as required by the National Building Code.

1.7 MAINTENANCE

.1 Provide one year's free maintenance with three (3) free inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Engineer.

PART 2 Products

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.1 Control Panel

.2 Remote Annunciator Panel

.3 Remote Booster Power Supply Panels

.4 Manual Pull Stations

.5 Detectors

.6 Duct Detectors

.7 Remote Keyed Test Stations for Duct Detectors

.8 Monitor Modules

.9 Control Modules

.10 Fault Isolator Modules

.11 Audible/Visual Fire Alarm Signal Devices

.2 All products shall have been manufactured within at least one year prior to their installation. Products older than this criterion will be rejected. Provide supporting documents within the shop drawing submission.

.3 All devices shall be installed in outlets boxes.

.4 All wiring shall be run in conduit raceway.

.5 All equipment and devices shall be manufactured by **GE Troy Life Safety (Edwards) or Notifier.**

.6 The new materials are as specified herein:

2.2 FIRE ALARM CONTROL PANELS

.1 Fire Alarm Control Panels shall be modular and solid state design for ease of expansion and servicing. The control panels shall continuously supervise all field wiring and control panel modules connected to alarm initiating devices, alarm signalling devices, annunciator indications and battery connections for open-circuits, shorts, grounds and placement.

.2 The control panels shall be as located on the floor plans. The panel covers shall be hinged, and shall have clear windows and locking mechanism to prevent tampering. Panel cabinets/back-boxes and chassis shall be provided for surface and flush mounted applications. In finished areas, the panels shall be flush mounted in existing or new partitions. Surface boxes shall be provided for panels located in utility rooms such as electrical rooms, telephone rooms and fan rooms.

.3 All controls shall be labelled, all addresses shall be identified, and the control panels shall be provided with permanently mounted operating instructions.

.4 The control panel shall maintain the following features:

.1 All required hardware and software to allow the panel configuration and operation to be changed. Field programmable at the panel. Systems that require off-site programming will not be accepted.

.2 The memory data for panel configuration and operation shall reside in non-volatile memory or battery-backed RAM.

.3 Multi-port motherboard to facilitate plug-in modules.

.4 All plug-in modules shall be supervised against removal, improper module position and incorrect module type.

.5 Absolute electronic protection of all circuitry such that any module may be inserted or removed, while the control panel is fully powered without causing an alarm condition, or any damage to the equipment.

.6 Backlit LCD display indicating device location, address designation, and time of event.

.7 Keypad for panel and system programming.

.8 Built-in alarms, trouble, security and supervisory relays.

.9 Provide switches for Panel Setup, Disable/Test, Reset, Drill (via monitor modules), Manual Evacuation Alarm, Acknowledgement/Panel Silence, Alarm Silence, and Status.

.10 Provide individual supervisory LED’s for Power, Fire Alarm, Pre-Alarm, Security, Supervisory, Disable/Test, System Trouble, CPU Failure, Low Battery, Ground Fault, Signals Silenced, Drill. Remote Silence and Remote Reset inputs shall also be provided.

.11 Built-in Degraded Mode operation. In the event of a CPU failure, the system is capable of providing an alarm in the event of a fire condition.

.12 Provide a day/night mode to enable a higher level of detector sensitivity (for example) during a buildings non-occupied time and a lower sensitivity during heavily occupied hours. Multiple sensitivity levels shall be available for pre-signal alarm based on pre-determined levels of alarm. These levels may be set manually, or can change automatically between day and night.

.13 Alarm verification section per point with tally. Interrogate each device, and interpret the response from each device, analyzing the response from each device according to specific address, type of device and its present status.

.14 All signal circuits shall be installed as per the signal circuit notations as shown on the drawings and herein specified. All signal circuits shall be Class ‘B’ type. Class ‘B’ loops shall run on separate sides of the corridors and shall not be run together. Refer to drawings for the number of signal circuits required.

.15 Provide appropriate number of circuits to power all strobe lights. Strobes shall be connected to the same panel as the surrounding initiating devices. All strobe circuits shall be fully synchronized.

.5 For control of addressable devices, the fire alarm control panels shall have the following features:

.1 Provide plug-in modules to monitor (1) one intelligent Signalling Line Circuits (addressable Fault-Tolerant Class 'B' loops). All initiating circuits shall be Class 'B' type.

.2 Have the minimum capacity to communicate with up to 125 detectors and 125 modules (N.O. manual stations, two-wire smoke, notification, or relay) per Signalling Line Circuit (addressable loop); to a maximum of 250 devices per loop/2500 per fire alarm control panel.

.3 Provide a numeric display which shall uniquely show the device type, its specific address and device location.

.4 Provide alarm confirmation by device. To avoid spurious nuisance alarms, the control panel will identify the device and locations as well as noting its continuing alarm status thereby case the control panel to initiate the required sequence.

.5 Detect and identify a loop short circuit, ground or open circuit.

.6 Through the use of fault isolator modules, immediately isolate the wiring fault so that as possible field devices are made inoperative with all other devices remaining fully operational. As a minimum, fault isolators shall be provided at every fire separation and barrier and every twenty five (25) devices.

.7 Provide a minimum 30% spare capacity on each loop for future expansion.

.6 Provide compatible contact for connection to telephone system to close at the initiation of any signal device.

.7 Provide a software programming scheme in the main control panel to bypass the shutdown of ventilation equipment feature during fire alarm testing purposes only. Activation of this scheme shall initiate a trouble condition on the fire alarm system.

.8 Provide a manually operated switch in the control panel that will permit the resetting of the electromagnetic locks in the facility following the disabling of the locks upon activation of fire alarm system.

.9 The fire alarm control panel shall have the capacity to operate a minimum of two (2) visual alarm circuits for the facility.

2.3 REMOTE ANNUNCIATOR PANEL

.1 Remote Annunciator Panels: Intelligent annunciator panels shall be as located on the floor plans. The annunciator panels shall include the following features:

.1 80-character backlit LCD fire annunciator panel, compact design, semi-flush cabinet for mounting in new and existing partitions. Cabinet shall include hinged door with key lock.

.2 Power from the host control panel.

.3 Non-volatile memory.

.4 Mimic all display information on the host control panel.

.5 Keypad with audible feedback.

.6 LED indication for Power, Fire, Security Alarm, Supervisory, Trouble, Signals Silence, CPU Failure.

.7 Switches for Acknowledge, Signal Silence, System Reset, and Lamp Test.

.2 Provide a manually operated switch in the annunciator panel to bypass the shutdown of ventilation equipment during fire alarm testing purposes only. Activation of the bypass switch shall initiate a trouble condition on the fire alarm system.

.3 Provide a manually operated switch in the annunciator panel that will permit the resetting of the electromagnetic locks in the facility following the disabling of the locks upon activation of the fire alarm system.

2.4 DEVICES

.1 **Manual Pull Stations:** Manual fire alarm pull stations shall be addressable single-stage, pull lever, dual action type, finished in red metal semi-flush mounting, complete with second stage key. Manual pull stations shall be mounted up 1350mm.

.2 **Detectors:** Provide multi-sensor low-profile intelligent analog detectors designed to increase immunity to false alarms. The detectors shall be microprocessor-based, combination photoelectric and thermal technology. The detector shall adjust its sensitivity automatically without needing operator intervention or control panel programming. The thermal sensing rating shall be fixed-temperature set point 135°F (57°C). Includes LED red indicator when in alarm; flashes green in standby for normal conditions. The device shall include LED red indicator flashes when in alarm, flashes green when polled in normal conditions.

.3 **Smoke Detector Protective Cages:** Detectors mounted in Rooms 133,134, 137, 138, 144, 146, 150, 151, and 156 shall have protective cages installed as indicated on the drawings and details. Cages shall be one of the following models: Simplex model 2098-9829C, GE security model 6255-004 or Notifier G1A-2.

.4 **Thermal Detectors:** Provide low-profile intelligent thermal detectors using thermistor sensing circuit to produce 135°F (57°C) fixed temperature. Includes LED red indicator when in alarm; flashes green in standby for normal conditions.

.5 Thermal detectors located in high ambient temperature rooms such as Boiler Rooms, Mechanical Rooms, attic spaces, shall be fixed temperature, 200°F (93°C).

.6 **Duct Detectors:** Photoelectric type smoke detectors shall operate on the light scattering principle and be activated by smoke particles. Smoke duct detectors shall be plug-in base type equipped with sampling tubes and framework to support the sampling tubes. LED's shall be provided on the detector to indicate an alarm condition. Duct detectors shall be of the same manufacturer as the fire alarm system from which the device is connected.

.7 **Monitor and Control Relay Modules:** Provide addressable monitor and control relay modules to interface to conventional non-addressable devices. All modules shall be of the same manufacturer as the fire alarm system from which the devices are connected.

.1 Monitor modules shall be installed to supervise a circuit of dry-contact input devices, such as conventional thermal detectors and pull stations, or monitor and power a circuit of two-wire smoke detectors. Powered directly by the SLC loop, high-noise (EMF/RFI) immunity, LED flashes green for normal operation and latches on steady red to indicate alarm.

.2 Control modules provide the control panels a circuits for operating horns, strobes, speakers, etc., or to monitor a telephone circuit. Addressability allows the control module to be activated, either manually or through panel programming on a select zone or area of coverage. LED blinks green each time a communication is received from the control panel and turns on in steady red when activated.

.3 Relay modules provide the system with a dry-contact output for activating a variety of auxiliary devices, such as fans, dampers, control equipment, etc. Addressability allows the dry contact to be activated, either manually or through panel programming. LED blinks green each time a communication is received from the control panel and turns on in steady red when activated.

.4 In locations where there are a multiple of devices required to be monitored, 10-input monitor modules may be supplied and installed. Such locations best suited for this requirement are at the main sprinkler assembly where multiple points are required to be monitored by the fire alarm system. The 10-input monitor module shall be mounted in a surface mounted lockable cabinet.

.8 **Fault Isolators:** Provide fault isolator modules to detect and isolate short-circuited segments of the Class 'A' fault tolerant loops. The module shall automatically determine return-to-normal condition of the loop and restore the isolated segment.

.9 **End-of-Lines:** End-of-line devices for signalling zones and sprinkler flows and tampers shall be mounted in separate single gang box with red cover plate. Mount end of line in wall above device but not above 1800 mm above finished floor.

.10 **Audible/Visual Fire Alarm Signalling Devices:** Audible and visual signal devices shall be combined horn/strobe type, surface wall mounted unless otherwise noted. The horns shall produce a code-3 temporal pattern. The horn shall have a minimum dBA output of approximately 92 dBA. The horns shall be provided with adjustable audible output with High setting for 98 dBA output or Low setting for 94 dBA sound output. The synchronizing strobe shall produce white light with a minimum of 75 candela across all viewing angles in common areas. Signal devices shall be surface wall mounted on flush outlet boxes.

.11 Ceiling mounted audible/visual signal devices shall be low-profile, combination horn/strobe type, surface mount application, white textured housing and clear polycarbonate lens. The horns shall produce a code-3 temporal pattern and shall have a minimum dBA output of 92

dBA. The synchronizing strobe shall produce white light with a minimum 75 candela across all viewing angles common areas.

.12 Audible/visual signalling devices shall be WHITE and shall be labelled with 'FIRE markings in RED.

.13 All signal circuits shall be supervised. All signal devices shall be synchronized.

2.5 SPARE DEVICES

.1 Provide the following spare devices with material, labour, and verification to install the devices along with 10m of conduit and wire to each device:

.1 Two (2) pull stations
.2 Four (4) multi-sensor detectors
.3 Six (6) monitor modules
.4 Six (6) control relay modules
.5 Four (4) horn/strobes, surface ceiling mounted
.6 Four (4) horn/strobe, surface wall mounted
.7 One (1) duct detector

PART 3 Execution

3.1 INSTALLATION

.1 The contractor must make available to the Owners a local service department of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repairman available to the Owner on a 24 hours' notice. The systems shall be guaranteed for a period of one year. Refer to section 260501 – Common Works Results. Provide, during the guarantee period, all service, maintenance, parts, etc., required for the normal operation of the systems, such that the Owner need not purchase additional maintenance agreement or contracts. The manufacturer shall visit the jobsite a minimum of once every four (4) months during the guarantee period to perform above noted maintenance at no cost to the owner.

.2 The overall system co-ordination shall be the responsibility of the contractor, and he shall ensure that all of the necessary system components are installed to result in a complete, workable system.

.3 All field devices including manual pull stations, detectors, monitor, control and relay modules shall be externally labelled showing the address and device controlled and monitored. A self-adhesive identification label shall be applied to the device, and shall be 12mm WHITE laminated marker tape with black typed lettering. Identification shall be placed on the inside of doors where doors are either controlled by magnetic door holders, electric locks, or magnetic locks.

.4 Detectors shall be mounted in suitable mounting plates with finish ring. Where shown in proximity to unit heaters, detectors shall be located at least 3000mm from such unit heaters, and

out of line of direct heat. Detectors shall be located 1500mm from any air handling diffusers or grilles.

.5 All ceiling mounted fire detection devices shall be installed as close as possible to the centre of ceilings in rooms, shafts and portions of corridors or as noted on drawings. Detectors in stair shafts shall be safely reachable by ladder. Detectors shall be mounted at highest point of area to be protected. Ensure that these detectors are sufficiently spaced from supply air diffusers, light fixtures and other ceiling mounted items that might block the movement of heat or smoke to the detectors. Smoke detectors shall not be located within 900mm of the peak of a vaulted ceiling.

.6 Duct detectors shall be provided with new sampling tubes and framework to support the sampling tubes. Detector assembly shall be security mounted on the outside of the duct in a location easily accessible for servicing. Detectors shall be located along a straight section of the duct away from bends, silencers, coils and vanes. An air-flow meter shall be used to ensure that the air sample through the detectors is acceptable for the manufacturer's listing requirements.

.7 Where duct detectors are located in areas where it is difficult to reach or access by ladder for verification purposes, remote keyed test stations shall be installed.

.8 Where fire alarm devices are installed within unheated spaces or spaces where temperatures may drop below 0°C, appropriate fire alarm devices intended for those conditions shall be provided.

3.2 WIRING

.1 Perform tests in accordance with Section 260501 – Common Works Results, and CAN/ULC-S537.

.2 All wiring shall be color coded. Wire and conduit necessary to make the system operable shall be provided and installed as instructed by the manufacturer of the fire alarm system. All wiring shall be installed in conduit with a maximum conduit fill of 40%.

.3 Wiring shall be as follows:

.1 Wiring for signal device circuits shall be a minimum #14 gauge RW90, 300 volt, solid copper. Wiring may be run in same conduit system as the initiating circuits.

.2 Addressable devices shall be #18 gauge, twisted shielded jacketed pair. Shielding must be continuous throughout and isolated from ground except at the control panel. All existing shielded wiring being reused for the addressable loops shall be taped at every termination point.

.3 Ancillary circuits shall be #14 gauge RW90, 300 volt, solid copper. Run in separate conduit.

.4 Annunciator wiring shall be as per manufacturer's recommendations.

.5 Interconnection to the Building Security Alarm Panel shall be 2 x Z-wire, 4 conductor #22 AWG solid copper.

.4 All wiring and its installation must comply with all appropriate codes including CAN/ULC-S524-M06. Refer to Appendix 'A' of CAN/ULC-S524-M06 for further requirements.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 – Common Work Results - Electrical, and CAN/ULC-S537.

.2 Manufacturer shall allow for a required amount of on-the-job site assistance for the contractor during the construction period.

.3 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check the entire system to the approval of the Consultant. The manufacturer shall verify the entire system and demonstrate its complete operation to those having jurisdiction.

.4 The manufacturer shall perform a complete verification and inspection of all installed equipment, including each and every component, such as manual stations, automatic detectors, sprinkler switches, audible signalling appliances, station indicating lamps, control equipment, remote peripherals, etc., to ensure the following:

.1 That the type of equipment installed is that designated by the Consultant's specifications and plans;

.2 That the wiring connections to all equipment are correct and in accordance with CSA and ULC requirements;

.3 That the equipment is installed in accordance with the manufacturer's recommendations;

.4 That the regulations concerning the supervision of components have been adhered to (e.g. stations, detectors, signal devices, etc.), and are properly wired and supervised;

.5 That any subsequent changes necessary to conform to the above will be done by the contractor, with technical advice supplied by the manufacturer.

.5 During the period of inspection, the Contractor shall supply to the manufacturer, one (1) electrician and one (1) helper.

.6 The contractor shall also supply any required equipment such as ladders, scaffolding, etc.

.7 To assist the installer in preparing his bid, the manufacturer shall indicate the number of hours necessary to complete this inspection.

.8 Upon completion of the inspection, and when all of the above conditions have been compiled with, the manufacturer shall issue to the Consultant the following:

.1 A copy of the inspecting technician's report, showing the location of each device, and certifying the test results of each device.

.2 A certificate of verification confirming that the inspection has been completed, and showing the condition upon which such inspection and certification have been rendered.

.3 Proof of liability insurance for the inspection.

.9 All verification certificates shall include the testing of the audibility of the signal devices to confirm compliance with the 2010 National Building Code.

3.4 TRAINING

.1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

.2 The Owner's operating and maintenance personnel shall be instructed in the operation and maintenance of the system for a minimum of two separate 2-hour training sessions totally two

(2) hours. Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Salvaging and stockpiling topsoil.

1.2 RELATED WORK

.1	Tree Protection	Section 01 56 39
.2	Site Preparation	Section 02 41 13
.3	Site Grading	Section 31 22 00
.4	Topsoil and Finish Grading	Section 32 91 19
.5	Seeding	Section 32 92 20

Part 2 Products

2.1 MATERIALS

.1 Existing Topsoil: existing natural onsite organic topsoil, capable of supporting good vegetative growth. Existing topsoil shall meet the requirements of Section 32 91 19 – Topsoil and Finish Grading. Do not screen.

.2 Imported Topsoil: topsoil hauled from offsite sources. Imported topsoil shall meet the requirements of Section 32 91 19 – Topsoil and Finish Grading. Do not screen.

Part 3 Execution

3.1 TOPSOIL STRIPPING

.1 Remove vegetation, stones, debris and other foreign material in excess of 50 mm diameter before start of work, per Section 02 41 13 - Site Preparation.

.2 Strip existing topsoil only from those areas that will be disturbed by excavation, filling, road or building construction, or compaction by equipment.

.3 Determine soil stripping depth by taking soil cores within areas to be stripped. Topsoil depth ranges from 150 mm to 250 mm, per Geotechnical Report by Clifton Associates Ltd., (report #S2068), dated on 30 January, 2015, but may be variable throughout the site. Avoid mixing topsoil with subsoil.

.4 Avoid stripping material in either wet or dry conditions to minimize degradation of soil structure.

.5 Imported topsoil (if required) shall be hauled to the site and stockpiled in locations designated by the Owner of General Contractor.

.6 Salvaged existing topsoil exceeding the quantity required shall be disposed of at Contractor's expense.

.7 All planned erosion and sediment control practices shall be in place and functioning properly prior to stripping.

3.2 STOCKPILING

.1 Do not screen salvaged existing topsoil or imported topsoil prior to stockpiling.

.2 Locate stockpiles to avoid slopes, natural or constructed drainage, and traffic routes.

.3 No soil stockpile shall exceed 2.5 meters in height.

.4 All topsoil stockpiles shall be protected from sediment erosion by surface roughening, watering, and perimeter silt fencing.

.5 Stabilize stockpiles within seven (7) days of stockpile formation by seeding with a temporary cover crop such as oats or barley nurse crop, or approved equivalent, or the approved specified final seed mixture. Maintain vegetative cover throughout life of stockpile; re-seed annually as required.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 The work under this Section shall include area grading of the RCMP Detachment site.

1.2 SAFETY

.1 Excavation shall be in accordance with municipal safety regulations and Occupational Health and Safety recommendations.

1.3 EXISTING UTILITIES

.1 Locate buried utilities and services prior to excavation.

.2 Locations of any utilities and services on the Drawings are approximate only. Further utilities and services may exist in addition to those shown.

1.4 PROTECTION OF PROPERTY

.1 All work shall be executed in such a manner as to protect private property, fences, utility poles, survey pins and markers, manholes, valve boxes and other utility appurtenances. Any of these items which are damaged or removed by the Contractor in the performance of the work shall be repaired or replaced to their original condition at the expense of the Contractor.

1.5 MAINTENANCE

.1 Defects or misalignment of any part of the work caused by settlement or faulty workmanship and materials during the maintenance period shall be corrected by the Contractor at their expense.

1.6 TESTING

.1 The Contractor will be responsible for providing all materials testing for site. Nuclear densometer testing shall be provided as specified or as requested by the Consultant. At a minimum, at least one test per 1000 square meters of work area shall be conducted for each 300mm of fill material placed. It will be the Contractors responsibility to take samples to obtain a relevant proctor for the in-situ materials.

.2 Testing results will be submitted to the Consultant for review within three working days of the tests being conducted. The Contractor is to track the location and depths of all testing on a site plan, and provide to the Consultant for review with the test results.

.3 All testing shall be performed by a third party licensed company certified to provide the testing.

.4 The Contractor is to complete a load test with a full water truck or large motor grader prior to the placement of Granular material. If there are areas of concern identified during the load test, the Contractor is to notify the Consultant prior to proceeding.

Part 2 Execution

2.1 SITE GRADING

.1 After the development area has been cleared, grubbed, and stripped of topsoil, commence site grading. Co-ordinate clearing, grubbing, and topsoil stripping with Landscape Drawings and specifications.

.2 Excavate all non-organic materials to the lines and grades shown on the Drawings.

.3 Place excavated material suitable for site grading on fill areas. Place excavated material unsuitable for site grading outside of the gravel areas on site, as indicated by the Consultant, otherwise waste, or dispose of off-site.

.4 Place fill material for site grading in maximum loose lift thickness of 150mm. Compact with mechanical compaction equipment to a minimum 98% of the maximum Standard Proctor Density at optimum moisture content. Import clean fill free of organic materials, rubble, frost, or deleterious materials as necessary.

.5 The allowable moisture content tolerance during fill placement is +/- 2% of optimum. Water or dry soil material to achieve acceptable moisture conditions within the specified limits.

.6 Rocks shall be included as common excavation. Remove rocks over 150mm in diameter from the fill material. No extra payment will be made for rock excavation. Dispose of rocks in a designated area.

.7 No extra shall be allowed for wet excavation.

.8 Remove and dispose of concrete, rubble, organic or frozen material or other debris such as brush and roots from fill and dispose off-site.

.9 Dispose of other excess materials off-site.

.10 Disposal of materials must be to a place approved by local governing authority or Municipality.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 This Section describes the work required for the excavation and backfilling of utility trenches for the installation of water distribution and sewage collection pipelines.

1.2 RELATED WORK

.1 Site Water Utility Distribution Piping: Section 33 11 16.

.2 Site Sanitary Utility Sewerage Piping: Section 33 31 15.

1.3 SAFETY

.1 Trench excavation to be in accordance with municipal safety regulations and Occupational Health and Safety recommendations.

1.4 MAINTENANCE

.1 Defects or misalignment of any part of the work caused by settlement or faulty workmanship and materials during the maintenance period shall be corrected by the Contractor at their expense.

1.5 ROAD CLOSURES & TRAFFIC COORDINATION

.1 Apply for road closures from governing authorities as required.

.2 Coordinate road closures to ensure full access is available to the surrounding community at all times.

Part 2 Products

2.1 BACKFILL MATERIAL

.1 Backfill material over pipelines shall be native excavated material, free of large rocks or boulders, tree stumps, large roots or other deleterious material.

2.2 BEDDING SAND

.1 Bedding sand shall conform to the following gradation limits:

Sieve Size	% Passing
5 mm	95 - 100
2 mm	75 - 100
0.90 mm	40 - 80
0.40 mm	15 - 45
0.16 mm	0 - 20
0.071 mm	0 - 5

2.3 CRUSHED ROCK

.1 Uniformly sized 20mm crushed rock.

Part 3 Execution

3.1 GENERAL SURFACE EXCAVATION

.1 Where applicable, salvage granular material on roadways prior to trenching for placement on road surface after trenching and backfilling.

3.2 WATER AND SEWER UTILITY TRENCH EXCAVATION

.1 Excavate sufficiently to allow for the installation of pipes, fittings and appurtenances to the lines, grades and elevations as shown on the Drawings. Pipes shall rest on approved compacted granular material. Over-excavation shall be brought up to grade using compacted granular material at the expense of the Contractor.

.2 Obey laws, rules and ordinances related to excavation. Trenches shall be sheeted or braced as required by the regulations of the Workers' Compensation Board and to protect life, property, and the Work. Open V-cut methods of excavation may be used provided the trench sides meet regulations.

.3 The maximum trench width at the top of the pipe shall be:

.1 Pipe 900 mm nominal diameter and over; the outside diameter of the pipe plus 600 mm.

.2 Pipes under 900 mm nominal diameter; the outside diameter of the pipe plus 400 mm, except the Contractor will not be required to excavate a trench less than 900 mm wide.

.4 Replace unstable foundation material with compacted crushed rock, or other special foundation as required. This shall be classified as extra work under the terms of the contract. Dewater excavations. No extra shall be allowed for wet excavation.

.5 Unsuitable backfill material such as rocks and chunks of concrete and masonry over 150 mm in diameter shall be hauled from the site and disposed. Clearance between rocks left in place in the trench and the wall of the pipe shall be a minimum of 150 mm, the space between the rock and the pipe shall be filled with selected and compacted material.

.6 Trench bottom shall be free from sloughed sidewall material, large stones, large dirt clods, frozen material or any other condition that could lead to non-uniform or unstable support of the pipe. Keep trench bottom dry during installation of the pipe and embedment material.

3.3 WATER AND SEWER UTILITY TRENCH BACKFILLING

.1 Initial backfilling to 300mm above the pipe shall be pipe bedding as described in the sections for the specific utility.

.2 Above the 300mm layer, the backfill shall be Class II. Approved excavated material shall be placed in maximum 150 mm lifts and compacted to a minimum of 96% of the Standard Proctor Density using mechanical compaction equipment.

.3 Stones and rock over 150mm in diameter, chunks of concrete, organic or frozen material or other debris such as brush and roots are not allowed in the backfill. Large rocks may

be useable for landscaping purposes. Coordinate with Landscape Drawings and Specifications accordingly.

.4 Leave a maximum of 5 m of trench open at the end of a working day. This open trench must be appropriately secured and marked according to rules and regulations in force for the safety of pedestrians and vehicles.

.5 Backfill all excavations prior to leaving site for planned days off.

.6 Where excavation takes place in top soiled areas not intended for gravel, strip and replace the top soil upon the completion of work.

.7 Upon completion of the work, remove all unused or damaged material and other construction debris from the site and dispose at an approved disposal area. Blade all areas smooth and level where work has been performed and leave the site in an acceptable appearance.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this Section.

1.2 WORK INCLUDED

.1 Timber piles as detailed.

.2 Establish and verify required cutoff elevations.

.3 Correct as directed all piles not meeting requirements of this specification at no expense to Owner.

.4 Leave site neat, tidy, free of plant and/or equipment and in safe condition.

1.3 RELATED WORK

.1	Soils Report	Section 02 01 50
.2	Excavation to Working Level	Section 31 23 00

1.4 TESTING AND INSPECTION

.1 An inspector representing the Owner may be present at all times during the driving of all piles, including test piles, to assess the pile materials and driving, and to rule on conformance with this specification. The Contractor shall give adequate notice of not less than one week to the Consultant of his intention to drive piles.

.2 The fees for the pile driving inspection will be paid for by the Owner.

Part 2 Products

2.1 TIMBER PILES

.1 All piles shall be Douglas Fir or Pine, sized as detailed on drawings, conforming to current CSA O56-10 "Round Wood Piles". They shall be cut from sound, live trees, free from shakes, falling breaks, rot, large and unsound knots, large clusters of small knots, large season checks, splints, cat-faces, burls or other defects which materially reduce the strength or durability of the piles, or make them unfit or use for the purpose intended.

.2 Piling showing traces of attack by marine borers, or other worms or insects, or dry rot of fungus will not be accepted.

.3 No swell, hook, or churn butted pilings will be accepted. The minimum diameter at the butt and minimum diameter of the tip shall conform to CSA O56-10.

.4 All piles shall have a natural, uniform taper, and a line drawn from the centre of the butt to the centre of the tip shall not lie less than 50 mm inside the surface pile.

.5 Piling with short bends having a deviation of more than 25 mm in 3 Metres will not be accepted.

.6 Piling with spiral grain, having one complete twist in a length of 12 Metres or less, shall not be accepted.

.7 All piles shall be carefully peeled clean of all bark and have knots trimmed closely to the sides of the piling.

.8 All piles shall be treated by the pressure process with copper naphthenato in accordance with CSA Standard 080 Series 08.

OR

All timber piles shall be treated in accordance with The Best Management Practices for the Use of Treated Wood in Aquatic Environment. The treating plant shall supply a certificate of treatment showing inspection results, preservative retention and certification that the piles have been processed in accordance with CSA 080 Series 08 Specification for Foundation Piles.

2.2 SEALANT

.1 'Kilz' as manufactured by C-I-L, applied in accordance with manufacturer's recommendations.

Part 3 Execution

3.1 TIMBER PILES

.1 Timber piles are to be driven to the full specified length or until the following recognized refusals has been attained. For a pile driven to refusal the following capacities may be considered to have been reached.

NOMINAL PILE SIZE (METRIC)	ENERGY PER HAMMER BLOW (JOULES)	REFUSAL CRITERIA HAMMER BLOWS for 25 mm PENETRATION	ALLOWABLE CAPACITY (KN)
No. 35	32 000 (24 000 ft-lbs)	3	375 (84kips)
No. 30	27 000 (20 000 ft-lbs)	3	285 (64kips)
No. 25	22 000 (16 000 ft-lbs)	3	155 (35kips)

NOTES:

1. For drop hammers, a minimum drop hammer mass of twice the mass of the pile but not exceeding 5 times the mass of the pile is to be used.

2. If a timber pile refuses at less than 4.5 Metres into natural undisturbed soil, the installation procedures will be reviewed and additional recommendations prepared.

3. An Inspector representing the Owner may be on site to document the installation of each driven timber pile.

4. In frozen soil, pre-bore upper 2 M to a minimum diameter of butt diameter + 50 mm.

5. All piles driven within 2.0 M of existing buildings are to be started by pre-boring to a depth of 2.0 M below existing grade or to the underside of the existing foundation, whichever is greater.

.2 The foregoing penetration resistances may be modified by the Consultant to take care of the loss of energy should a follower be used, or should the pile head be crushed during driving, etc.

.3 The Contractor shall submit details, in writing to the Consultant, of the equipment he intends using for approval before commencing any pile driving.

.4 Piling shall be accurately placed and securely held in position while driving. When driven, piles shall be within 40 mm of the position called for on the plan, and shall not deviate more than 6 mm per Metre from the vertical, or the batter called for on the plans.

.5 The timber piles shall be driven in such a way that they are not broken or split. The heads of timber piles shall be square cut with chamfered edges and banded sufficiently by rings or wire mesh to prevent the head from splitting during driving. Provide steel protection for the tips, as required, to prevent damage during driving.

.6 Any pile so damaged in driving, or any pile so far out of position or off vertical or the intended batter, such that in the opinion of the Consultant it is unfit for the intended use, shall be replaced by a minimum of two new piles driven adjacent to the rejected pile at locations determined by the Consultant and a pile cap of reinforced concrete as designed by the Consultant shall be constructed over the pile group, all at the Contractor's expense. Pile lengths specified on drawings are final, in-place lengths measured from cut-off elevations.

.7 In driving, sufficient length above cut-off shall be allowed so that no part of the head damaged or deformed during driving remains in the work.

.8 All piles shall be cut-off within 25 mm of specified cut-off elevation.

.9 Immediately after cut-off, the heads of all piles shall be given two coats of copper naphthenato. There shall be sufficient interval between applications to permit absorption of each coat before the succeeding coat is applied.

.10 After installation, all piles shall receive a thorough application of Kilz in accordance with the manufacturer's recommendations, to all that portion of the pile above and extending 150 below finished ground elevation.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 This Section describes the work required for the preparation, gravelling, compaction, shaping, and trimming of road approach, driving, and parking surfaces within the Detachment site.

1.2 PROTECTION OF PROPERTY

.1 All work shall be executed in such a manner as to protect private property, fences, utility poles, survey pins and markers, manholes, valve boxes and other utility appurtenances. Any of these items which are damaged or removed by the Contractor in the performance of their work shall be repaired or replaced to their original condition at the expense of the Contractor. Earth, rock or debris deposited in sewer manholes and pipes and in valve boxes shall be completely removed prior to acceptance of the work.

1.3 SUBMITTALS

.1 The Contractor shall submit granular and bedding material sieve results prior to material being incorporated into the Work.

.2 The Contractor shall submit all density testing results to the Consultant within 3 days of the testing date.

1.4 SUBMITTALS

.1 The Contractor will be responsible for providing all materials testing for site. Nuclear densometer testing shall be provided as specified or as requested by the Consultant. At a minimum, at least one test per 1000 square meters of work area shall be conducted for each 300mm of fill material placed.

.2 Testing results will be submitted to the Consultant for review within three working days of the tests being conducted. The Contractor is to track the location and depths of all testing on a site plan, and provide to the Consultant for review with the test results.

.3 All testing shall be performed by a third party licensed company certified to provide the testing.

.4 The Contractor is to complete a load test with a full water truck or large motor grader following the placement of Granular material. If there are areas of concern identified during the load test, the Contractor is to notify the Consultant.

Part 2 Products

2.1 SURFACE GRAVEL

.1 Saskatchewan Ministry of Highways and Infrastructure Type 104.

2.2 GRANULAR BASE

.1 Saskatchewan Ministry of Highways and Infrastructure Type 31.

Part 3 Execution

3.1 SURFACE PREPARATION

.1 Upon completion of building construction and utility installations within the Detachment site, construct road approach, driving, and parking surfaces to the lines and grades as shown on the Drawings.

.2 Compact surfaces to a minimum Standard Proctor Density of 98%. Surface moisture shall be corrected as required to achieve the specified density.

3.2 SURFACE GRAVEL

.1 Upon completion of the preparation of driving and parking surfaces, supply and place Type 104 gravel to a finished compacted depth of 150mm.

.2 Compact, shape and trim gravelled surfaces to ensure a smooth, dense surface to support normal road traffic without rutting or becoming unstable.

3.3 SECURE BAY RAMP

.1 Coordinate infill of secure bay ramp with General Contractor.

.2 Once timbers are in place and secured, fill ramp area with granular base (Type 31). Place in maximum loose lifts of 150mm and compact to 98% of maximum Standard Proctor density.

.3 Fill top 75mm of ramp with surface gravel (Type 104) compacted to 98% of maximum Standard Proctor density.

3.4 MANHOLE AND VALVE BOX ADJUSTMENTS

.1 Adjust manholes and valves to approximately 150mm below finished grade.

.2 Manholes shall be adjusted by removing or adding adjusting rings to a maximum ring depth of 300mm with a minimum depth of 100mm.

.3 Valve boxes shall be adjusted by raising or lowering the telescoping top section of the box or by adding approved risers.

.4 Gravel and earth shall be kept out of valve boxes and sanitary sewers. Any such material deposited in these appurtenances shall be removed by the Contractor. The Contractor shall be completely responsible for all conditions which arise as the result of this material entering the sanitary sewer systems.

.5 Valve boxes and manholes damaged by the Contractor shall be repaired or replaced at their expense.

.6 Place temporary fabric underneath manhole frame to prevent granular material from entering the sanitary sewer system. Fabric is to be removed following completion of construction. Sanitary sewer manholes will be inspected prior to and upon completion of granular material placement. Any debris in the manholes shall be cleaned out and the sewer mains flushed, at the expense of the Contractor.

END OF SECTION

PART 1 General

1.1 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet.

.3 Shop Drawings:

.1 Indicate location, type, size, arrangement, anchor and mounting details.

1.2 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 STORAGE AND PROTECTION

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

1.4 SECTION INCLUDES

.1 Fence framework, fabric, and accessories.

.2 Excavation for post bases; concrete foundation for posts.

.3 Manual gates and related hardware.

1.5 RELATED REQUIREMENTS

.1 Division 1 – General Requirements

.2 Section 03 30 00 – Cast-In-Place Concrete

1.6 REFERENCES

.1 ASTM A116 - Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric.

.2 ASTM A121 - Zinc-Coated (Galvanized) Steel Barbed Wire.

.3 ASTM A123 - Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

.4 ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.5 ASTM A392 - Zinc-Coated Steel Chain-Link Fence Fabric.

.6 ASTM F567 - Installation of Chain-Link Fence.

.7 ASTM F669 - Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fence.

PART 2 Products

2.1 PRODUCTS

.1 Fence Fabric: 50 mm mesh by 9 gauge, zinc coated after weaving. Minimum zinc coating to be 490 grams per square metre of surface area.

.2 Fabric height: See drawings.

.3 Terminal and Straining Posts: The terminal posts and straining posts shall be 90 mm O.D. with minimum weight of 11.24 kg per metre, Schedule 40 pipe, zinc coated with minimum coating of 490 grams per square metre. The minimum length of terminal posts and straining posts shall be 2,900 mm

.4 Line Posts: Posts shall be 60 mm O.D. with minimum weight of 5.43 kg per metre, Schedule 40 pipe, zinc coated with minimum coating of 490 grams per square metre. The minimum length of line posts shall be 2,670 mm unless otherwise indicated.

.5 Top Rails and Pipe Braces: The top rails and pipe braces shall be 43 mm O.D., Schedule 40 pipe, zinc coated with minimum coating of 490 grams per square metre.

.6 Top and Bottom Wire: Wire shall be Number 6 Gauge, single strand 57 grams electro-galvanized and be stretched taut along the top and bottom of the fabric fastened at 460 mm intervals

.7 Gate Frames: Gate frames are to be made of 43 mm O.D., Schedule 40 pipe, zinc coated with minimum coating of 490 grams per square metre. All joints to be electrically welded. Gates are to be supplied complete with zinc coated malleable iron hinges, latch and latch catch. Double gates to have centre rest with drop bolt for closed position and chain hold open. Gate latches are to be suitable for padlock which can be attached and operated from either side of gate. Hinges are to permit gate to swing back 180 degrees against fence. Gate braces shall be 33 mm O.D. zinc coated steel pipe with minimum coating of 490 grams per square metre.

.8 Accessories: other components such as tension bars, bands, rail ends, terminal post tops, line post tops, top rail sleeves, wire ties, nuts, bolts, and washers to be zinc coated steel with a minimum coating of 490 grams per square metre.

.9 Provide 300mm high line post bar arm (refer to drawings for orientation) complete with three (3) wires of double-strand 12.5 ga. four-point electro-galvanized barbed wire where indicated on drawings

PART 3 Execution

3.1 INSTALLATION

.1 Embed terminal posts and straining posts 900 mm. Set terminal posts and straining posts plumb and in accordance with the alignment staked.

.2 Straining posts shall be installed as per the manufacturer's instructions.

.3 Brace terminal sections, straining sections and corner sections with a pipe brace as per the manufacturer's instructions and as shown in the detailed plans and specifications.

.4 Attach fence fabric, wire ties, top rail, pipe braces, tension bar and fittings to the posts and assembled according to the manufacturer's instructions and as specified on the plans as designated by the Engineer.

.5 The chain link fence fabric shall be attached to the inside of the posts facing the dust collector. Gates open in the direction shown on the drawings.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Topsoil, planting mix, fertilizer and finish grading.

1.2 RELATED WORK

.1	Topsoil Stripping and Stockpiling	Section 31 14 13
.2	Site Grading	Section 31 22 00
.3	Seeding	Section 32 92 20
.4	Planting	Section 32 93 10

1.3 SOIL TESTS

.1 Conduct soil tests of topsoil and planting mix as required to determine recommended soil amendments and fertilizer compositions for seeding, sodding and planting. Samples shall be taken in accordance with recommendations of approved testing laboratory. Testing regimen as follows:

- .1 PSA-2 (Particle size analysis).
- .2 C-TOT-ORG (organic carbon).
- .3 SAL-DETAIL+TGR (detailed salinity).
- .4 Soil Analysis Package 1 (for NPKS - with recommendations).

.2 Soil tests shall be paid for by the Contractor and shall be conducted by an approved testing laboratory.

.3 Submit two (2) copies of soil test results and fertilizer recommendations to the Consultant for review.

Part 2 Products

2.1 MATERIALS

.1 Topsoil: stripped and stockpiled or imported material to be reasonably free from subsoil, roots, grass, weeds, toxic materials, stones and foreign objects, and shall be subject to analysis by a testing laboratory before use. Topsoil shall consist of black topsoil, a fertile, friable natural loam, neither heavy clay nor very light sand; 5-20% organic matter by weight; acidity value ranging from pH 6.0 to 7.5. Amend as recommended by soil tests. Topsoil to be in a moist, not wet, condition when incorporated into the work. Submit a one (1) litre sample to Consultant for approval prior to incorporation into the work. Do not screen topsoil.

.2 Manure: well decomposed cattle excrement, rich in organic matter and humus containing balanced proportions of nitrogen, phosphorus and potash; reasonably free of living vegetation, weed seeds, and couch grass or brome grass rhizomes; in a pulverised, friable condition, not containing fresh or "green" manure, clay, silt, gravel or foreign material.

.3 Planting mix: 80% sandy loam topsoil, 20% well-rotted manure; to approved sample.

.4 Fertilizer: Complete commercial synthetic slow release fertilizer with maximum 35% water soluble nitrogen; uniform in composition and free flowing. Formulation ratio: as recommended by soil tests.

Part 3 Execution

3.1 COORDINATION

.1 Ensure proper scheduling of work to avoid conflicts with completed and intended work.

3.2 PREPARATION

.1 Eliminate uneven areas and low spots from areas that have been rough graded. Ensure positive drainage in accordance with grading plans. Notify Consultant of grading problems before proceeding. Remove debris, roots, branches, stones in excess of 50 mm diameter and other extraneous materials. Remove subsoil that has been contaminated with oil, gasoline, calcium chloride or other undesirable chemicals. Dispose of removed materials off-site on a daily basis and at a location approved by local officials.

.2 Cultivate all areas, which are to receive topsoil, to depth of 100 mm. Repeat cultivation in those areas where equipment used for hauling and spreading has compacted the subgrade.

.3 Do not damage structures, membranes, fabrics, gravel or other materials adjacent to or below landscaped areas.

3.3 TOPSOIL AND PLANTING MIX

.1 Do not spread topsoil until Consultant has inspected subgrade.

.2 Spread topsoil with adequate moisture in uniform layers during dry weather over approved, dry, unfrozen subgrade, where seeding, sodding and planting is indicated.

.3 Bring topsoil to finish grade, taking mulching into account.

.4 Uniformly place topsoil or planting mix, as indicated, in maximum 300 mm loose lifts to the following minimum compacted depths:

.1 100 mm topsoil for seeded areas.

.2 Minimum 300 mm planting mix for planting beds.

.3 Compact each lift to maxmum 85% of standard Proctor density.

3.4 FERTILIZER

.1 Apply fertilizer at least 6 days before seeding or planting.

.2 Spread fertilizer uniformly with mechanical spreaders over entire area of topsoil at rate determined on basis of soil tests.

.3 Incorporate fertilizer thoroughly into upper 50 mm of growing media.

3.5 FINISH GRADING

.1 Remove stones, roots, grass, debris and foreign non-organic objects from growing media.

.2 Manually spread topsoil around existing trees and at areas subject to damage by equipment.

.3 Fine grade entire landscaped area to contours and elevations as indicated. Eliminate rough spots and low areas to ensure positive drainage in accordance with the grading plans. Notify Consultant of grading problems before proceeding.

.4 Fine grade and loosen topsoil prior to seeding or sodding. Prepare loose friable bed by means of shallow discing or harrowing and subsequent raking. Roll lightly and rake wherever growing media is loose.

.5 Leave surface smooth and uniform, with a fine loose texture.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Seed and application of seed.

1.2 RELATED WORK

.1	Topsoil Stripping and Stockpiling	Section 31 14 13
.2	Site Grading	Section 31 22 00
.3	Topsoil and Finish Grading	Section 32 91 19
.4	Landscape Maintenance	Section 32 93 40

Part 2 Products

2.1 MATERIALS

.1 **Grass seed:** Certified Canada No. 1 Grade to Government of Canada Seeds Regulations and having minimum germination of 75% and minimum purity of 97%. Submit original seed bag labels for each seed mix.

.2 **Fertilizer:** refer to Section 32 91 19

2.2 SEED MIXES (by weight)

.1 Dryland Mix:

30% Sheeps fescue (*Festuca ovina*)

25% Blue grama (*Bouteloua gracilis*)

20% Buffalo grass (*Buchloe dactyloides*)

20% Little bluestem (*Schizachyrium scoparium*)

5% Canada wild rye (*Elymus Canadensis*) nurse crop

Seed rate: 2.2 kg / 100 m^2

Part 3 Execution

3.1 PREPARATION

.1 Remove debris, roots, branches, stones in excess of 50 mm diameter and other extraneous materials. Remove contaminated subsoil. Dispose of removed materials off-site at municipally approved location.

.2 Fine grade areas to be seeded. Eliminate uneven areas and low spots. Ensure positive drainage.

.3 Prepare loose, friable seed bed by means of shallow discing or harrowing and subsequent raking.

.4 Leave surface smooth and uniform with a fine loose texture.

3.2 SEEDING

.1 All areas to be seeded shall be harrowed once with a landscape harrow to a maximum depth of 50 mm.

.2 Fertilize: Do not fertilize seeded areas unless directed by Consultant

.3 Seed shall be evenly applied with an approved mechanical seeder. Seeding shall be done in two operations at right angles to one another.

.4 Sow during calm weather (winds less than 10 km/h), using equipment suitable for area involved. Sow half of required amount of seed in one direction and remainder at right angles. Incorporate seed into soil to a maximum depth of 13 mm simultaneously or within one hour after seeding operation. Mix carefully with light chain harrow or wire rakes.

.5 Sow during calm weather (winds less than 10 km\h), using equipment suitable for area involved. Sow half of required amount of seed in one direction and remainder at right angles. Incorporate seed into soil to a maximum depth of 13 mm simultaneously or within one hour after seeding operation. Mix carefully with light chain harrow or wire rakes.

.6 Water with fine spray, avoiding washing out of seed. Apply enough water to ensure penetration of minimum 50 mm.

.7 Protect seeded areas against damage. Maintain protection until acceptance of seeded areas.

.8 Reseed at 2 week intervals where germination has failed.

3.3 MAINTENANCE

.1 Keep soil moist during germination period and adequately water seeded areas until accepted by Consultant.

.2 Apply water to ensure moisture penetration of 50 to 100 mm. Control watering to prevent wash-outs.

.3 Cut grass when it reaches height of 100 mm, and cut to a height of 65 mm. Evenly distribute (do not remove) clippings which exceed 10 mm in depth.

.4 Maintain grassed areas free of weeds and disease.

.5 Provide snow fence to protect seeded area, if necessary.

3.4 ACCEPTANCE

.1 Seeded areas will be accepted provided that:

.1 Seeded areas are properly established for the intended purpose and to the satisfaction of the Consultant and true to grade.

.2 Turf is free of eroded, bare or dead spots and reasonably free of weeds.

.3 Seeded areas have been cut at least twice, the last cut being carried out within 24 hours of acceptance.

.2 Areas seeded in fall will be accepted in the following spring one month after start of growing season provided acceptance conditions are fulfilled.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Plant material.

1.2 RELATED WORK

.1	Topsoil and Finish Grading	Section 32 91 19
.2	Plant List	Section 32 93 11
.3	Mulches	Section 32 93 20
.4	Landscape Maintenance	Section 32 93 40

1.3 REFERENCE STANDARD

.1 Comply with the current edition of the Canadian Nursery Landscape Association (CNLA) Canadian Standards for Nursery Stock.

1.4 CONTRACTOR QUALIFICATIONS

.1 Contractors supplying and/or installing plant material are required, at the discretion of the Consultant, to be Members in-good-standing of the Saskatchewan or Canadian Nursery Landscape Association. Upon request, provide evidence of such standing to the satisfaction of the Consultant.

1.5 SOURCE QUALITY CONTROL

.1 Imported plant material must be accompanied with necessary permits and import licenses and conform to federal and provincial regulations.

.2 Trees and shrubs shall have strong fibrous root systems, and be structurally sound and free of disease, insects, insect eggs, sunscald, frost cracks, rodent damage, defects, injuries and damage.

.3 Plant material with dieback or tip kill, that adversely affects the structure of the tree, is unacceptable (e.g. damaged leader or severe tip kill to lateral branches).

.4 Plant material with stumps included in the root ball is unacceptable.

.5 Container and basket trees must have well-developed branches and foliage. Trees with sparse foliage or over-elongated branches are unacceptable.

.6 Black Ash trees must be grafted on to Green Ash rootstock unless otherwise approved by the Consultant.

.7 Plants dug from native stands, woodlots, Christmas tree lots, orchards or neglected nurseries, and have not received proper maintenance as advocated by CNLA, shall be designated as “collected plants”. “Collected plants” are acceptable subject to written approval by Consultant.

.8 Plant material shall meet or exceed the sizes specified on the Plant List. If larger plants are used, the root ball shall be increased in proportion to the size of the plant to conform to CNLA specifications. If acceptable plant material is not commercially available at the minimum size specified, smaller sizes of the same species may be acceptable, subject to Consultant approval. The Consultant reserves the right to reject plant material that does not meet the minimum size requirements.

.9 Cold storage: Consultant approval required for plant material which has been held in cold storage. Inspection to occur at site of storage.

.10 Bare root material: unacceptable outside natural dormancy period.

.11 Tree spade material: turf surrounding the source material to be free from invasive perennial species. If invasive species are present, treat with Round-Up a minimum of seven (7) days before transplanting.

.12 To prevent the importation of Dutch Elm disease:

.1 Elm trees shall not be imported from an area where Dutch Elm Disease has been confirmed (governed by federal and provincial legislation).

.2 Imported elm trees must be accompanied by written certification, stating that the trees are free of disease and have been sprayed with Dursban Turf or other approved insecticide to control the elm bark beetle.

.3 Transportation of elm trees must comply with Provincial DED regulations.

1.6 SUBSTITUTIONS

.1 Substitutions to plant material are not permitted unless written approval is obtained from the Consultant prior to tender close, except under extraordinary circumstances. Plant substitutions must be of similar species and of equal size to those originally specified.

1.7 SHIPMENT AND PRE-PLANTING CARE

.1 Coordinate shipping of plants and site preparation to ensure minimum time lapse between transport and planting.

.2 Pack plants in damp peat moss, place in bales or boxes, and keep damp until arrival at the site.

.3 Cover plant foliage with tarpaulin, to prevent loss of moisture during transit and storage. Avoid crushing or breaking of tops of plants.

.4 Keep roots moist and protected from sun and wind. If trees and shrubs cannot be planted within 24 hours of arrival on site: heel in, protect from direct sun, and water well.

.5 Place bundles of whips and seedlings in pails with 50 mm of moist peat moss. Keep roots moist at all times. Avoid breaking or stripping bark from bundles.

.6 Remove broken and damaged roots with sharp pruning shears. Make clean cuts.

.7 Protect root balls against sudden changes in temperature and exposure to heavy rainfall.

.8 Protect bales or boxes from sun and wind exposure during planting.

1.8 PLANTING TIME

.1 Provide planting schedule. Undertaking planting operations over an extended period, with limited personnel, is unacceptable.

.2 Plant only under conditions that are conducive to health and optimum physical conditions of plants.

.3 Plant material growing in containers may be planted throughout growing season.

1.9 WARRANTY

.1 Warranty plant material to remain healthy for one full year following date of Substantial Performance; and warranty that invasive perennial species are not imported into the project site with the plant material. Plant material damaged by accidental causes or vandalism is exempted from warranty provisions.

.2 The Consultant reserves the right to extend Contractor's warranty responsibilities for an additional one year if, at end of initial warranty period, leaf development and growth is not sufficient to ensure future survival.

1.10 REPLACEMENTS

.1 During warranty period, promptly remove plant material that has died or failed to grow satisfactorily as directed by Consultant.

.2 Replace plant material the same or next planting season.

.3 Extend warranty on replacement plant material for a period equal to the original warranty period.

.4 Continue such replacement and warranty until plant material is acceptable.

1.11 INSPECTIONS AND APPROVALS

.1 Consultant reserves the right to approve nursery plant material at source. Notify Consultant of source, minimum 7 days in advance of shipment. No work under this Section is to proceed without approval.

.2 Acceptance of plant material at source does not prevent rejection on site prior to, or after, planting operations.

.3 Stake location of trees, shrubs and edge of planting beds for inspection by Consultant. Obtain Consultant approval before planting.

.4 Notify the Consultant if the layout has been altered from the design drawings. Adjustments may be required as a consequence of site conditions, and must be approved by the Consultant before installing plant material.

.5 Inspection of plant material to include, but not limited to: species; size; health; location/massing; installation; and invasive perennial species.

.6 Inspection of shrub beds to include, but not limited to: clean crisp edge and smooth continuous curve.

1.12 AS BUILT DRAWINGS

.1 Keep one set of drawings and specifications on the job for the sole purpose of recording any changes to the work. Update drawing set daily as work progresses.

1.13 PAYMENT

.1 No additional payment will be made for: excavation, tree supports, mulching of trees in grass areas, and related work which is incidental to plant material.

.2 Plant material that has been rejected after installation and prior to substantial completion will not be certified for payment.

.3 No additional payment will be made for plant material larger than the minimum size specified.

.4 Undersized plant material is subject to Consultant approval and may be rejected.

Part 2 Products

2.1 MATERIALS

.1 Plant list: refer to Section 32 93 11.

.2 Water: free of minerals and contaminants which may be detrimental to plant growth.

.3 Supports: refer to details.

.4 Tree tie: Arbortape or equivalent; 19 mm flat, woven polypropylene tree tie material.

.5 Mulch: refer to Section 32 93 20.

.6 Planting mix: refer to Section 32 91 19.

Part 3 Execution

3.1 PLANTING SETBACKS

.1 Locate and flag underground utilities within 5 metres of proposed planting sites.

.2 Unless otherwise approved by the Consultant, trees shall be set back the following minimum distances, measured from the center of the tree:

- .1 0.6 m: 120 B 240 voltage lines (e.g., streetlight power lines), traffic control lines
- .2 1.0 m: sidewalks, pathways
- .3 1.5 m: local road curb face, driveways and private walks
- .4 2.0 m: buried high voltage power lines, overhead power lines , SaskTel/AT&T/telephone lines, Sask Energy/gas distribution lines, Shaw/telecable lines, utility pedestals, curb face of arterial or collector roadways, roadway signs except from the front of stop and yield signs
- .5 3.0 m: fibre optic lines, water and sewer lines, electrical transformers, street lights, fire hydrants, buildings, side and back of bus stop signs, front of bus stop signs where tree is more than 3.0 m from curb face
- .6 7.0 m: street corners, front of stop and yield signs
- .7 10.0 m: Transgas/gas transmission lines
- .8 12.0 m: front of bus stop signs where tree is less than 3.0 m from curb face, railway tracks

.3 Set shrubs back a distance equal to one half of shrub spacing at shrub bed perimeters.

3.2 EXCAVATION

.1 Seedlings: 300 mm x 300 mm x 450 mm deep.

.2 Shrubs: in continuous planting beds excavated to a depth of 300 mm.

.3 Small trees (up to 3.0 m): depth: equal to height of root ball; diameter: double the width of root spread or root ball.

.4 Large trees (over 3.0 m): depth equal to height of root ball; diameter: double the diameter of root ball; if tree location has heavy clay soil, in an irrigated turf area; increase planting hole widths by 50 mm for each 100 mm of root ball diameter; if tree location has heavy clay soil, in a dryland turf area: increase planting hole widths by 100 mm for each 100 mm of root ball diameter.

.5 Provide drainage for planting holes in heavy clay soil if natural drainage does not exist; method to be approved by Consultant.

.6 Remove water from excavations prior to planting.

.7 Scarify the wall and bottom of tree holes before installing spade, basket or container material.

3.3 PLANTING MIX

.1 Refer to Section 32 91 19.

3.4 PLANTING

.1 Remove tags, flagging, string, or other shipping materials. Retain protective coverings on trunks until tree is installed.

.2 Install plant material in upright position.

.3 Bare root material: position top of root system, indicated by the trunk flare or dark stain on the trunk, at finished grade; backfill with planting mix to maintain natural root structure; damaged or broken roots to be cut back with a sharp knife to living wood; roots to be spread out to prevent girdling of the root system; water immediately - refer to Section 32 93 40.

.4 Container stock: remove container without disturbing root ball; for small trees: if roots have grown to the edge of the container, cut three (3) vertical slices around the root ball; install plant immediately with top of root ball flush with proposed finished grade; backfill with planting mix and compact firmly around the plant; water immediately - refer to Section 32 93 40.

.5 Balled and burlapped plant material:

.1 Rest root ball on undisturbed / compacted subgrade.

.2 Place top of root ball at the same level as it was in the nursery (+/- 50 mm), allowing for future settlement

.3 If tree location is in heavy clay soil, place top of the root ball 50 mm above the level it was in the nursery (+/- 50 mm).

.4 Provide planting mix at edges of excavation to support root ball.

.5 Tamp planting mix around root system in 150 mm layers, eliminating air voids. When 2/3 of planting mix has been placed, fill hole with water. After water has completely penetrated into soil, complete backfilling.

.6 Remove top 1/3 of wire basket.

.7 When planting mix is installed to half the root ball height, cut and remove the top 1/3 of the burlap; remove carefully so as to not disturb the root ball.

.8 Build a 100 mm high by 100 mm wide soil ring around the perimeter of the root ball to assist with maintenance watering.

.9 Set trees plumb and in the centre of the tree hole and positioned to give the best appearance and relationship to adjacent structures, walkways, roadways or park features.

.10 Water immediately - refer to Section 32 93 40.

.6 Tree Spade material:

.1 Dig plant material with mechanized digging equipment of hydraulic spade type. Dig with a firm natural cone of earth of sufficient diameter and depth to encompass enough of the root systems necessary for full recovery of the plants. The following will govern the material size allowable for transplant by the tree spade method:

Tree spade size	Maximum tree caliper (300 mm above ground)	Tree height
1350 mm (44")	75 mm (3")	3.0 - 3.6 m (10-12')
1500 mm (60")	100 mm (4")	3.0 - 3.6 m (10-12')
1650 mm (66")	150 mm (6")	3.6 - 4.2 m (12-14')
2100 mm (84")	200 mm (8")	4.2 - 4.8 m (14-16')

.2 Dig tree hole with same mechanical equipment as used to dig plant material. Ensure hole dug is upright.

.3 Scarify the top half of the tree spade dug hole to a depth of 75 mm.

.4 Remove excess soil from the bottom of the hole before placing tree.

.5 Place tree plumb. Backfill crevices with planting mix, and water immediately - refer to Section 32 93 40. Repeat until soil is flush with finished grade.

3.5 TREE SUPPORTS

.1 Install tree supports as detailed.

.2 Install tree tie using Arborknot techniques per manufacturer's specifications.

.3 Ensure tree supports penetrate minimum 300 mm into undisturbed subgrade and do not conflict with root ball or underground utilities.

3.6 PRUNING

.1 Prune dead, injured and rubbing branches.

.2 Remove projecting stubs back to branch collar.

.3 Postpone pruning of trees, where heavy bleeding may occur, until in full leaf. **Do not prune elms between 01 April and 31 August.**

3.7 EDGING OF PLANTING BEDS

.1 Edge all planting beds.

.2 Layout proposed edge of planting bed by spray painting. Notify Consultant for inspection and approval before proceeding.

.3 Spray inside the edge of planting bed with Round-Up if weeds or other vegetation are present.

.4 Trim edge of planting bed, one (1) week after spraying with Round-Up; with flat spade or edging tool; provide clean crisp edge; remove excess material before reinstating or placing mulch.

3.8 MULCH

.1 Refer to Section 32 93 20.

3.9 METAL EDGING

.1 Manufacturer: Permaloc Corporation, 13505 Barry Street, Holland, MI 49424: info@permaloc.com; 1(800) 356 9660.

.2 Model: Permaloc CleanLine XL; size: 4.8 x 203 mm (3/16" x 8"); finish: Mill (natural aluminum).

.3 Install level and with smooth, continuous curves as per manufacturer's specifications; fasten section connections with metal screws.

3.10 CLEAN UP

.1 Provide a final washing of foliage to remove settled construction dust.

.2 Prune branches damaged during construction.

.3 Remove shipping materials, tags, flags, wire, burlap and protective coverings from the plant material and beds.

END OF SECTION

QUANTITY	COMMON / *Botanical Name*	SIZE AND REMARKS
CONIFEROUS SHRUBS:		
10	'BLUE CHIP' JUNIPER / *Juniperus horizontalis* 'Blue Chip'	- 400 diam. min.; bushy, even growth and form; B & B, min. ball diam. 250 or container grown, # 2 pot.
17	'HUGHES' JUNIPER / *Juniperus horizontalis* 'Hughes'	- 400 diam. min.; bushy, even growth and form; B & B, min. ball diam. 250 or container grown, # 2 pot.
27	'CALGARY CARPET' JUNIPER / *Juniperus sabina* 'Calgary Carpet'	- 400 diam. min.; bushy, even growth and form; B & B, min. ball diam. 250 or container grown, # 2 pot.

NOTES:

- in the case of discrepancy between the plant list and the drawings, the planting plans shall be taken as correct.
- sizes are in millimetres unless noted otherwise.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Landscape mulches.

1.2 RELATED WORK

.1	Topsoil and Finish Grading	Section 32 91 19
.2	Planting	Section 32 93 10
.3	Landscape Maintenance	Section 32 93 40

1.3 LAYING OUT WORK

.1 Lay out work and be responsible for accuracy. Provide the necessary personnel to assist the Consultant in checking the work.

Part 2 Products

2.1 WOOD MULCH

.1 Untreated shredded fibres or chips; to Consultant approved sample.

Part 3 Execution

3.1 WOOD MULCH

.1 Mulch shrub beds and individual trees and shrubs.

.2 Minimum uniform compacted mulch depths: 50 mm in irrigated areas; 100 mm in non-irrigated areas.

.3 Install planting bed mulch following turf establishment. Remove weeds prior to mulching.

.4 Do not install mulch within 100 mm of tree trunks.

.5 Taper mulch layer at base of shrubs to provide a 100 mm diameter saucer centered on the shrub, with no mulch directly on the base of the stem(s).

.6 Finish by hosing down to settle in place.

.7 Do not install mulch on non-vegetated swales or drainage strips.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Landscape maintenance.

1.2 RELATED WORK

.1	Topsoil and Finish Grading	Section 32 91 19
.2	Seeding	Section 32 92 20
.3	Planting	Section 32 93 10
.4	Mulches	Section 32 93 20

1.3 MAINTENANCE PERIOD

.1 The maintenance period is from the beginning of the Contract until one year following Substantial Performance of the work. The maintenance period shall coincide with the warranty period.

.2 Submit contact list of maintenance staff and landscape maintenance schedule.

1.4 INSPECTIONS

.1 Final inspection to include, but not necessarily limited to, the following to ensure that:

- .1 Existing plant material identified to remain is healthy.
- .2 New plant material is healthy.
- .3 The site is free of weeds.
- .4 Shrub beds are free of weed and grass growth, and neatly edged.
- .5 Damaged areas have been repaired.
- .6 The site is free of debris.

1.5 VANDALISM

.1 The Contractor is not responsible for repair or replacement of items that have been damaged as a result of evident vandalism, provided such damages are not caused by fault of the Contractor as determined by the Consultant.

Part 2 Products

2.1 CHEMICALS

.1 All insecticides, herbicides, fungicides, etc., shall be in accordance with municipal regulations.

.2 Chemicals to be applied by a licensed Pesticide Applicator.

2.2 EQUIPMENT AND TOOLS

.1 All equipment and tools shall be suitable for the work and in good working order.

.2 Mowers: size suitable to the work to be performed, in good working order and with sharp blades.

Part 3 Execution

3.1 GENERAL

.1 Keep the site free of debris. Collect and dispose of debris, refuse and excess material on regular basis.

.2 Remove weeds, including their roots. Remove turf from shrub bed areas.

.3 Do not store equipment or materials on site.

.4 Review all operations and procedures with the Consultant before beginning work.

3.2 WATERING

.1 Supply water and equipment, including: portable sprinkler systems, tank trucks, hoses and sprinklers.

.2 Ensure that erosion and compaction are not caused during water procedures. Repair damage.

.3 Seedlings, shrubs and relocated plants: water weekly or as required to keep the top 150 - 200 mm depth of soil in a continually moist condition.

.4 Trees: every seven to fourteen days depending on soil moisture level. Water slowly to ensure that water does not discharge from the root zone and so the top 300 mm of soil around the root system of the tree is well saturated. Water a minimum of eight times during the growing season with the following amounts of water based on tree caliper: 30 - 50 mm: 90 litres (20 gallons)/tree; 51 - 75 mm: 136 litres (30 gallons)/tree; 76 - 85 mm: 227 litres (50 gallons)/tree.

.5 Ensure adequate moisture in root zone at freeze-up; complete one watering cycle in October after temperatures fall below freezing.

3.3 PLANTING BEDS

.1 Remove weeds and turf from mulched areas.

.2 Maintain specified mulch depths.

.3 Maintain crisp spade edge along design shapes.

3.4 PRUNING

.1 Prune in accordance with Section 32 93 10 and to the satisfaction of the Consultant and Owner.

3.5 RODENT CONTROL

.1 Provide rodent control as required. Conform to applicable regulations.

3.6 MAINTENANCE DURING WARRANTY PERIOD

.1 Ensure that the Owner is familiar with the standard practice of maintaining the work and is prepared to continue the maintenance from the designated completion date until expiry of the warranty period.

.2 If at any time during the warranty period, the Contractor considers that proper maintenance is not being provided, the Contractor shall notify the Consultant in writing.

3.7 MAINTENANCE MANUAL

.1 Provide three (3) copies of a landscape maintenance manual in accordance with Section 01 78 00. Include brief instructions on operations, procedures and maintenance for the following:

- .1 Fertilizing
- .2 Watering
- .3 Weed control
- .4 Mulching
- .5 Pruning
- .6 Pest and disease control
- .7 Turf care

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 This Section describes the work required to construct the water pipeline complete as shown on the Drawings.

1.2 RELATED WORK

.1 Water & Sewer Utility Trench Excavation & Backfill: Section 31 23 16.

1.3 MATERIALS

.1 Materials required to complete the Work shall be supplied by the Contractor. They shall be new and of the type specified. They shall be handled and stored in accordance with the manufacturers' written instructions.

1.4 SUBMITTALS

.1 The Contractor shall submit pipe material specifications prior to the material being incorporated into the Work.

1.5 MAINTENANCE

.1 Defects or misalignment of any part of the work caused by settlement or faulty workmanship and materials during the maintenance period shall be corrected by the Contractor at his expense.

Part 2 Products

2.1 GENERAL

.1 Supply the following types or classes of materials. Alternatives shall be approved prior to the closing of tenders.

.2 Bolts and nuts used in buried metal products shall be Type A-304 stainless steel as per ASTM A276.

2.2 PIPE

.1 150mm AWWA-C900, Class 150 PVC pipe complete with factory installed elastomeric gaskets.

2.3 INSULATION

.1 Styrofoam Highload 40 extruded polystyrene foam insulation.

2.4 BEDDING SAND

.1 Bedding sand shall conform to the following gradation limits:

Sieve Size	% Passing
5 mm	95 - 100
2 mm	75 - 100
0.900 mm	40 - 80
0.4400 mm	15 - 45
0.160 mm	0 - 20
0.071 mm	0 – 5

2.5 CRUSHED ROCK

.1 Uniformly sized 20 mm crushed rock.

Part 3 Execution

3.1 UTILITY TRENCH EXCAVATION & BACKFILL

.1 As described in Section 31 23 16.

3.2 PIPE LAYING

.1 Lay pipes accurately to the lines and grades as shown on the Drawings.

.2 Method of installation shall conform to current AWWA Specifications for the type of pipe being used.

.3 Inspect piping and fittings for damage before being lowered into the trench. Damaged materials or those not meeting the specifications shall be rejected and removed from the site.

.4 Keep earth and other foreign material out of pipelines and pipe joints.

.5 Lay piping in a consistent location in the trench for the full length of the pipeline.

3.3 PIPE BEDDING

.1 Bedding material shall be placed evenly around the pipe to prevent movement of the pipe.

.2 Bedding sand shall be used and placed to a minimum of 500mm above the pipe.

.3 Compact using hand or mechanical methods.

3.4 CONNECTION TO EXISTING WATER PIPELINES

.1 Notify Community authorities a minimum of 48 hours prior to connecting to existing mains. Make necessary arrangements for closing valves. Keep shutdown time to a minimum.

.2 Locate existing water main, remove plug, and proceed with construction.

3.5 FLUSHING AND SWABBING PIPE

.1 The Contractor is responsible to ensure that the interior of all piping is free of all foreign material and air prior to acceptance of the work. The piping shall be filled with suitable quality potable water prior to the completion of the contract.

.2 Dirt and other foreign material shall be removed from the pipe lengths prior to installation. All piping should be visually inspected for foreign material and cleaned.

.3 All practical precautions shall be taken to prevent the introduction of foreign material into previously installed pipelines and/or valves.

.4 Flushing of all piping shall be completed **prior** to the disinfection process.

3.6 DISINFECTION

.1 All piping carrying treated water shall be chlorinated in accordance with Saskatchewan Water Security Agency recommendations **after initial flushing** has been completed.

.2 Short connections and stub pipes (less than 20 metres) can be chlorinated using HTH disinfection powder.

.3 Dispose of all chlorinated water in an environmentally safe manner.

.4 All testing apparatus, lab testing and labour required for disinfection shall be supplied by the Contractor.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 This Section describes the work required to construct the sanitary sewer service pipelines as shown on the Drawings.

1.2 RELATED WORK

.1 Water & Sewer Utility Trench Excavation & Backfill: Section 31 23 16.

1.3 MATERIALS

.1 Materials required to complete the Work shall be supplied by the Contractor. They shall be new and of the type specified. They shall be handled and stored in accordance with the manufacturers' written instructions.

1.4 MAINTENANCE

.1 Defects or misalignment of any part of the work caused by settlement or faulty workmanship and materials during the maintenance period shall be corrected by the Contractor at his expense.

1.5 SUBMITTALS

.1 The Contractor shall submit pipe material and insulation specifications prior to the material being incorporated into the Work.

Part 2 Products

2.1 GENERAL

.1 Supply the following types or classes of materials. Alternatives shall be approved prior to the closing of tenders.

.2 Bolts and nuts used in buried metal products shall be Type A-304 stainless steel as per ASTM A276.

2.2 PIPE

.1 Sanitary Sewerage Service Piping: 150mm SDR35 PVC pipe conforming to ASTM D-3034; pipe shall be complete with factory installed gasket joints conforming to CSA B182.2.

2.3 INSULATION

.1 Styrofoam Highload 40 extruded polystyrene foam insulation.

2.4 BEDDING SAND

.1 Bedding sand shall conform to the following gradation limits:

Sieve Size	% Passing
5 mm	95 - 100
2 mm	75 - 100
0.900 mm	40 - 80
0.400 mm	15 - 45
0.160 mm	0 - 20
0.071 mm	0 – 5

2.5 CRUSHED ROCK

.1 Uniformly sized 20 mm crushed rock.

Part 3 Execution

3.1 UTILITY TRENCH EXCAVATION & BACKFILL

.1 As described in Section 31 23 16.

3.2 TEMPORARY PUMPING

.1 Provide temporary pumping if required to complete the connection to the existing system. Under no circumstances shall sewage be discharged to the ground.

3.3 PIPE LAYING

.1 Lay pipes accurately to the lines and grades as shown on the Drawings.

.2 Confirm the elevation of the existing sanitary sewers prior to commencing construction. Advise Consultant immediately if sewer differs from elevations shown on the Drawings.

.3 Method of installation shall conform to current AWWA Specifications for the type of pipe being used.

.4 Prior to installation of the piping, the bottom of the trench shall be smooth, straight and free of large rocks such that the piping is supported along its entire length.

.5 Pipe laying shall commence at the lowest point of the sewer. Pipe shall be laid uphill with the spigot ends laid in the direction of flow.

.6 Inspect piping and fittings for damage before being lowered into the trench. Damaged materials or those not meeting the specifications shall be rejected and removed from the site.

.7 Keep earth and other foreign material out of pipelines and pipe joints. Place a suitable cover over the end of the pipe during excavation and when the work is shut down.

.8 Join pipes and fittings in accordance with manufacturer's instructions using gaskets and lubricants as supplied or specified by the manufacturers.

3.4 PIPE BEDDING

.1 Bedding material shall be placed evenly around the pipe to prevent movement of the pipe.

.2 Bedding sand shall be used and placed around the pipe as shown on the Drawings.

.3 Compact using hand or mechanical methods.

3.5 CONNECTION TO EXISTING SANITARY SEWER MANHOLE

.1 Notify authorities a minimum of 48 hours prior to connecting to existing mains. Provide temporary pumping as required.

.2 Expose manhole and core through barrel. Install new sewer pipe into the manhole at the required line and elevation.

.3 Patch and grout the hole in the manhole wall. Re-grout the benching in the bottom of the manhole. Do not allow construction debris to enter the pipeline.

3.6 INSULATION

.1 Insulate Sanitary Sewer the length of the pipe and the width detailed on the Drawings. Install insulation in accordance with manufacturer's guidelines.

3.7 INFILTRATION

.1 Infiltration shall not exceed 170 litres per day per mm diameter of pipe per km of pipe. If required, infiltration tests shall be carried out by the Contractor at his expense.

.2 The Contractor shall, where the actual leakage on a section of pipe exceeded the allowable, repair and/or replace the section and then retest the section until the actual leakage no longer exceeds the allowable.

3.8 CLEAN-UP

.1 The Contractor shall clean up the site as work progresses.

.2 The Contractor shall remove all equipment, plant, tools and surplus material from the site of the finished work and shall repair and restore all drainage facilities which have been blocked or damaged as a result of the Contractor's operations.

END OF SECTION