

## TECHNICAL ADDENDUM

The following changes in the tender documents are effective immediately. This addendum will form part of the contract documents.

### 1 TENDER INQUIRY

- .1 “Division 23.05.33 is not listed within the Table of Contents yet it is in the Specification book (Heat trace for pipe and tanks). The print M1.1 Note 8 says Division 26 supplies and installs the heat trace. Please verify.”

**DELETE Section 23.05.33 in Mechanical Specification. Refer to Division 26 for heat trace cable.**

- .2 The drawings indicate that there is an existing lightening protection system on the Tertiary Garage Building and that the new lightening protection system shall connect to it in three (3) locations. We do not believe that there is an existing lightening protection system on the existing garage. If we are correct, how should the system be installed.

**Price as per documents at this time.**

- .3 The lightening protection system for the existing Travelers Building, the existing commercial building, etc. Utilize air terminals. Will air terminals be installed for the new structures as well?

**Provide air terminals as required.**

- .4 The drawings indicate that copper lightening protection materials are to be installed on surfaced that are not galvanically compatible (eg. Parapet capping). Are UL for Canada listed aluminum lighting protection materials be an approved alternate for the rooftop installation?

**No, provide copper complete with protection for non galvanically compatible materials.**

### 2 SPECIFICATIONS

- .1 Division 00

- .1 Section 00 00 03 – TABLE OF CONTENTS

- .1 **Replace** this TABLE OF CONTENTS with the revised version appended to the end of this Addendum.

Revisions to the original TABLE OF CONTENTS are indicated in ***bold italicized text with a 25% grey tone highlight*** as such.

Public Works and Government Services Canada	Expansion and Redevelopment of the Emerson Port of Entry, Emerson, MB	Addendum No. 02 Page 2 of 14
Project No.: R.068431.001		December 9, 2016

.2 Section 01 11 00 Summary of Work:

- .1 Revise article 1.3.1.1. as follows: Uninterrupted CBSA Port of Entry operations with the exception of the commercial examination warehouse function, which will be carried out off-site by CBSA for the duration of the construction period.
- .2 Revise article 1.3.1.2. as follows: 60 Staff parking stalls must be made available throughout the construction period.
- .3 Add Article 1.3.1.4. as follows: Existing PIL#6 must not be taken out of service for replacement until new PILs #7,8,9 are in operation.

.3 Section 01 52 00 Construction Facilities

- .1 Replace Article 1.9.1 as follows: A portion of the existing examination warehouse will be made available throughout the construction period for use by the Contractor. This area can serve as the contractor's office as well as space for storage of equipment and tools. Refer to attached DWG. XXXX
- .2 Delete Article 1.9.3.

.4 Section 01 56 00 Temporary Barriers and Enclosures

- .1 Replace Article 1.3.1 as follows: Provide 2.4m high construction fence enclosure as per Provincial safety regulations but no less than 6m from new building construction

.5 Section 01 31 19 Meeting minutes

- .1 1.1.6 to read: Prime Consultant to record meeting minutes. Include significant proceedings and decisions. Identify action by parties
- .1 1.1.7 to read: Prime Consultant to Distribute copies of minutes within three days after meetings to Departmental Representative for review. Following approval from Departmental Representative, and distribute to meeting participants.

.6 Section 28 323 00 Video Surveillance – Attachment

- .1 Article 2, Scope
  - .1 Remove the following: "A security clearance of CBSA Reliability is required pursuant to the Government of Canada Policy on Security"
- .2 Article 3. Requirements concerning the CCTV System equipment in General
  - .1 Remove the following: "Systems not meeting all the following Mandatory Specifications will be considered non-compliant. Please note that compliance with the stated criteria must be demonstrated by submission of supporting documentation such as technical literature/brochures, operating manuals, and/or written statement describing how each requirement is met. If a bidder only states 'comply' without any further details, this is not considered demonstration of compliance. Proposal evaluation will be based upon the information supplied with the bid only. Failure to demonstrate compliance with any area of the criteria will render your proposal non-responsive and no further consideration will be given. References are to be specific to supporting documentation (ex. Document title, page, and paragraph number).

.7 Section 01 31 19

Project No.: R.068431.001

December 9, 2016

- .1 Replace Article 1.3.4 as follows: Consultant to record and distribute minutes of meetings.
- .8 Section 01 32 16.07 Construction Progress Schedule – Bar (GANTT) Chart
  - .1 Replace Article 1.6.2 as follows: Provide Progress Schedule to include main activities including:
    - .1 Award
    - .2 Permits
    - .3 Mobilization
    - .4 Project Phasing
    - .5 Primary Power Relocation
    - .6 Commercial Warehouse Addition
      - .1 Structural Foundations
      - .2 Structural Superstructure
      - .3 Insulation
      - .4 Cladding
      - .5 Roofing
      - .6 Doors and Windows
      - .7 Interior Partitions
      - .8 HVAC
      - .9 Electrical Power and Data
      - .10 Electrical Lighting
    - .7 Tertiary Garage Addition
      - .1 Structural Foundations
      - .2 Structural Superstructure
      - .3 Insulation
      - .4 Cladding
      - .5 Roofing
      - .6 Doors and Windows
      - .7 HVAC
      - .8 Electrical Power and Data
      - .9 Electrical Lighting
    - .8 Existing Commercial Warehouse Renovations
      - .1 Interior partitions
      - .2 HVAC
      - .3 Electrical Power and Data
      - .4 Electrical Lighting
    - .9 PIL Booths #7,#8,#9
    - .10 PIL Booth #6
    - .11 Canopy above PIL Booths #7,#8,#9
      - .1 Structural Foundations
      - .2 Structural Superstructure
      - .3 Roofing
    - .12 Site Lighting

Project No.: R.068431.001

December 9, 2016

- .13 Video Surveillance Systems
  - .14 Selective Site Demolition
  - .15 New access roads
    - .1 Granular base and sub base
    - .2 Asphalt Paving
  - .16 New truck parking area
    - .1 Granular base and sub base
    - .2 Concrete Paving
  - .17 New Bypass roads
    - .1 Granular base and sub base
    - .2 Concrete Paving
    - .3 Land drainage system
  - .18 New staff parking area
    - .1 Granular base and sub base
    - .2 Asphalt Paving
  - .19 New crossover lane
    - .1 Granular base and sub base
    - .2 Asphalt Paving
  - .20 F.A.S.T. System
  - .21 Generator
  - .22 Exterior Signage
  - .23 Commissioning
    - .1 Building Systems
    - .2 F.A.S.T. System
  - .24 Substantial Completion
  - .25 Final Completion
  - .26 Warranty Period and Warranty Inspection
- .10 Division 06 – WOOD & PLASTICS
- .1 **Add** the following Specification Section to this Division:  
  
**Section 06 40 00 – Architectural Woodwork** appended to the end of this Addendum.
- .11 Division 07 – THERMAL & MOISTURE PROTECTION:
- .1 Specification Section 07 42 43 – Composite Wall Panels, Subsection 1.2 – Design Requirements:
    - .1 **Add** the following Subsection:

Project No.: R.068431.001

December 9, 2016

.2 Wall panels are to be designed to withstand loading capacities as determined by a Professional Engineer authorized to practise in the Province of Manitoba.  
"

.3 Specification Section 07 92 00 – Joint Sealants,  
Subsection 2.3 – Sealant Selection:

.1 **Add** the following Subsection:

Colour: As selected by the Consultant from the manufacturer's  
standard colour range. "

.13 Division 09 – FINISHES:

.1 Specification Section 09 22 14 – Furring and Lathing,  
Subsection 2.1 – Materials:

.1 **Add** the following Subsection:

.5 Cement parging: commercial grade galvanized, expanded, ribbed lath. "

.14 Division 10 – SPECIALTIES:

.1 Specification Section 10 51 13 – Metal Lockers and Benches,  
Subsection 2.1 – Manufactured Units:

.1 **Revise** Subsection .1 to read as follows:

.1 Lockers: to CAN/CGSB-44.40, Type 1 – Single full-height locker, Class 1 –  
**forty-six** complete lockers, floor mounted.

.1 Size: 305 mm wide x 460 mm deep x **1830** mm high,  
Steel thickness No. 15 MSG.

.2 Assembly: welded construction.

.3 Top: **flat**. "

.15 Division 11 – EQUIPMENT:

Project No.: R.068431.001

December 9, 2016

.1 Section 11 13 16 - Loading Dock Seals and Shelters,

Subsection 2.1 - Equipment

.1 Add to truck dock seals:

- .6 For each new overhead door, provide adjustable curtain dock seal c/w rope & cleat. Seal to be 40oz. vinyl material. Standard of acceptance: LDC dock seal as distributed by Pari Sales. "

.16 Division 13 – SPECIAL CONSTRUCTION

- .1 PIL booths are to be Pre-Fabricated units as per Specification Section 13 34 23.

.17 Division 23 – HEATING, VENTILATING & AIR CONDITIONING (HVAC):

- .1 **Delete** all Division 23 Specification Sections.
- .2 **Replace** with revised **Division 23** sections as appended to the end of this Addendum.

Note that 2 files were posted which included Division 23 sections [entitled *Division 23*, and, *Division 25\_* (labelled as such in error)], resulting in duplication of Division 23 sections. ***This attachment contains a complete, but finite set of Division 23 Sections.***

.18 Division 26 32 13.04 - DIESEL ELECTRIC GENERATING UNITS – LIQUID CLARIFICATIONS:

- .1 2.2 Design Criteria:
- .1 1.1 - Generator Size: 600kw 347/600V 3Ø 4w;
- .2 1.8 - Duty Rating: Standby without overloading.
- .2 2.5 Diesel Engine:
- .1 .6 - Separate analog gauges are not required;
- .2 .12 - Exhaust pyrometer are not required.
- .3 2.6 Cooling and Ventilation System:
- .1 .4 and .5 - Generator shall be outdoor unit with weather tight enclosure.
- .4 2.7 Lubrication System:
- .1 .5 – Separate oil priming pump not required if generator is purposely built without requirement.
- .5 2.9 Exhaust System:
- .1 Exhaust pyrometers are not required.
- .6 2.11 Speed Governor:
- .1 Electronic isochronous (ADEC) governor is acceptable.
- .7 2.12 Starting System:

Project No.: R.068431.001

December 9, 2016

- Accumulators for turbocharged engines are not required.
- .8 2.1.3 Generator:
    - .1 Revise 80°C temperature rise to 130°C. Revise insulation classification to Class H;
  - .9 2.1.4 Panel
    - .1 2nd free standing control panel not required. Remote annunciator shall be required.
  - .10 2.1.5 Control Panel:
    - .1 Digital genset mounted controller is acceptable.
  - .11 2.1.6 Engine Generator Control:
    - .1 Provide a Modbus Communication Gateway type to be determined.
  - .12 2.1.7 Sub-base:
    - .1 MTU onsite energy sub-base equal approved.
    - .2 Extended tank acceptable.
  - .13 2.1.9 Signs:
    - .1 Provide bilingual signage for generator and transfer switch;
    - .2 Drawings are not required to be bilingual;
    - .3 O & M's require both official languages and six (6) copies are required.
  - .14 2.2.2 Quality Control:
    - .1 Delete reference to specification Section 26 32 13.07 Factory Test;
    - .2 Site test shall be required;
    - .3 Site test will be acceptable with requirements as described.
    - .4 .8 – Delete reference to ambient requirement.
  - .19 DIVISION 26 36 23 - AUTOMATIC TRANSFER SWITCHES
    - .15 2.3.3 Revise 600Amp to 800Amp rating.
    - .16 2.3.9 Revise neutral bar to 800Amp
  - .20 Existing fire system is an Edwards EST-3.

### 3 ARCHITECTURAL DRAWING REVISIONS

- .1 Drawing G1.1 Construction Phasing
  - .1 Add General note as follows: This drawing is a suggested phasing drawing provided to illustrate a possible phasing sequence as well as the number of phases that may be required. Subject to approval by the Departmental Representative, an alternate phasing sequence may be utilized.
- .2 Drawing C22 and C23

Public Works and Government Services Canada	Expansion and Redevelopment of the Emerson Port of Entry, Emerson, MB	Addendum No. 02 Page 8 of 14
Project No.: R.068431.001		December 9, 2016

- .1 Re-issued.
- .3 Drawing G1.0 – General Notes & Assemblies
  - .1 For Interior Partition type P4, add note "warehouse side only" to "16mm plywood up to 1220mm AFF painted.
- .4 Refer to Ceiling Assemblies. Revise ceiling assembly "C4" to read from top to bottom as follows;
  - 1 layer 16mm plywood
  - 1 layer 16mm type "x" gypsum board
  - Engineered ceiling joists (see structural)
  - 2 layers 16mm type "x" gypsum board
- .5 Drawing A1.1 – Fire Separation Plan
  - .1 Revise fire separation for Tertiary building from 1 hour to 1.5 hour
- .6 Drawing A1.2 – Floor Plan: New Warehouse Addition
  - .1 Section symbol 4/A3.2 along Grid Line "6" to be referenced through exterior door 240F along Grid Line "6"
  - .2 Relocate storm sump pit along Grid Line "6" between grids "B" & "B.1" to north of Grid Line "A.1". Refer to Mechanical Drawing M1.1.
- .7 Drawing A1.4 – New Roof Plan
  - .1 Building Section reference numbers "2" and "3" to be reversed.  
Building Section 2 to be in North direction and Building Section to be in West direction.
- .8 Refer to Drawing 1.5 – Reflected Ceiling Plan: New Warehouse Addition & Canopy
  - .1 Section symbol 4/A3.2 along Grid Line "6" to be referenced through exterior door 240F along Grid Line "6" as per drawing A1.2.
  - .2 Add Keynote "7" to ceilings for Rooms 242 – CCTV and 243 – Electrical Room.
- .9 Drawing A2.0 – Building & Canopy Elevations
  - .1 Under "Signage Keynotes" add the following:
    - S10 – Surface mounted aluminum signage. Typical per Pil Booth. Code g-3E34a



Project No.: R.068431.001

December 9, 2016

.10 Drawing A3.0 – Building and Canopy Sections

- .1 Building Section 3 / A1.2 / A3.0. Wall between Electrical Room 243 and Warehouse 240 to be wall type "P4" and is to be 500mm south of gridline C. See Floor Plan A1.2.

.11 Drawing A3.1 – Wall Sections

- .2 Wall Section 1 / A3.0 / A3.1.
  - Revise dimension 2540 to read 2850 to allow for 3050mm from floor to underside of ceiling.
  - Revise ceiling type from C1 to C4.
  - Revise room name from 242 CCTV to Room 243 Electrical

.12 Drawing A3.2 – Wall Sections

- .1 Wall Section 4 / A3.2. Add "Sim." To reference bubble. Section 9/A3.4 is taken through overhead door sill.

.13 Drawing A3.4 – Section Details

- .1 Section Detail 1/ A3.4. Revise number of where detail is reference to A3.0 from A3.2.
- .2 Section 8 / A3.4. Scupper section details should be reference from Roof Plan A1.4, not A3.2
- .3 Section Detail 9 / A3.4. Revised bollard size from 150mm to 200mm.
- .4 Section Detail 3 / A3.4 referenced from Wall Sections 1 & 3 / A3.3. Delete reference to note "JOINT TREATMENT – SEE STRUCTURAL". Refer to attached detail sheet "SECTION DETAIL 1 / AD2.1 / AD2.1 for joint treatment.

.14 Drawing A3.5 – Section Details

- .1 Section Detail 1 / A5.5 through pipe penetration. Reference number to be revised from A / 3.1 to A / 1.4 – Roof Plan
- .2 Section details 2, 3, 6, 10 & 15. Revise drawing from where detail is referenced from A / 3.1 to A / 3.0.

.15 Drawing A3.6 – Plan Details

Public Works and Government Services Canada	Expansion and Redevelopment of the Emerson Port of Entry, Emerson, MB	Addendum No. 02 Page 10 of 14
Project No.: R.068431.001		December 9, 2016

- .1 Plan Detail 7 / A 3.6. Steel channel on door jamb side of wide flange column to be relocated into stud space to provide bearing for H.S.S. lintel above overhead door. See Structural.
- .2 Plan Details 10 & 11 / A3.6. Revise location of grid line "2" to be centred on web of steel column.
- .16 Drawing A4.0 – Enlarged Plans & Stair Details.
  - .1 See attached drawing A4.0 Rev. B.
- .17 Drawing A4.1 – PIL Booth Plans, Elevations and Sections
  - .1 1 / A4.1 – PIL 6 Enlarged Plan. Revised number from where plan is referenced to A1.3 from A1.2
  - .2 6 / A4.1 – PIL 6 Enlarged Plan. Revise detail name to PIL 7-9 Enlarged Plan.
  - .3 6 / A4.1 – PIL 6 Enlarged Plan. Revised number from where plan is referenced to A1.2 from A1.3.
- .18 Drawing A4.2 – Tertiary Garage Addition Floor Plan, Roof Plan, and Reflected Ceiling Plan
  - .2 See attached drawing A4.2 Rev. B.

## 4 STRUCTURAL DRAWING REVISIONS

- .1 Drawing M2.1 Warehouse HVAC – Renovation Plan
  - .1 Units CU-1A and CU-2A require concrete pads below the support frames.
  - .2 Provide 150mm thick concrete pads with 15M top reinforcing @ 300mm on-centre maximum. (ensure minimum 5 bars provided in each direction)
  - .3 Refer to Architectural and Mechanical drawings for size and location.
  - .4 Refer to General Notes, Drawing S1.0 for concrete specifications.
  - .5 Support frame design, details and anchorage to be provided by others.
- .2 Drawing S1.3 Main Floor Framing Plan and Schedules
  - .1 Refer to Mechanical drawing M1.1 for locations of precast pits along gridline 6. Thickened edge of slab to be modified to accommodate the entire pit opening as shown on plan.

Project No.: R.068431.001

December 9, 2016

.2 Drawing S1.5 Tertiary Garage Main Floor & Roof Framing Plans – Tertiary Garage Foundation Plan

- .1 7.1 Refer to Mechanical drawing M7.1 for locations of precast pits along gridline 15. Thickened edge of slab to be modified to accommodate the entire pit opening as shown on drawing S1.3. Ensure pit covers are rated for expected wheel loads. Coordinate cover anchorage.

.3 Drawing S1.5 Tertiary Garage Main Floor & Roof Framing Plans – Tertiary Garage Roof Framing Plan

- .1 Delete previously issued Structural Drawing S1.5 and replace with attached S1.5, dated 2016/12/06..

.4 Drawing S2.1 Tertiary Garage Elevations

- .1 Delete previously issued Structural Drawing S2.1 and replace with attached S2.1, dated 2016/12/06.

.5 Drawing S3.1 Sections

- .1 Refer to section 2/S3.1
- .2 Revise dimension to outside face of perimeter roof angle and HSS 127x127x6.4 girt dimension from gridline A.1 from 450mm to 431mm.
- .3 Revise dimension to outside face of perimeter roof angle and HSS 127 x 127 x 6.4 girt dimension from gridline A.1 from 450mm to 431mm.
- .4 Refer to section 3/S3.1

.6 Drawing S3.6 Sections

- .1 Delete previously issued Structural Drawing S3.6 and replace with attached S3.6, dated 2016/12/06.

.7 Drawing S4.1 Details

- .1 Refer to detail G/S4.1
- .2 Revise dimension from outside face of concrete to centerline of HSS 127x127 wind post from 64mm to 83mm. Baseplate is to be moved accordingly to match.

.8 Drawing S4.1 Details

- .3 Refer to detail G/S4.1
- .1 Revise dimension from outside face of concrete to centerline of HSS 127x127 wind post from 64mm to 83mm. Baseplate is to be moved accordingly to match.

.9 Drawing S4.3 Details

Project No.: R.068431.001

December 9, 2016

- .2 Delete previously issued Structural Drawing S4.3 and replace with attached S4.3, dated 2016/12/06.

## 5 MECHANICAL DRAWING REVISIONS

- .1 Drawing M6.3, RM-04 Revised Gas Loads
- .1 Revise Tertiary gas meter (METER - A) natural gas load chart.
  - .2 Revise Commercial Building gas meter (METER B) natural gas chart.
  - .3 DELETE: 38mm gas supply for emergency generator. Refer to electrical for new generator fuel supply details. Generator changed to diesel powered.
- .2 Drawing M8.1, RM-02:
- .1 Drawing M8.1, Tertiary Bldg. floor plan updated, Drawing Notes added.
- .3 Drawing M7.1, RM-03:
- .1 Drawing M7.1, Tertiary Bldg. floor plan updated.
- .4 Drawing M6.3 Plumbing Fixtures: Trench Drain TD-1:
- .1 Revise fixture specification to read as follows:
    - .1 The precast trench shall be manufactured using polyester polymer concrete with the following material properties when tested:
- | Property                       | Test Method       | Value                       |
|--------------------------------|-------------------|-----------------------------|
| Compressive Strength           | ASTM C579         | 14,000 psi Minimum          |
| Bending Strength               | ASTM C580         | 4,000 psi Minimum           |
| Tensile Strength               | ASTM C307         | 2,000 psi Minimum           |
| Moisture Absorption            | ASTM D570         | 0.1% Maximum                |
| Chemical Resistance            | ASTM C267         | Pass                        |
| Freeze/Thaw<br>w/o weight loss | ASTM C666 1600    | Number of Cycles<br>Minimum |
| Resistance to Fungi            | ASTM G21 Zero (0) | Rating Mold Growth          |
| UL/ULC Listed- Flame Spread    | UL-723            | Class A                     |
- .2 The trench consisting of 39.19" (nominal 1 meter) or 19.56" (1/2 meter) channels with nominal 6" (155mm) outside width, 4 " (100mm) inside width. Pre-sloped channels shall have a standard slope of 0.6% with radius bottom. Non-sloping channels must have written approval by engineer prior to installation. Channels shall have tongue and groove joints. Grate lock down slots shall have polyethylene vibration dampening inserts. All channels must have full length anchoring ribs for a positive mechanical lock with the surrounding concrete.
  - .3 Sidewall extensions for channels may be used for hydraulic performance or to maintain the standard slope of 0.6% in greater trench run lengths. Sidewall extensions shall be composed of similar material and thickness as the channels and shall have tongue and groove joints.
  - .4 Frame & Grate: Black polymer coated ductile iron conforming to ASTM A-536 with a minimum of 0.23Ft<sup>2</sup> /L Ft (.072m<sup>2</sup>/Lm) open area. Grates shall meet a

minimum 2469 psi proof load per AASHTO M-306 test modified by utilizing a 9" x 3.75" load plate. The grate and frame assembly shall be independently anchored in the encapsulating concrete. Each 19.66" (0.5m) long grate and frame assembly shall have a minimum anchor flange area of 18 in<sup>2</sup> (116cm<sup>2</sup>) per side. Grate and frame assemblies shall withstand a minimum vertical pull out of 1,000 lbs. with a minimum 3,000 psi concrete encapsulation. Grates shall be retained in their frame per manufactures recommendation. The grate retaining devices shall not obstruct hydraulic flow in the channel. All grates shall be bicycle safe.

## 6 ELECTRICAL DRAWING REVISIONS

- .1 Drawing E4.0:
  - .1 Revise Generator G1 to 600kw, 347/600v 3Ø4w with a 700Amp 100% rated main breaker.
  - .2 Revise transfer switch TS-1 to 800Amp, 347/600v 3Ø4w.
  - .3 Revise 600Amp breaker feeding TS-1 from MD-2 to a 800Amp 100% rated.
  - .4 Revise MD-2 to 800Amp rated.
  - .5 Revise main breaker for MD-2 to 800Amp 100% rated.
  - .6 Revise feeder #2 to (3x) 4-#350 MCM RA90 in 78mm conduit as per CEC diagram D11 Detail #3 and Table D11A Detail #3 complete with 1- #3/0 ground for ampacity of 858 Amp.
  - .7 Revise feeder #5 to 4-1C #750MCM RW90 single conductor +1-#3/0 ampacity of 750 Amps.
  - .8 Revise feeder #6 to 4-1C #750 MCM RW90 as per CEC diagram D8 Detail #1 and Table D8A Detail #1 for ampacity of 784 Amps.
- .2 Drawing EP2.1:
  - .1 Delete Note 15.
- .3 Drawing EP2.2:
  - .1 Provide additional sixteen (16) quadplex receptacles at counter height in new Tertiary Garage 401 connected to panel P3 with two (2) quadplex receptacles per circuit.
- .4 Drawing EP2.1:
  - .1 Adjacent to Note 14. Provide 60Amp/600 Volt 3Ø circuit connected to MD-2 complete with 3-#6 RW-90 in 27mm conduit.
- .5 Drawing EP2.1:
  - .1 Delete Note 15.
- .6 Drawing EP2.2:
  - .1 Provide additional sixteen (16) quadplex receptacles at counter height in new Tertiary Garage 401 connected to panel P3 with two (2) quadplex receptacles per circuit.
- .7 Drawing EP2.1:
  - .1 Adjacent to Note 14. Provide 60Amp/600 Volt 3Ø circuit connected to MD-2 complete with 3-#6 RW-90 in 27mm conduit.

Project No.: R.068431.001

December 9, 2016

-----END-----

SECTION / TITLE	PAGES
00 00 01 Title Page .....	1
<b>DIVISION 01 GENERAL REQUIREMENTS</b>	
01 11 00 Summary of Work.....	3
01 14 00 Work Restrictions .....	2
01 21 00 Allowances.....	1
01 31 19 Project Meetings .....	3
01 32 <b>16.07</b> Construction Progress Schedule – Bar (GANTT) Chart.....	3
01 33 00 Submittal Procedures .....	5
01 35 00.06 Special Procedures for Traffic Controls.....	3
01 35 29.06 Health and Safety Requirements.....	3
01 35 43 Environmental Procedures .....	5
01 41 00 Regulatory Requirements.....	1
01 45 00 Quality Control .....	3
01 51 00 Temporary Utilities .....	3
01 52 00 Construction Facilities .....	4
01 56 00 Temporary Barriers and Enclosures.....	2
01 61 00 Common Product Requirements .....	4
01 71 00 Examination and Preparation .....	2
01 73 00 Execution Requirements .....	2
01 74 11 Cleaning .....	<b>2</b>
01 74 21 Construction/Demolition Waste Management and Disposal .....	9
01 77 00 Closeout Procedures.....	2
01 78 00 Closeout Submittals .....	8
01 91 13 General Commissioning (CX) Requirements .....	10
01 91 31 Commissioning Plan .....	12
01 91 33 Commissioning Forms .....	<b>20</b>
01 91 41 Commissioning Training.....	<b>4</b>
<b>DIVISION 02 SITE CONDITIONS</b>	
02 41 13 Selective Site Demolition.....	<b>7</b>
02 41 13.14 Asphalt Paving Removal.....	1
02 41 16 Structure Demolition.....	<b>7</b>

### **DIVISION 03 CONCRETE**

03 10 00	Concrete Forming and Accessories.....	4
03 20 00	Concrete Reinforcing .....	4
03 30 00	Cast-in-Place Concrete.....	<b>9</b>
03 35 00	Concrete Finishing .....	3
31 63 23	Bored Concrete Piles.....	<b>4</b>

### **DIVISION 04 MASONRY**

Not Used

### **DIVISION 05 METALS**

05 12 23	Structural Steel for Buildings.....	6
05 21 00	Steel Joist Framing.....	<b>5</b>
05 31 00	Steel Decking .....	<b>4</b>
05 41 00	Structural Metal Stud Framing.....	5
05 50 00	Metal Fabrications .....	5
05 51 29	Metal Stairs and Ladders.....	4

### **DIVISION 06 WOOD AND PLASTICS**

06 10 00	Rough Carpentry .....	5
06 40 00	Architectural Woodwork.....	8

### **DIVISION 07 - THERMAL AND MOISTURE PROTECTION**

07 11 13	Bituminous Dampproofing .....	4
07 21 13	Board Insulation.....	4
07 21 16	Blanket Insulation .....	3
07 21 19	Foamed-in-Place Insulation .....	2
07 27 10	Air Barriers .....	<b>6</b>
07 42 43	Composite Wall Panels .....	6
07 46 13	Preformed Metal Cladding.....	<b>5</b>
07 52 00	Modified Bituminous <b>Membrane</b> Roofing .....	10
07 62 00	Sheet Metal Flashing and Trim.....	6
<b>07 72 69</b>	<b>Roof Anchors and Safety Restraints.....</b>	<b>6</b>
07 84 00	Fire Stopping.....	<b>6</b>
07 92 00	Joint Sealing.....	<b>6</b>
07 95 13	Expansion Joint Cover Assemblies.....	<b>4</b>
07 95 23	Manufactured Roof and Wall Expansion Joints.....	3



## **DIVISION 08 DOORS AND WINDOWS**

08 11 00	Metal Doors and Frames .....	<b>7</b>
08 36 12	Sectional Metal Doors.....	6
08 50 00	Aluminum Windows .....	4
08 71 00	Door Hardware.....	<b>12</b>
08 80 50	Glazing .....	<b>7</b>

## **DIVISION 09 FINISHES**

09 21 16	Gypsum Board Assemblies .....	8
09 22 14	Furring and Lathing .....	4
09 22 16	Non-structural Metal Framing .....	3
09 65 16	Resilient Sheet Flooring.....	5
09 91 23	Interior Painting .....	14
09 97 19	Painting Exterior Metal Surfaces .....	7

## **DIVISION 10 SPECIALTIES**

10 14 10	Building <del>Panel</del> Signage .....	7
10 14 53	Traffic Signage.....	<b>11</b>
10 14 54	Fabrication and Delivery of Traffic Signal Supports .....	8
10 14 55	Traffic Signal Standards.....	7
10 26 10	Wall and Corner Guards .....	2
10 44 20	Fire Extinguishers .....	2
10 51 13	Metal Lockers and Benches .....	2

## **DIVISION 11 EQUIPMENT**

11 13 13	Loading Dock Bumpers .....	2
11 13 16	Dock Seals and Shelters .....	2
11 13 20	Loading Dock Levellers.....	5
11 13 22	Loading Dock Lift.....	5

## **DIVISION 12 FURNISHINGS**

12 21 14	Roller Shade Blinds .....	2
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## **DIVISION 13 SPECIAL CONSTRUCTION**

13 34 23	Prefabricated Buildings.....	<b>5</b>
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## **DIVISION 21 FIRE SUPPRESSION**

21 05 01	Common Work Results for Mechanical.....	5
21 05 05	Common Work Results for Fire Suppression .....	5
21 13 13	Wet Pipe Sprinkler Systems.....	10
21 13 16	Dry Sprinkler Systems .....	6

## **DIVISION 22 PLUMBING**

22 05 00	Common Work Results for Plumbing.....	5
22 11 16	Domestic Water Piping .....	7
22 13 17	Drainage Waste and Vent Piping - Cast Iron and Copper.....	3
22 13 18	Drainage Waste and Vent Piping - Plastic .....	3
22 42 01	Plumbing Specialties and Accessories .....	8

## **DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)**

23 05 00	Common Work Results for HVAC .....	5
23 05 01	Use of HVAC Systems During Construction.....	2
23 05 05	Installation of Pipework .....	6
23 05 13	Common Motor Requirements for HVAC Equipment .....	4
23 05 17	Pipe Welding.....	4
23 05 19.01	Thermometers and Pressure Gauges – Piping Systems .....	4
23 05 23.01	Valves - Bronze.....	5
23 05 23.04	Valves – Lubricated Plug .....	5
23 05 29	Hangers and Supports for HVAC Piping and Equipment.....	8
<b>23 05 33</b>	<b><i>Heat Tracing for HVAC Piping and Tanks .....</i></b>	<b>3</b>
23 05 48	Vibration and Seismic Controls for HVAC Piping and Equipment.....	5
23 05 53.01	Mechanical Identifications .....	6
23 05 93	Testing, Adjusting and Balancing for HVAC .....	6
23 07 13	Duct Insulation.....	6
23 07 15	Thermal Insulation for Piping .....	9
23 08 01	Performance Verification Mechanical Piping Systems.....	2
23 11 23	Facility Natural Gas Piping.....	4
23 21 13.02	Hydronic Systems: Steel .....	6
23 21 14	Hydronic Specialties .....	3
23 23 00	<del>Copper Tubing and Fittings</del> Refrigerant Piping.....	5
23 31 13.01	Metal Ducts - Low Pressure to 500 Pa.....	6
23 33 00	Air Duct Accessories .....	4
23 33 14	Dampers - Balancing.....	3
23 33 16	Dampers - Fire and Smoke.....	4
23 33 53	Duct Liners.....	5
23 34 00	HVAC Fans.....	5

23 37 13	Diffusers, Registers and Grilles .....	3
23 37 20	Louvres, Intakes and Vents .....	4
23 44 00	HVAC Air Filtration .....	4
23 72 00	Air-to-Air Energy Recovery Equipment .....	3
23 73 11	Air Handling Units - Packaged .....	5
23 74 00	Packaged Outdoor HVAC Equipment .....	7
23 81 23	Computer Room Air Conditioning .....	8
23 82 39	Unit Heaters .....	5

## **DIVISION 25 INTEGRATED AUTOMATION**

250111	EMCS: Start-up, Verification and Commissioning .....	5
250112	EMCS: Training .....	3
250501	EMCS: General Requirements .....	6
250502	EMCS: Submittals and Review Process .....	3
250503	EMCS: Project Record Documents .....	3
250554	EMCS: Identification .....	2
250820	EMCS: Warranty and Maintenance .....	3
251001	EMCS: Local Area Network (LAN) .....	2
251002	EMCS: Operator Work Station (OWS) .....	2
253001	EMCS: Building Controllers .....	9
253002	EMCS: Field Control Devices .....	10
259001	EMCS: Site Requirements Applications and Systems Sequences of Operation .....	7

## **DIVISION 26 - ELECTRICAL**

26 05 00	Common Work Results For Electrical .....	7
26 05 20	Wires and Box <del>Connection</del> <del>Connectors (0-1000 V)</del> .....	2
26 05 21	Wires and Cables (0-1000 V) .....	3
26 05 29	Hangers and Supports for Electrical <del>Systems</del> .....	2
26 05 32	Outlet Boxes, Conduit Boxes, and Fittings .....	3
26 05 34	Conduits, Conduit Fastenings and Conduit Fittings .....	4
26 05 43.01	Installation of Cables in Trenches and in Ducts .....	4
26 05 80	Fractional Horsepower Motors .....	2
26 09 23.02	Lighting Control Devices - Photoelectric .....	2
26 09 43	Site Lighting Controls .....	6
26 12 16	Dry Type Medium Voltage Transformers .....	5
26 24 02	Service Entrance Board .....	4
26 24 16.01	Panelboards Breaker Type .....	3
26 27 26	Wiring Devices .....	4
26 28 16.02	Molded Case Circuit Breakers .....	3
26 28 23	Disconnect Switches – Fused, Non-fused .....	2

26 29 10	Motor Starters to 600 V .....	3
26 32 13.04	Diesel Electric Generating Units – Liquid Cooled.....	22
26 36 23	Automatic Transfer Switches .....	6
26 41 13	Lightning Protection for Structures.....	2
26 50 00	Lighting .....	2
26 52 00	Emergency Lighting.....	3
26 53 00	Exit Signs .....	3
26 56 19	<del>Roadway</del> <b>Site</b> Lighting.....	3

## **DIVISION 28 - ELECTRONIC SAFETY AND SECURITY**

28 14 00	Electrical Controls and Instrumentation - FAST Traffic Control <b>System</b> .....	8
28 <del>3</del> 23 00	Video Surveillance .....	5
28 31 00	Fire <b>Detection and</b> Alarm <b>Systems</b> .....	6
Attachment A	Video Surveillance Cover.....	1
Attachment A	to 28 23 00 .....	<b>77</b>

## **DIVISION 31 EARTHWORK**

31 05 10	Corrected Maximum Density For Fill.....	1
31 05 16	Aggregate Materials .....	3
31 14 13	Soil Stripping and Stockpiling .....	2
31 22 13	Rough Grading .....	4
31 23 33.01	Excavating, Trenching, and Backfilling.....	6
31 24 13	Roadway Embankments.....	6
31 32 19.01	Geotextiles .....	2
31 37 00	Rip-Rap .....	2
<b>31 63 23</b>	<b>Bored Concrete Piles.....(see DIVISION 03 – CONCRETE above)</b>	

## **DIVISION 32 EXTERIOR IMPROVEMENTS**

32 11 23	Aggregate Base Courses .....	5
32 12 13.16	Asphalt Tack Coat.....	4
32 12 13.23	Asphalt Prime Coat .....	4
32 12 16	Asphalt Paving .....	19
32 13 13	Concrete Paving .....	<b>32</b>
32 16 15	Concrete Walks Curbs and Gutters .....	6
32 17 23	Pavement Marking .....	3
32 31 13	Chain Link Fences and Gates.....	5
32 91 19.13	Topsoil Placement and Grading .....	3
32 92 19.13	Mechanical Seeding .....	3

### **DIVISION 33 UTILITIES**

33 05 16	Maintenance Holes and Catchbasin Structures .....	8
33 11 16	Site Water Utility Distribution Piping.....	8
33 41 00	Storm Utility Drainage Piping .....	9
33 41 01	Linear Trench Drain.....	5
33 42 13	Pipe Culverts.....	8

### **DIVISION 34 TRANSPORTATION**

34 71 13.01	Vehicle Concrete Barriers .....	2
34 71 13.29	Sand Filled Barrels.....	<b>4</b>

### **LIST OF DRAWINGS**

#### ARCHITECTURAL:

G0.1	COVER SHEET
G1.0	GENERAL NOTES & ASSEMBLIES
G1.1	CONSTRUCTION PHASING
A1.0	SITE PLAN
A1.1	FIRE SEPARATION PLAN
A1.2	FLOOR PLAN: NEW WAREHOUSE ADDITION
A1.3	FLOOR PLANS: EXISTING WAREHOUSE AND PIL 406 ALTERATIONS
A1.4	NEW ROOF PLAN
A1.5	REFLECTED CEILING PLAN: NEW WAREHOUSE ADDITION AND CANOPY
A1.6	REFLECTED CEILING PLAN: EXISTING WAREHOUSE
A2.0	BUILDING ELEVATIONS
A2.1	MISCELLANEOUS ELEVATIONS
A3.0	BUILDING & CANOPY SECTIONS
A3.1	WALL SECTIONS
A3.2	WALL SECTIONS
A3.3	WALL SECTIONS
A3.4	SECTION DETAILS
A3.5	SECTION DETAILS
A3.6	PLAN DETAILS
A4.0	ENLARGED PLANS & STAIR DETAILS
A4.1	PIL BOOTH PLANS, ELEVATIONS & SECTIONS
A4.2	TERTIARY GARAGE ADDITION: FLOOR PLAN, ROOF PLAN, AND REFLECTED CEILING PLAN
A4.3	TERTIARY GARAGE ADDITION: ELEVATIONS AND BUILDING SECTIONS
A4.4	TERTIARY GARAGE ADDITION: WALL SECTIONS AND MILLWORK PLAN & ELEVATIONS
A6.0	ROOM FINISH SCHEDULE, DOOR SCHEDULE AND DOOR & WINDOW ELEVATIONS

STRUCTURAL:

S1.0	GENERAL NOTES
S1.1	TYPICAL DETAILS & PIL BOOTH <b>FOUNDATION</b> PLANS
S1.2	FOUNDATION PLAN & <b>PILE</b> SCHEDULES
S1.3	MAIN FLOOR FRAMING PLAN & SCHEDULES
S1.4	ROOF FRAMING PLAN, <b>CANOPY FRAMING PLANS, COLUMN SCHEDULE</b>
S1.5	TERTIARY GARAGE - MAIN FLOOR & ROOF FRAMING PLANS, <b>STORAGE BUILDING</b> <b>SLAB SECTION</b>
S2.1	TERTIARY GARAGE ELEVATIONS
S3.1	SECTIONS
S3.2	SECTIONS
S3.3	SECTIONS
S3.4	SECTIONS
S3.5	SECTIONS & DETAILS
S3.6	SECTIONS
S3.7	<b>SECTIONS</b>
S4.1	DETAILS
S4.2	DETAILS
S4.3	DETAILS

MECHANICAL:

M0.0	MECHANICAL LEGEND & DRAWING LIST
M1.1	WAREHOUSE PLUMBING - RENOVATION PLAN
M2.1	WAREHOUSE HVAC - RENOVATION PLAN
M3.1	WAREHOUSE FIRE PROTECTION - RENOVATION PLAN
M4.1	WAREHOUSE ROOF PLAN
M5.1	WAREHOUSE ENLARGEMENTS & ELEVATIONS
M6.1	MECHANICAL SCHEMATICS & DETAILS
M6.2	VENTILATION CHARTS
M6.3	PLUMBING SPECIFICATIONS, CHARTS & GAS LOAD SCHEMATIC
M7.1	TERTIARY EXAM GARAGE ADDITION - PLUMBING RENOVATION PLAN
M8.1	TERTIARY EXAM GARAGE ADDITION - HVAC RENOVATION PLAN

MECHANICAL / ELECTRICAL:

ME1.0	MECHANICAL & ELECTRICAL DATA SHEETS
ME1.1	MECHANICAL & ELECTRICAL DATA SHEETS
ME1.2	MECHANICAL & ELECTRICAL DATA SHEETS

ELECTRICAL:

E1.0	ELECTRICAL SYMBOL LEGEND
ED1.1	SITE PLAN - ELECTRICAL DEMOLITION LAYOUT
E1.1	SITE PLAN - LIGHTING LAYOUT
E1.2	SITE PLAN - REVISED DISTRIBUTION AND PARKING LOT LAYOUT
EL2.1	WAREHOUSE AREA ADDITION - LIGHTING LAYOUT
EL2.2	EXISTING WAREHOUSE & NEW TERTIARY GARAGE ADDITION - <b>POWER</b> <b>LIGHTING LAYOUT</b>
EP2.1	WAREHOUSE AREA ADDITION - <b>POWER &amp; SYSTEMS</b> LAYOUT
EP2.2	EXISTING WAREHOUSE & NEW TERTIARY GARAGE ADDITION - <b>POWER &amp;</b> <b>SYSTEMS</b> LAYOUT
EC2.0	SITE PLAN - CCTV LAYOUT

EC2.1	COMMERCIAL BUILDING FLOOR PLAN - CCTV LAYOUT
EC2.2	EXISTING TRAVELERS BUILDING FLOOR PLAN - CCTV LAYOUT
EC2.3	PARTIAL FLOOR PLAN ADDITION - PIL BOOTH LICENCE PLATE READER SYSTEM
EC2.4	PARTIAL FLOOR PLAN EXISTING - PIL BOOTH LICENCE PLATE READER SYSTEM
EC2.5	LANES C1 TO C3 & LANE 6 CONFIGURATION 1 - EQUIPMENT LISTING
EC2.6	SITE PLAN - F.A.S.T. LAYOUT
EC2.7	WAREHOUSE AREA ADDITION - I.T. LAYOUT
EC2.8	EXISTING WAREHOUSE & NEW TERTIARY GARAGE <b>BUILDING</b> - I.T. LAYOUT
E3.0	ENLARGED PIL 6 FLOOR PLAN - ELECTRICAL LAYOUTS
E3.1	WAREHOUSE AREA ADDITION - LIGHTNING PROTECTION LAYOUT
E3.2	NEW TERTIARY GARAGE ADDITION - LIGHTNING PROTECTION LAYOUT
E4.0	SINGLE LINE DIAGRAM
E4.1	ELECTRICAL SCHEMATIC DIAGRAM
E5.0	ELECTRICAL SCHEDULES
E5.1	PANELBOARD SCHEDULES
E5.2	PANELBOARD SCHEDULES
E6.0	ELECTRICAL DETAILS

CIVIL:

C01	CIVIL SITE PLAN
C02	REMOVALS PLAN
C03	GEOMETRIC SITE PLAN - NORTH
C04	GEOMETRIC SITE PLAN - SOUTH
C05	LAND DRAINAGE SYSTEM PLAN & PROFILE
C06	SURFACE WORKS AND GRADING PLAN - NORTH
C07	SURFACE WORKS AND GRADING PLAN - SOUTH
C08	SURFACE WORKS AND GRADING PLAN - LOADING BAY & PIL BOOTHS
C09	CONCRETE JOINTING PLAN - NORTH
C10	CONCRETE JOINTING PLAN - SOUTH
C11	PAVEMENT MARKING & SIGNAGE PLAN - NORTH
C12	PAVEMENT MARKING & SIGNAGE PLAN - SOUTH
C13	SECTIONS - SHEET 1
C14	SECTIONS - SHEET 2
C15	DETAILS - SHEET 1
C16	DETAILS - SHEET 2
C17	MANHOLE WITH FLAPGATE DETAIL
C18	SIGNAL POLE STRUCTURES
C19	BYPASS CENTERLINE PROFILE - SOUTH
C20	BYPASS CENTERLINE PROFILE - NORTH
C21	SOUTHEAST DITCH PROFILE
C22	TERTIARY GARAGE EXPANSION - GEOMETRIC LAYOUT
C23	TERTIARY GARAGE EXPANSION - REMOVALS & SURFACE WORKS PLAN

**Part 1            General**

**1.1            REFERENCES**

- .1 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
  - .1 Architectural Woodwork Quality Standards Illustrated, 8th edition, Version 1.0 (2005).
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- .3 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 O112.5-Series-M-1977(R2006), Urea Resin Adhesives for Wood (Room- and High-Temperature Curing).
  - .4 CSA O112.7-Series M-1977(R2006), Resorcinol and Phenol-Resorcinol Resin Adhesives for Wood (Room- and Intermediate-Temperature Curing).
  - .5 CSA O121[M89(R2003), Douglas Fir Plywood.
  - .6 CSA O141-05, Softwood Lumber.
  - .7 CSA O151-04, Canadian Softwood Plywood.
  - .8 CSA O153-M1980(R2003), Poplar Plywood.
- .4 International Organization for Standardization (ISO)
  - .1 ISO 14040-2006, Environmental Management-Life Cycle Assessment - Principles and Framework.
  - .2 ISO 14041-98, Environmental Management-Life Cycle Assessment - Goal and Scope Definition and Inventory Analysis.
- .5 Forest Stewardship Council (FSC)
  - .1 FSC Accredited Certified Bodies.
- .6 National Electrical Manufacturers Association (NEMA)
  - .1 ANSI/NEMA LD-3-05, High-Pressure Decorative Laminates.
- .7 National Hardwood Lumber Association (NHLA)
  - .1 Rules for the Measurement and Inspection of Hardwood and Cypress 1998.
- .8 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber 2005.
- .9 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
  - .1 SCAQMD Rule 1113-04, Architectural Coatings.
  - .2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.



## **1.2 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 or 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 200 x 200 mm or 200 mm long unless specified otherwise.
  - .2 Provide duplicate colour samples of laminated plastic for colour selection.
  - .3 Provide duplicate samples of laminated plastic joints, edging, cutouts and postformed profiles.
- .4 Quality assurance submittals:
  - .1 Manufacturer's Instructions: manufacturer's installation instructions.

## **1.3 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 Mock-ups:
  - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
    - .1 Shop prepare one base cabinet unit, wall cabinet, counter top, shelving unit, complete with hardware and shop applied finishes, and install on project in designated location.
    - .2 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with this work.
    - .3 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.
- .4 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.

- .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 MATERIALS**

- .1 Softwood lumber: unless specified otherwise, S4S, moisture content 15% 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.
  - .4 Forestry Stewardship Council (FSC) certified.
- .2 Machine stress-rated lumber is acceptable for all purposes.
- .3 The manufacturing process must adhere to Lifecycle Assessment (LCA) Standards as per ISO 14040/14041 LCA Standards, CSA Z760 94 Life Cycle Assessment.
- .4 Hardwood lumber: moisture content 10 % or less in accordance with following standards:
  - .1 National Hardwood Lumber Association (NHLA).
  - .2 AWMAC custom grade, moisture content as specified.
  - .3 Forestry Stewardship Council (FSC) certified.
- .5 Indoor Environmental Quality Credit EQ - 4.4 Low - Emitting Materials: Composite Wood and Laminates Adhesives. Co-ordinate with Section 01 35 21 - LEED Requirements.
- .6 Douglas fir plywood (DFP): to CSA O121, standard construction.
  - .1 Forestry Stewardship Council (FSC) certified.
  - .2 Urea-formaldehyde free.
- .7 Canadian softwood plywood (CSP): to CSA O151, standard construction.
  - .1 Forestry Stewardship Council (FSC) certified.
  - .2 Urea-formaldehyde free.
- .8 Hardwood plywood: to ANSI/HPVA HP-1.
  - .1 Forestry Stewardship Council (FSC) certified.
  - .2 Urea-formaldehyde free.
- .9 Poplar plywood (PP): to CSA O153, standard construction.
  - .1 Forestry Stewardship Council (FSC) certified.
  - .2 Urea-formaldehyde free.
- .10 Interior mat-formed wood particleboard: to ANSI A208.1.

- .1 Forestry Stewardship Council (FSC) certified.
- .2 Urea-formaldehyde free.
- .11 Birch plywood: to AWMAC Select White.
  - .1 Forestry Stewardship Council (FSC) certified.
  - .2 Urea-formaldehyde free.
- .12 Fibreboard must contain less than 10% roundwood by weight, using a weighted average over a three month period at manufacturing locations.
  - .1 Forestry Stewardship Council (FSC) certified.
  - .2 Urea-formaldehyde free.
  - .3 Recycled content: sum of post-consumer and 1 / 2 preconsumer content 20%.
- .13 Hardboard:
  - .1 To CAN/CGSB-11.3.
  - .2 Forestry Stewardship Council (FSC) certified.
  - .3 Urea-formaldehyde free.
  - .4 Recycled content: sum of post-consumer and 1 / 2 preconsumer content 20%.
- .14 MDF (medium density fibreboard)core: to ANSI A208.2, Grade II, 19mm thick density 769 kg/m<sup>2</sup>.
  - .1 Medium density fibreboard must:
    - .1 Meet the performance requirements of ANSI A208.2.
    - .2 Forestry Stewardship Council (FSC) certified.
    - .3 Urea-formaldehyde free.
    - .4 Recycled content: sum of post-consumer and 1 / 2 preconsumer content 20%.
- .15 Laminated plastic for flatwork: to NEMA LD3, Grade VGL, Type S, 1.0 mm thick; based on solid or woodgrain colour range with satin finish.
- .16 Laminated plastic for postforming work: to NEMA LD3, Grade VGL, Type S, 0.7mm thick, based on solid or patterned colour range with satin finish.
- .17 Laminated plastic backing sheet: Grade BK, Type S not less than 0.5 mm thick or same thickness as face laminate.
- .18 Laminated plastic liner sheet: Grade GP, Type S, 0.3 mm thick, white colour.
- .19 Thermofused Melamine: to NEMA LD3 Grade VGL.
  - .1 High wear resistant thermofused melamine: equal or exceed 400 cycles (Minimum standard for HPL abrasion test).
- .20 Nails and staples: to CSA B111.
- .21 Wood screws: brass or stainless steel, type and size to suit application.
- .22 Splines: metal.

- .23 Sealant: in accordance with Section 07 92 00 - Joint Sealants SCAQMD Rule 1168 - Adhesives and Sealants Applications.
- .24 Laminated plastic adhesive:
  - .1 Adhesive: urea resin adhesive to CSA O112.5 or contact adhesive to CAN/CGSB-71.20.
    - .1 Maximum VOC limit SCAQMD Rule 1168, Adhesives and Sealants Applications 250 g/l.
    - .2 Adhesives urea-formaldehyde free.

## 2.2 MANUFACTURED UNITS

- .1 Casework:
  - .1 Fabricate caseworks to AWMAC Premium quality grade.
  - .2 Furring, blocking, nailing strips, grounds and rough bucks and sleepers.
    - .1 Board sizes: "standard" or better grade.
    - .2 Dimension sizes: "standard" light framing or better grade.
    - .3 Forestry Stewardship Council (FSC) certified.
  - .3 Framing species, NLGA II grade.
  - .4 Case bodies (ends, divisions and bottoms).
    - .1 DFP G1S or G2S grade, square edge, 19 mm thick.
    - .2 Laminated with 0.7 mm thick plastic laminate or HPL.
  - .5 Backs.
    - .1 DFP G1S or G2S grade, square edge, 19 mm thick.
    - .2 Thermofused Melamine: white.
  - .6 Shelving.
    - .1 DFP G2S grade, square edge, 19 mm thick.
    - .2 Solid wood: birch species, II grade, 19 mm thick.
    - .3 Laminated with HPL 0.7 mm thick.
- .2 Drawers:
  - .1 Fabricate drawers to AWMAC premium grade supplemented as follows:
  - .2 Sides and Backs.
    - .1 Fibreboard, Medium Density Fibreboard 12.5 mm thick.
    - .2 Thermofused Melamine: white.
  - .3 Bottoms.
    - .1 Fibreboard, Medium Density Fibreboard 12.5 mm thick.
    - .2 Thermofused Melamine: white.
  - .4 Fronts.
    - .1 Particleboard, laminated with HPL 1.0 mm thick.
- .3 Casework Doors
  - .1 Fabricate doors to AWMAC premium grade supplemented as follows:
    - .1 DFP G2S grade, square edge, 19 mm thick.

.2 Laminated with HPL 1.0 mm thick.

.4 Countertops and Backsplash

- .1 Solid countertops: Plastic laminate and backer sheet on one layer 19 mm particle board or plywood core. Provide blocking to suit. Use two layers 19 mm particle board or plywood core as required to ensure sound construction.
- .2 Countertops at Sinks: Plastic laminate and backer sheet on 19 mm exterior grade plywood core through full length of top. Provide blocking to suit.
- .3 Quartz countertops: 30 mm thick with standard eased edge profile. Install with supporting substrate as per manufacturer's recommendations. Prior to construction, fabricator to forward sample of edge profile and stacked edge to Consultant for review.
- .4 Backsplash: Where plastic laminate is specified, backsplash to match countertop material unless noted otherwise. Where quartz is specified, refer to elevations for material.

**2.3 FABRICATION**

- .1 Set nails and countersink screws apply plain wood filler to indentations, sand smooth and leave ready to receive finish.
- .2 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.
- .3 Shelving to cabinetwork to be adjustable unless otherwise noted.
- .4 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
- .5 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.
- .6 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .7 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .8 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 2400mm. Keep joints 600 mm from sink cutouts.
- .9 Form shaped profiles and bends as indicated, using postforming grade laminate to laminate manufacturer's instructions.
- .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.
- .12 Apply laminated plastic liner sheet to interior of cabinetry where indicated.

## **2.4 FINISHING**

- .1 SCAQMD Rule 1113 - Architectural Coatings.

## **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 bituminous coating 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 approved. Slightly bevel arises.
- .10 For site application, offset joints in plastic laminate facing from joints in core.

### **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.

**3.4 SCHEDULES**

- .1 Cabinets and Cupboards: Plastic Laminate, two colours or patterns.
- .2 Worktop Counters: Solid surface material.
- .3 Colour for plastic laminate to be approved by Departmental Representative.

**END OF SECTION**

**Part 1 General**

**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 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 Manitoba, Canada.
  - .2 Indicate on drawings:
    - .1 Mounting arrangements.
    - .2 Operating and maintenance clearances.
  - .3 Shop drawings and product data accompanied by:
    - .1 Detailed drawings of bases, supports, and anchor bolts.
    - .2 Acoustical sound power data, where applicable.
    - .3 Points of operation on performance curves.
    - .4 Manufacturer to certify current model production.
    - .5 Certification of compliance to applicable codes.
  - .4 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.
- .4 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
  - .2 Building Energy and Water Consumption:
    - .1 Constant and variable motor loads.
    - .2 Cooling load.
    - .3 Air economizer and heat recovery cycle.
    - .4 Air distribution static pressures and ventilation air volumes.
    - .5 Building-related process energy systems and equipment.
  - .3 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products.



## **1.2 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 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
  - .2 Operation data to include:
    - .1 Control schematics for systems including environmental controls.
    - .2 Description of systems and their controls.
    - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
    - .4 Operation instruction for systems and component.
    - .5 Description of actions to be taken in event of equipment failure.
    - .6 Valves schedule and flow diagram.
    - .7 Colour coding chart.
  - .3 Maintenance data to include:
    - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
    - .2 Data to include schedules of tasks, frequency, tools required and task time.
  - .4 Performance data to include:
    - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
    - .2 Equipment performance verification test results.
    - .3 Special performance data as specified.
    - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
  - .5 Approvals:
    - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative and Consultant for approval. Submission of individual data will not be accepted unless directed by Departmental Representative or Consultant.
    - .2 Make changes as required and re-submit as directed by Departmental Representative or Consultant.
  - .6 Additional data:
    - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
  - .7 Site records:
    - .1 Departmental Representative and Consultant will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and

- as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
- .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
- .3 Use different colour waterproof ink for each service.
- .4 Make available for reference purposes and inspection.
- .8 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 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).
  - .3 Submit to Departmental Representative and Consultant for approval and make corrections as directed.
  - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
  - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

### **1.3 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Furnish spare parts as follows:
  - .1 One set of packing for each pump.
  - .2 One casing joint gasket for each size pump.
  - .3 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

### **1.4 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 equipment from nicks, scratches, and blemishes.

- .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 HVAC and R Equipment:
  - .1 Refrigerant: R-410A
    - .1 HCFC based refrigerant.
    - .2 HFC based refrigerant.

## **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 installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative or Consultant.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 PAINTING REPAIRS AND RESTORATION**

- .1 Do painting in accordance with Section 09 91 23 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

### **3.3 SYSTEM CLEANING**

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of new ductwork and air handling units.

### **3.4 FIELD QUALITY CONTROL**

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Manufacturer's Field Services:

- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .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.

### **3.5 DEMONSTRATION**

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
  - .1 Air Handling, Fans, Unit Heaters.
- .3 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.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Departmental Representative DCC Representative Consultant will record these demonstrations on video tape for future reference.

### **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 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.7 PROTECTION**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

**END OF SECTION**

**Part 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 ventilating systems for supplying temporary heat ventilation is permitted only under following conditions:.

- .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 60 % filters, inspected daily, changed every 2 weeks 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.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.181-Latest Edition, Ready-Mixed Organic Zinc-Rich Coating.
- .2 Canada Green Building Council (CaGBC)
  - .1 Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
  - .2 Green Building Rating System Reference Guide For Commercial Interiors.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA B139-Latest Edition, Installation Code for Oil Burning Equipment.
- .4 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-11-2008, 2nd Edition, Environmental Standard for Paints and Coatings.
- .5 National Fire Code of Canada (NFCC 2005)

**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, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3 QUALITY ASSURANCE**

- .1 Sustainability Standards Certification:
  - .1 Low-Emitting Materials: provide listing of sealants used in building, comply with VOC and chemical component limits or restriction requirements.

**1.4 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:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 MATERIAL**

- .1 Paint: zinc-rich to CAN/CGSB-1.181.
  - .1 Primers, Paints, Coating: in accordance with manufacturer's recommendations for surface conditions.
  - .2 Primer: maximum VOC limit 250 g/L to Standard GS-11, to SCAQMD Rule 1113.
  - .3 Paints: maximum VOC limit 150 g/L to Standard GS-11, to SCAQMD Rule 1113.
- .2 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
  - .1 Sealants: maximum VOC limit to SCAQMD Rule 1168 to GSES GS-36.
- .3 Sealants: maximum VOC limit to SCAQMD Rule 1168 to GSES GS-36.
- .4 Adhesives: maximum VOC limit to SCAQMD Rule 1168 to GSES GS-36.

## **Part 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 CONNECTIONS TO EQUIPMENT**

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges 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.

### **3.3 CLEARANCES**

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of Canada CSA B139.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer, CSA B139, as indicated without interrupting operation of other system, equipment, components.

### **3.4 DRAINS**

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.



- .3 Pipe each drain valve discharge separately to above floor drain.
  - .1 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.

### **3.5 AIR VENTS**

- .1 Install manual air vents to CSA B139 at high points in piping systems.
- .2 Install isolating valve at each automatic air valve.
- .3 Install drain piping to approved location and terminate where discharge is visible.

### **3.6 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.

### **3.7 PIPEWORK INSTALLATION**

- .1 Install pipework to CSA B139.
- .2 Screwed fittings jointed with Teflon tape.
- .3 Protect openings against entry of foreign material.
- .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .5 Assemble piping using fittings manufactured to ANSI standards.
- .6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
  - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .8 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .10 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .11 Group piping wherever possible and as indicated.
- .12 Ream pipes, remove scale and other foreign material before assembly.
- .13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .14 Provide for thermal expansion as required.

- .15 Valves:
  - .1 Install in accessible locations.
  - .2 Remove interior parts before soldering.
  - .3 Install with stems above horizontal position unless indicated.
  - .4 Valves accessible for maintenance without removing adjacent piping.
  - .5 Install globe valves in bypass around control valves.
  - .6 Use gate, ball, valves at branch take-offs for isolating purposes except where specified.
  - .7 Install plug cocks, ball valves for gas service.
- .16 Check Valves:
  - .1 Install silent check valves on discharge of pumps and as indicated.
  - .2 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

### **3.8 SLEEVES**

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: schedule 40 black steel pipe.
- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
- .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:
    - .1 Provide space for firestopping.
    - .2 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.
  - .1 Chrome or nickel plated brass or type 302 stainless steel..
- .3 Sizes: outside diameter to cover opening or sleeve.
  - .1 Inside diameter to fit around pipe or outside of insulation if so provided.

### **3.10 PREPARATION FOR FIRE STOPPING**

- .1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .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 fire stopping material or installation.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

### **3.11 FLUSHING OUT OF PIPING SYSTEMS**

- .1 Flush system in accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning supplemented as specified in relevant mechanical sections.
- .3 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 and Consultant 48 hours minimum prior to performance of pressure tests.
- .2 PIPework: test as specified in relevant sections of heating, ventilating and air conditioning work.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
- .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.

### **3.13 EXISTING SYSTEMS**

- .1 Connect into existing piping systems at times approved by Departmental Representative.
- .2 Request written approval by Departmental Representative 10 days minimum, prior to commencement of work.

- .3 Be responsible for damage to existing plant by this work.

**3.14 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 recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

**Part 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 and 23. Refer to Division 26 for quality of materials and workmanship.

**1.2 REFERENCES**

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
  - .1 ASHRAE 90.1-Latest Edition, 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 ACTION AND INFORMATIONAL 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.
    - .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 Shop Drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba.
- .3 Quality Control: in accordance with Section 01 45 00 - Quality Control.
  - .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.

- .4 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, CEEA, TDGA, applicable Provincial /Territorial regulations.

#### **1.5 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.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

#### **2.2 GENERAL**

- .1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

#### **2.3 MOTORS**

- .1 Provide motors for mechanical equipment as specified.
- .2 Motors under 373 W( 1/2 HP) : speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.
- .3 Motors 373 W (1/2 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, 208 V, unless otherwise indicated.

#### **2.4 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.

## **2.5 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.

## **2.6 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 dia 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.
  - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
  - .2 Securely fasten in place.
  - .3 Removable for servicing.
- .5 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.

**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 datasheet.

**3.2 INSTALLATION**

- .1 Fasten securely in place.
- .2 Make removable for servicing, easily returned into, and positively in position.

**3.3 FIELD QUALITY CONTROL**

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
- .2 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  - .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, as directed in PART 1 - QUALITY ASSURANCE.
- .3 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Certified wood.
  - .8 Low-emitting materials.

**3.4 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 REFERENCES**

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
  - .1 ANSI/ASME B31.1-Latest Edition, Power Piping.
  - .2 ANSI/ASME B31.3-Latest Edition, Process Piping.
  - .3 ANSI/ASME Boiler and Pressure Vessel Code-Latest Edition.:
    - .1 BPVC 2007 Section I: Power Boilers.
    - .2 BPVC 2007 Section V: Nondestructive Examination.
    - .3 BPVC 2007 Section IX: Welding and Brazing Qualifications.
- .2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1 ANSI/AWWA C206-Latest Edition, Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS)
  - .1 AWS C1.1M/C1.1-2000 Latest Edition, Recommended Practices for Resistance Welding.
  - .2 AWS Z49.1-2005, Safety in Welding, Cutting and Allied Process.
  - .3 AWS W1-2000, Welding Inspection Handbook..
- .4 Canada Green Building Council (CaGBC)
  - .1 Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
  - .2 Green Building Rating System Reference Guide For Commercial Interiors.
- .5 Canadian Standards Association (CSA International)
  - .1 CSA W47.2- Latest Edition, Certification of Companies for Fusion Welding of Aluminum.
  - .2 CSA W48-Latest Edition, Filler Metals and Allied Materials for Metal Arc Welding.
  - .3 CSA B51-03 Latest Edition, Boiler, Pressure Vessel and Pressure Piping Code.
  - .4 CSA-W117.2-Latest Edition, Safety in Welding, Cutting and Allied Processes.
  - .5 CSA W178.1-Latest Edition, Certification of Welding Inspection Organizations.
  - .6 CSA W178.2-Latest Edition, Certification of Welding Inspectors.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3 QUALITY ASSURANCE**

- .1 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 Submit 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.
- .3 Certifications:
  - .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.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15 Sustainable Requirements: Construction.

#### **2.2 ELECTRODES**

- .1 Electrodes: in accordance with CSA W48 Series.

### **Part 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 QUALITY OF WORK**

- .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 special procedures specified elsewhere in Division 15 and applicable requirements of provincial authority having jurisdiction.

### **3.3 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.

### **3.4 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.

### **3.5 SPECIALIST EXAMINATIONS AND TESTS**

- .1 General:
  - .1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by Departmental Representative.
  - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
- .2 Hydrostatically test welds to ANSI/ASME B31.1.
- .3 Visual examinations: include entire circumference of weld externally and wherever possible internally.
- .4 Failure of visual examinations:
  - .1 Upon failure of welds by visual examination, perform additional testing as directed by Departmental Representative ..

### **3.6 REPAIR OF WELDS WHICH FAILED TESTS**

- .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

**3.7 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

## **Part 1 General**

### **1.1 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B40.100-Latest Edition, Pressure Gauges and Gauge Attachments.
  - .2 ASME B40.200-Latest Edition, Thermometers, Direct Reading and Remote Reading.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-14.4 – Latest Edition, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.
  - .2 CAN/CGSB-14.5-Latest Edition, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.
- .3 Efficiency Valuation Organization (EVO)
  - .1 International Performance Measurement and Verification Protocol (IPMVP)
    - .1 IPMVP Latest Edition Version.
  - .2 .

### **1.2 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 thermometers and pressure gauges 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 Manitoba, Canada.
- .4 Certificates:
  - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Test and Evaluation Reports:
  - .1 Submit certified test reports for thermometers and pressure gauges from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

### **1.3 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 thermometers and pressure gauges indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect thermometers and pressure gauges from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 Design point to be at mid-point of scale or range.
- .2 Ranges: as indicated.

### **2.2 DIRECT READING THERMOMETERS**

- .1 Industrial, variable angle type, mercury-free, liquid filled, 125 mm scale length: to CAN/CGSB-14.4 ASME B40.200.
  - .1 Resistance to shock and vibration.

### **2.3 REMOTE READING THERMOMETERS**

- .1 100 mm diameter mercury-free liquid filled vapour activated dial type: to CAN/CGSB-14.5 ASME B40.200, accuracy within one scale division, brass movement, stainless steel capillary, stainless steel spiral armour, stainless steel bulb and polished brass stainless steel case for wall mounting.

### **2.4 THERMOMETER WELLS**

- .1 Copper pipe: copper or bronze.
- .2 Steel pipe: brass .

### **2.5 PRESSURE GAUGES**

- .1 112 mm, dial type: to ASME B40.100, Grade 2A, bourdon tube having 0.5% accuracy full scale unless otherwise specified.
- .2 Provide:
  - .1 Snubber for pulsating operation.
  - .2 Diaphragm assembly for corrosive service.

- .3 Gasketted pressure relief back with solid front.
- .4 Bronze stop cock.
- .5 Oil filled for high vibration applications.

### **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 installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

#### **3.2 GENERAL**

- .1 Install thermometers and gauges so they can be easily read from floor or platform.
  - .1 If this cannot be accomplished, install remote reading units.
- .2 Install between equipment and first fitting or valve.

#### **3.3 THERMOMETERS**

- .1 Install in wells on piping. Include heat conductive material inside well.
- .2 Install in locations as indicated:
- .3 Install wells as indicated only for balancing purposes.
- .4 Use extensions where thermometers are installed through insulation.

#### **3.4 PRESSURE GAUGES**

- .1 Install in locations as follows:
  - .1 Suction and discharge of pumps.
  - .2 Upstream and downstream of PRV's.
  - .3 Upstream and downstream of control valves.
  - .4 In other locations as indicated.
- .2 Install gauge cocks for balancing purposes, elsewhere as indicated.
- .3 Use extensions where pressure gauges are installed through insulation.

#### **3.5 NAMEPLATES**

- .1 Install engraved lamicoid nameplates in accordance with Section 23 05 53.01 - Mechanical Identification, identifying medium.

**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 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.7 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by thermometer and gauge installation.

**END OF SECTION**



## **Part 1 General**

### **1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
  - .1 ANSI/ASME B1.20.1- Latest Edition, Pipe Threads, General Purpose (Inch).
  - .2 ANSI/ASME B16.18-Latest Edition , Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 ASTM International
  - .1 ASTM A276-Latest Edition , Standard Specification for Stainless Steel Bars and Shapes.
  - .2 ASTM B62-Latest Edition, Standard Specification for Composition Bronze or Ounce Metal Castings.
  - .3 ASTM B283-Latest Edition, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
  - .4 ASTM B505/B505M-Latest Edition, Standard Specification for Copper-Base Alloy Continuous Castings.
- .3 Canada Green Building Council (CaGBC)
  - .1 Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
  - .2 Green Building Rating System Reference Guide For Commercial Interiors.
- .4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
  - .1 MSS-SP-25-Latest Edition, Standard Marking System for Valves, Fittings, Flanges and Unions.
  - .2 MSS-SP-80-2Latest Edition, Bronze Gate Globe, Angle and Check Valves.
  - .3 MSS-SP-110-Latest Edition, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

### **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 data sheets for equipment and systems 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 Manitoba, Canada.
  - .2 Submit data for valves specified in this Section.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials/Spare Parts:
  - .1 Furnish following spare parts:
    - .1 Valve seats: one for every 10 valves each size, minimum 1.
    - .2 Discs: one for every 10 valves, each size. Minimum 1.
    - .3 Stem packing: one for every 10 valves, each size. Minimum 1.
    - .4 Valve handles: 2 of each size.
    - .5 Gaskets for flanges: one for every 10 flanged joints.
  - .2 Tools:
    - .1 Furnish special tools for maintenance of systems and equipment.
    - .2 Include following:
      - .1 Lubricant gun for expansion joints.

### **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:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Valves:
  - .1 Except for specialty valves, to be single manufacturer.
  - .2 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 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 lockshield.
- .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.

.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 lockshield.

- .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.
- .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 bronze to ASTM B62.
    - .2 Pressure rating: Class125 2760-kPa CWP 4140-kPa CWP, 860 kPa steam.
    - .3 Connections: screwed ends to ANSI B1.20.1 and with hexagonal shoulders ,solder ends to ANSI.
    - .4 Stem: tamperproof ball drive.
    - .5 Stem packing nut: external to body.
    - .6 Ball and seat: replaceable stainless steel hard chrome solid ball and Teflon seats.
    - .7 Stem seal: TFE with external packing nut.
    - .8 Operator: removable lever handle.

### **Part 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 at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

#### **3.2 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 in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

## **Part 1 General**

### **1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
  - .1 ANSI/ASME B1.20.2M-Latest Edition, Pipe Threads, 60 deg. General Purpose (Metric).
  - .2 ASME B16, Fittings and Valves Package.
  - .3 ANSI/ASME B16.1-Latest Edition, Grey Iron Pipe Flanges and Flanged Fittings. Classes 25, 125, and 250.
  - .4 ANSI/ASME B16.10-Latest Edition, Face-to-Face and End-to-End Dimensions Valves.
  - .5 ANSI/ASME B16.11-Latest Edition, Forged Fittings, Socket-Welding and Threaded.
  - .6 ANSI/ASME B16.25-Latest Edition, Buttwelding Ends.
  - .7 ANSI/ASME B16.34-Latest Edition, Valves Flanged, Threaded and Welding End. Includes Supplement (2010).
- .2 ASTM International
  - .1 ASTM A126-04 Latest Edition, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  - .2 ASTM B62-Latest Edition, Standard Specification for Composition Bronze or Ounce Metal Castings.
  - .3 ASTM B209-Latest Edition, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 Canadian Registration Number (CRN)
- .4 Efficiency Valuation Organization (EVO)
  - .1 International Performance Measurement and Verification Protocol (IPMVP)
    - .1 IPMVP 2007 Version.
- .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP-78-2011, Cast Iron Plug Valves, Flanged and Threaded Ends.

### **1.2 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 each valve 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 Manitoba, Canada.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
    - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

### **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 valves - lubricated plug 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 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 off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect valves from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Extra Stock Materials:
- .3 Furnish following spare parts:
  - .1 Valve seats: one for every 10 valves each size, minimum 1.
  - .2 Discs: one for every 10 valves, each size, minimum 1.
  - .3 Stem packing: one for every 10 valves, each size, minimum 1.

- .4 Valve handles: 2 of each size.
- .5 Gaskets for flanges: one for every 10 flanged joints.

## **Part 2 Products**

### **2.1 MATERIAL**

- .1 Valves:
  - .1 To be of single manufacturer.
  - .2 Ensure products have CRN registration number.

### **2.2 ECCENTRIC PLUG VALVES - SCREWED ENDS**

- .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 plug seals.
    - .4 Isobutene isoprene stem seal with isobutene-isoprene plug seals.
  - .5 End connections: screwed.
  - .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. Metal-to-metal contact and sealing compound ensures leak-tight seal.
- .2 Testing: to MSS SP-78 for non-shock pressure as per manufacturers.
- .3 End connections:
  - .1 NPS to 2: screwed ends.
- .4 Valve:
  - .1 Body: cast iron to ASTM A126 Class B semi-steel.



- .2 Pressure rating: NPS to 12:
  - .1 Screwed end valves: screwed to NPT standards.
  - .2 Flanged end valves: flanged to ANSI B16.1 Class 125.
  - .3 Hydrostatic tests: body 300 psig. Seat: 100 psig.
- .3 Lubrication system, nickel-plated.
- .4 Lubricant: to suit type, temperature and pressure of contained fluid.
- .5 Include sealing compound injection gun designed for use with pre-packed sealing compound cartridges and valve fitted with button head nipples and combination sealing screws.
- .6 Feeding system: lubricant forced into lubrication grooves between seating surfaces of plug and body to form positive seal, leak proof operation, and corrosion preventing film.
  - .1 Ensure lubricant receptacle can hold additional lubricant.
  - .2 Include lubricant screw for lubrication.
  - .3 Include check valve to prevent reverse flow of lubricant.
  - .4 Include O-rings between body and plug.
- .5 Operator:
  - .1 Up to NPS 5: manual lever.
- .6 3-port and 4 port valves:
  - .1 Supply with transflow pattern.
  - .2 Include limit stops.

### **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 installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

#### **3.2 INSTALLATION OF LUBRICATED PLUG VALVES**

- .1 Install with line pressure acting to hold plug against body port.
  - .1 Cut off from higher pressure.

#### **3.3 COMMISSIONING OF LUBRICATED PLUG VALVES**

- .1 Determine type of sealing compound for particular application.

- .2 Ensure even distribution of sealing compound and tight shut-off by opening and closing valve 3 times minimum.
- .3 Ensure that plug is free to float when operating valve by easing valve off body.
- .4 Determine frequency of re-lubrication during commissioning of remainder of system.

### **3.4 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 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.5 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by plug valve installation.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B31.1-Latest Edition, Power Piping.
- .2 ASTM International
  - .1 ASTM A125-1996 Latest Edition, Standard Specification for Steel Springs, Helical, Heat-Treated.
  - .2 ASTM A307-Latest Edition , Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A563-Latest Edition, Standard Specification for Carbon and Alloy Steel Nuts.
- .3 Canada Green Building Council (CaGBC)
  - .1 Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
  - .2 Green Building Rating System Reference Guide For Commercial Interiors.
- .4 Factory Mutual (FM)
- .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP58-Latest Edition, Pipe Hangers and Supports - Materials, Design and Manufacture.
  - .2 MSS SP69-Latest Edition, Pipe Hangers and Supports - Selection and Application.
  - .3 MSS SP89-Latest Edition, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .6 Underwriter's Laboratories of Canada (ULC)

**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 data sheets for hangers and supports 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 Manitoba, Canada.
  - .2 Submit shop drawings for:
    - .1 Bases, hangers and supports.

- .2 Connections to equipment and structure.
- .3 Structural assemblies.
- .4 Certificates:
  - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturers' Instructions:
  - .1 Provide manufacturer's installation instructions.
    - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

### **1.4 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:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 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.
  - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

## **2.2 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

## **2.3 GENERAL**

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP58.

## **2.4 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 epoxy coated.
- .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 carbon steel retaining clip.
    - .1 Rod: 9 mm 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.
- .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.
  - .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.
- .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.
- .5 Shop and field-fabricated assemblies:
  - .1 Trapeze hanger assemblies:
  - .2 Steel brackets:
- .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.
- .7 Pipe attachments: material to MSS SP58:
  - .1 Attachments for steel piping: carbon steel galvanized.
  - .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 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 epoxy coated with formed portion plastic coated.

## **2.5 RISER CLAMPS**

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42.
- .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

## **2.6 INSULATION PROTECTION SHIELDS**

- .1 Insulated cold piping:
  - .1 64 kg/m<sup>3</sup> 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.

## **2.7 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.

**2.8 EQUIPMENT SUPPORTS**

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

**2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES**

- .1 Provide templates to ensure accurate location of anchor bolts.

**2.10 PLATFORMS AND CATWALKS**

- .1 To Section 05 50 00 - Metal Fabrications.

**2.11 HOUSE-KEEPING 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.

**2.12 OTHER EQUIPMENT SUPPORTS**

- .1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings .
- .2 Submit structural calculations with shop drawings.

**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 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, boilers, chillers, cooling towers, 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.

### 3.3 HANGER SPACING

- .1 Plumbing piping: to Canadian Plumbing and authority having jurisdiction.
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
- .4 Copper piping: up to NPS 1/2: every 1.5 m.
- .5 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.
- .6 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m
3	3.7 m	3.0 m
3-1/2	3.7 m	3.3 m
4	3.7 m	3.6 m
5	4.3 m	
6	4.3 m	
8	4.3 m	
10	4.9 m	
12	4.9 m	

- .7 Pipework greater than NPS 12: to MSS SP69.

### 3.4 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.



### **3.5 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.

### **3.6 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.

### **3.7 FIELD QUALITY CONTROL**

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .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, as directed in PART 1 - QUALITY ASSURANCE.

### **3.8 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 in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Expansion and Redevelopment of the Emerson Port of Entry  
Emerson, MB

Section 23 05 29  
HANGERS AND SUPPORTS FOR HVAC PIPING  
AND EQUIPMENT

PWGSC Project No. R.068431.001

Page 8 of 8

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Heat tracing cables for pipes and tanks including controls and installation.
- .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).

**1.3 ACTION AND INFORMATIONAL 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.
- .3 Instructions: submit manufacturer's installation instructions.
  - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

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

**Part 2 Products**

**2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

**2.2 PIPE/TANK TRACING HEATING CABLES**

- .1 Type D: self-limiting heating cable with copper ground wire, thermoplastic rubber polyolefin fluoropolymer primary and overall jackets. Heating capacity: 30.2 W/m; for use with 208 V power supply.
- .2 Provide cold lead connection kit, locate as indicated.
- .3 Provide central panel, connectors and sensor connectors.

**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 datasheet.

**3.2 INSTALLATION**

- .1 Install heating cables in accordance with manufacturer's instructions. Co-ordinate installation with pipe insulation application.
- .2 Install heating cables in accordance with manufacturer's instructions. Distribute and fasten cable evenly on pipe using pipe strap or tape at maximum spacing 0.5 m. Ensure that heating cables do not touch or cross each other. Run only cold leads in conduit and ensure sensing bulb does not touch cable. Ground shield to building ground. Coordinate cable installation with insulation application. Loop additional cable at fittings, valves, and flanges.
- .3 Make power and control connections.

**3.3 FIELD QUALITY CONTROL**

- .1 Tests:
  - .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Use 500 V Megger to test cables for continuity and insulation value and record readings before, during and after installation.
- .3 Where resistance of 50 megohms or less is measured, stop work and advise Departmental Representative.
- .4 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
  - .1 Materials and resources.

- .2 Storage and collection of recyclables.
- .3 Construction waste management.
- .4 Resource reuse.
- .5 Recycled content.
- .6 Local/regional materials.
- .7 Low-emitting materials.

### **3.4 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 SUMMARY**

- .1 Section Includes:
  - .1 Vibration isolation materials and components, seismic control measures and their installation.

**1.2 REFERENCES**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 13-Latest Edition, Standard for the Installation of Sprinkler Systems.
- .3 National Building Code of Canada (NBC) – Latest Edition

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
  - .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 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
  - .2 Provide separate shop drawings for each isolated system shop drawings complete with performance and product data.
  - .3 Provide detailed drawings of seismic control measures for equipment and piping.
- .3 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.
  - .3 Manufacturer's Field Reports: manufacturer's field reports specified.

**1.4 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.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 Size and shape of bases type and performance of vibration isolation as indicated.

### **2.2 ELASTOMERIC PADS**

- .1 Type EP1 - neoprene waffle or ribbed; 9 mm minimum thick; 50 durometer; maximum loading 350 kPa.
- .2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.
- .3 Type EP3 - neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.
- .4 Type EP4 - rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

### **2.3 ELASTOMERIC MOUNTS**

- .1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

### **2.4 SPRINGS**

- .1 Design stable springs: ratio of lateral to axial stiffness is equal to or greater than 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with levelling devices.
- .2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.
- .3 Cadmium plate for outdoor installations.
- .4 Colour code springs.

### **2.5 SPRING MOUNT**

- .1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.

- .2 Type M2 - stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.
- .3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.
- .4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.
- .5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.
- .6 Performance: as indicated.

## **2.6 HANGERS**

- .1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.
- .2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.
- .3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.
- .4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.
- .5 Type H4 - stable spring, elastomeric element with precompression washer and nut with deflection indicator.
- .6 Performance: as indicated.

## **2.7 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES**

- .1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

## **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 datasheet.

### **3.2 INSTALLATION**

- .1 Seismic control measures to meet requirements of NBC.
- .2 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.



- .3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .4 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:
  - .1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and Over: first 6 points of support.
  - .2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.
- .5 Where isolation is bolted to floor use vibration isolation rubber washers.
- .6 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

### **3.3 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.
  - .2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:
    - .1 After delivery and storage of Products.
    - .2 After preparatory work is complete but before installation commences.
    - .3 Twice during the installation, at 25% and 60% completion stages.
    - .4 Upon completion of installation.
  - .3 Submit manufacturer's reports to Departmental Representative within 3 days of manufacturer representative's review.
  - .4 Make adjustments and corrections in accordance with written report.
- .2 Inspection and Certification:
  - .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
  - .2 Take vibration measurements for equipment as indicated listed below.
  - .3 Provide Departmental Representative with notice 24 h in advance of commencement of tests.
  - .4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).
  - .5 Submit complete report of test results including sound curves.
- .3 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
  - .1 Materials and resources.

- .2 Storage and collection of recyclables.
- .3 Construction waste management.
- .4 Resource reuse.
- .5 Recycled content.
- .6 Local/regional materials.
- .7 Certified wood.
- .8 Low-emitting materials.

### **3.4 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 SUMMARY**

- .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.
  - .2 Sustainable requirements for construction and verification.

**1.2 REFERENCES**

- .1 Canadian Gas Association (CGA)
  - .1 CSA/CGA B149.1-Latest Edition, Natural Gas and Propane Installation Code.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.60 – Latest Edition, Interior Alkyd Gloss Enamel.
  - .2 CAN/CGSB-24.3-Latest Edition, Identification of Piping Systems.
- .3 National Fire Protection Association (NFPA)
  - .1 NFPA 13-Latest Edition, Standard for the Installation of Sprinkler Systems.
  - .2 NFPA 14-Latest Edition, Standard for the Installation of Standpipe and Hose Systems.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Product Data:
- .2 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Product data to include paint colour chips, other products specified in this section.
- .4 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

**1.4 QUALITY ASSURANCE**

- .1 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

**1.5 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.
- .2 Waste Management and Disposal:

- .1 Construction/Demolition Waste Management and Disposal: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Dispose of unused material at official hazardous material collections site approved by Departmental Representative.
- .3 Do not dispose of unused material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

## **Part 2 Products**

### **2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES**

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
  - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
  - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

### **2.2 SYSTEM NAMEPLATES**

- .1 Colours:
  - .1 Hazardous: red letters, white background.
  - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
  - .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
  - .1 Conform to following table:

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

- .2 Use maximum of 25 letters/numbers per line.
- .4 Locations:
  - .1 Terminal cabinets, control panels: use size # 5.
  - .2 Equipment in Mechanical Rooms: use size # 9.

- .5 Identification for PWGSC Preventive Maintenance Support System (PMSS):
  - .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
  - .2 Equipment in Mechanical Room:
    - .1 Main identifier: size #9.
    - .2 Source and Destination identifiers: size #6.
    - .3 Terminal cabinets, control panels: size #5.
  - .3 Equipment elsewhere: sizes as appropriate.

## **2.3 EXISTING IDENTIFICATION SYSTEMS**

- .1 Continue with existing numbering system in sequence..
- .2 Where existing identification system does not cover for new work, use identification system specified this section.
- .3 Before starting work, obtain written approval of identification system from Departmental Representative.

## **2.4 PIPING SYSTEMS GOVERNED BY CODES**

- .1 Identification:
  - .1 Natural gas: to CSA/CGA B149.1 authority having jurisdiction.
  - .2 Sprinklers: to NFPA 13.
  - .3 Standpipe and hose systems: to NFPA 14.

## **2.5 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:
  - .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
  - .1 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 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 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.
- .7 Colours and Legends:
  - .1 Where not listed, obtain direction from Departmental Representative DCC Representative Consultant.
  - .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
** Add design temperature		
++ Add design temperature and pressure		
Raw water	Green	RAW WATER
City water	Green	CITY WATER
Treated water	Green	TREATED WATER
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
High temp HW Htg. supply	Yellow	HTHW HTG. SUPPLY++
High temp HW Htg. return	Yellow	HTHW HTG. RETURN++
Make-up water	Yellow	MAKE-UP WTR
Boiler feed water	Yellow	BLR. FEED WTR
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Waste water	Green	WASTE WATER
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
Natural gas	Yellow	NAT. GAS
Gas regulator vents	Yellow	NAT. GAS - BENT
Compressed air (	Green	COMP. AIR kPa
Compressed air (700kPa)	Yellow	COMP. AIR kPa
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS

## 2.6 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

- .2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

## **2.7 VALVES, CONTROLLERS**

- .1 Brass tags with 12 mm stamped identification data filled with black paint.
- .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.

## **2.8 CONTROLS COMPONENTS IDENTIFICATION**

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

## **2.9 LANGUAGE**

- .1 Identification in English.

# **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 datasheet.

## **3.2 TIMING**

- .1 Provide identification only after painting specified Section 09 91 23 - Interior Painting has been completed.

## **3.3 INSTALLATION**

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC CSA registration plates as required by respective agency.
- .3 Identify systems, equipment to conform to PWGSC PMSS.

## **3.4 NAMEPLATES**

- .1 Locations:
  - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
  - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection:
  - .1 Do not paint, insulate or cover.

### **3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS**

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 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.
- .9 Identification easily and accurately readable from usual operating areas and from access points.
  - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

### **3.6 VALVES, CONTROLLERS**

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, 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 Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

### **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**



**Part 1 General**

**1.1 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.

**1.2 QUALIFICATIONS OF TAB PERSONNEL**

- .1 Submit names of personnel to perform TAB to Departmental Representative within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 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-Latest Edition.
  - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-Latest Edition.
  - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 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.

### **1.3 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.

### **1.4 EXCEPTIONS**

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

### **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 PRE-TAB REVIEW**

- .1 Review contract documents before project construction is started confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Departmental Representative 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.

### **1.7 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.

### **1.8 OPERATION OF SYSTEMS DURING TAB**

- .1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

### **1.9 START OF TAB**

- .1 Notify Departmental Representative 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.

#### **1.10 APPLICATION TOLERANCES**

- .1 Do TAB to following tolerances of design values:
  - .1 HVAC systems: plus 10 %, minus 5 %.
  - .2 Hydronic systems: plus or minus 10 %.

#### **1.11 ACCURACY TOLERANCES**

- .1 Measured values accurate to within plus or minus 2 % of actual values.

#### **1.12 INSTRUMENTS**

- .1 Prior to TAB, submit to Departmental Representative 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 Departmental Representative .

**1.13 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

**1.14 PRELIMINARY TAB REPORT**

- .1 Submit for checking and approval of Departmental Representative , 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.

**1.15 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 6 copies of TAB Report to Departmental Representative for verification and approval, in English French both official languages in D-ring binders, complete with index tabs.

**1.16 VERIFICATION**

- .1 Reported results subject to verification by Departmental Representative.
- .2 Provide personnel and instrumentation to verify up to 30 % of reported results.
- .3 Number and location of verified results as directed by Departmental Representative.
- .4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

**1.17 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.

**1.18 COMPLETION OF TAB**

- .1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

## **1.19 AIR SYSTEMS**

- .1 Standard: TAB to most stringent of TAB standards of AABC NEBB SMACNA ASHRAE.
- .2 Do TAB of systems, equipment, components, controls specified Division 23 and following systems, equipment, components, controls:
  - .1 Supply Air Systems.
  - .2 Exhaust Systems.
  - .3 ERV.
  - .4 Split A/C Systems.
  - .5 Fans.
  - .6 Gas Heaters.
  - .7 Plumbing Systems.
- .3 Qualifications: personnel performing TAB current member in good standing of AABC NEBB.
- .4 Quality assurance: perform TAB under direction of supervisor qualified by to standards of AABC NEBB.
- .5 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.
- .6 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.
- .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

## **1.20 OTHER TAB REQUIREMENTS**

- .1 General requirements applicable to work specified this paragraph:
  - .1 Qualifications of TAB personnel: as for air systems specified this section.
  - .2 Quality assurance: as for air systems specified this section.
- .2 Laboratory fume hoods:
  - .1 Standard: Treasury Board of Canada Handbook of Occupational Health and safety, 4th edition Canada Labour Code state applicable Provincial or other standard.
  - .2 TAB procedures: as described in standard.
- .3 Building pressure conditions:
  - .1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions at all times during winter summer design conditions.

- .4 Zone pressure differences:
  - .1 Adjust HVAC systems, equipment, controls to establish specified air pressure differentials, with systems in every possible combinations of normal operating modes.
- .5 Smoke management systems:
  - .1 Test for proper operation of all smoke and fire dampers, sensors, detectors, installed as component parts of air systems specified Division 23.
  - .2 Emergency evacuation: see post-occupancy TAB activities specified below.
- .6 Measurement of noise vibration from equipment specified in Division 23.
- .7 Measurement of spatial noise, vibration:

**1.21 POST-OCCUPANCY TAB**

- .1 Measure DBT, WBT (or %RH), air flow patterns, NC levels, in occupied zone of following areas: interview, office.
- .2 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within 1 month of termination of Warranty Period.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 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" - means "not concealed" as previously defined.
    - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
  - .2 TIAC Codes:
    - .1 CRD: Code Round Ductwork,
    - .2 CRF: Code Rectangular Finish.
- .2 Reference Standards:
  - .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
    - .1 ANSI/ASHRAE/IESNA 90.1-Latest Edition, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
  - .2 ASTM International Inc.
    - .1 ASTM B209M-Latest Edition, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
    - .2 ASTM C335-Latest Edition, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
    - .3 ASTM C411-Latest Edition, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
    - .4 ASTM C449/C449M-Latest Edition, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
    - .5 ASTM C547-Latest Edition, Standard Specification for Mineral Fiber Pipe Insulation.
    - .6 ASTM C553-Latest Edition, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
    - .7 ASTM C612-Latest Edition, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
    - .8 ASTM C795-Latest Edition, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
    - .9 ASTM C921-Latest Edition, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
  - .3 Canadian General Standards Board (CGSB)
    - .1 CGSB 51-GP-52Ma-Latest Edition, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

- .4 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-36-Latest Edition, Commercial Adhesives.
- .5 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168-Latest Edition, Adhesive and Sealant Applications.
- .6 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).
- .7 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102-Latest Edition, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S701-Latest Edition, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

## **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 duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.
    - .1 Description of equipment giving manufacturer's name, type, model, year and capacity.
    - .2 Details of operation, servicing and maintenance.
    - .3 Recommended spare parts list.
- .3 Shop Drawings:
  - .1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
- .4 Samples:
  - .1 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.
  - .2 Mount sample on 12 mm plywood board.
  - .3 Affix typewritten label beneath sample indicating service.
- .5 Manufacturers' Instructions:
  - .1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, cleaning procedures .

## **1.3 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, member of TIAC.



#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.
- .3 Packaging Waste Management: remove in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 FIRE AND SMOKE RATING**

- .1 To 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 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).
- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to ASTM C553.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to ASTM C553.

#### **2.3 JACKETS**

- .1 Canvas:
  - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .2 Lagging adhesive: compatible with insulation.
  - .1 Maximum VOC limit to SCAQMD Rule 1168 GSES GS-36.
- .3 Aluminum:
  - .1 To ASTM B209 with moisture barrier as scheduled in PART 3 of this section.
  - .2 Thickness: 0.50 mm sheet.
  - .3 Finish: Smooth.
  - .4 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.
    - .1 Stainless steel:

- .5 Type: 304 316.
- .6 Thickness: 0.25 0.50 mm sheet.
- .7 Finish: Smooth Corrugated Stucco embossed.
- .8 Jacket banding and mechanical seals: 12 19 mm wide, 0.5 mm thick stainless steel.

## **2.4 ACCESSORIES**

- .1 Vapour retarder lap adhesive:
  - .1 Water based, fire retardant type, compatible with insulation.
    - .1 Maximum VOC limit to SCAQMD Rule 1168 GSES GS-36.
- .2 Indoor Vapour Retarder Finish:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
- .4 ULC Listed Canvas Jacket:
  - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .5 Outdoor Vapour Retarder Mastic:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
  - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m<sup>2</sup>.
- .6 Tape: self-adhesive, aluminum, plain, 50 mm wide minimum.
- .7 Contact adhesive: quick-setting
  - .1 Maximum VOC limit to SCAQMD Rule 1168 GSES GS-36.
- .8 Canvas adhesive: washable.
  - .1 Maximum VOC limit to SCAQMD Rule 1168 GSES GS-36.
- .9 Tie wire: 1.5 mm stainless steel.
- .10 Banding: 12 mm wide, 0.5 mm thick stainless steel.
- .11 Facing: 25 mm stainless steel hexagonal wire mesh stitched on both faces of insulation.
- .12 Fasteners: 2 4 mm diameter pins with 35 mm diameter square clips, length to suit thickness of insulation.

## **Part 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 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure test ductwork systems complete, witness and certify.
- .2 Ensure surfaces are clean, dry, free from foreign material.

### 3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers 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 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
  - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

### 3.4 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thicknesses: conform to following table:

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
Rectangular warm air ducts	C-1	no	25
Round warm air ducts	C-1	no	25
Supply, return and exhaust ducts exposed in space being served	none		
Outside air ducts to mixing plenum	C-1	yes	50
Mixing plenums	C-1	yes	25
Exhaust duct between dampers and louvres	C-1	no	25
Rectangular ducts outside	C-1	special	50
Round ducts outside	C-1	special	50
Acoustically lined ducts	none		

- .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 table:

TIAC Code		
Rectangular	Round	
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/1
Indoor, exposed elsewhere	CRF/1	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/3
Outdoor, elsewhere	CRF/3	CRD/3

### **3.5 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 in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

**Part 1            General**

**1.1            SUMMARY**

- .1    Section Includes:
  - .1      Thermal insulation for piping and piping accessories in commercial type applications.

**1.2            REFERENCES**

- .1    American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  - .1      ASHRAE Standard 90.1 latest edition 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- latest edition, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
  - .2      ASTM C335-latest edition, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .3      ASTM C411-latest edition, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .4      ASTM C449/C449M-latest edition , Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .5      ASTM C533-latest edition, Calcium Silicate Block and Pipe Thermal Insulation.
  - .6      ASTM C547-latest edition, Mineral Fiber Pipe Insulation.
  - .7      ASTM C795-latest edition, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  - .8      ASTM C921-latest edition, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3    Canadian General Standards Board (CGSB)
  - .1      CGSB 51-GP-52Ma-latest edition, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  - .2      CAN/CGSB-51.53-latest edition, Poly (Vinyl Chloride) Jacketing 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-latest edition, Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S701-latest edition, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .3 CAN/ULC-S702-latest edition, Thermal Insulation, Mineral Fibre, for Buildings
  - .4 CAN/ULC-S702.2-latest edition, 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 ACTION AND INFORMATIONAL 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.
    - .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.
- .3 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
    - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
- .4 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 label beneath sample indicating service.
- .5 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.

## **1.5 QUALITY ASSURANCE**

- .1 Qualifications:
- .2 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.

## **1.6 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 Deliver, store and handle materials in accordance with manufacturer's written instructions.
  - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
  - .1 Protect from weather, construction traffic.
  - .2 Protect against damage.
  - .3 Store at temperatures and conditions required by manufacturer.
- .3 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Place excess or unused insulation and insulation accessory materials in designated containers.
  - .3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.
  - .4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

## **Part 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, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
  - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
  - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
  - .1 Mineral fibre: to CAN/ULC-S702.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/ULC-S702.
- .5 TIAC Code C-2: mineral fibre blanket faced with without factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/ULC-S702 ASTM C547.
- .6 TIAC Code A-6: flexible unicellular tubular elastomer.
  - .1 Insulation: with vapour retarder jacket.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Certified by manufacturer: free of potential stress corrosion cracking corrodants.
- .7 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
  - .1 Insulation: to ASTM C533.
  - .2 Design to permit periodic removal and re-installation.

## **2.3 INSULATION SECUREMENT**

- .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, 19mm wide, 0.5 mm thick.

## **2.4 CEMENT**

- .1 Thermal insulating and finishing cement:
  - .1 Hydraulic setting Air drying on mineral wool, to ASTM C449/C449M.



**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.

**2.7 OUTDOOR VAPOUR RETARDER FINISH**

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m<sup>2</sup>.

**2.8 JACKETS**

- .1 Polyvinyl Chloride (PVC):
  - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
  - .2 Colours: by Departmental Representative.
  - .3 Minimum service temperatures: -20 degrees C.
  - .4 Maximum service temperature: 65 degrees C.
  - .5 Moisture vapour transmission: 0.02 perm.
  - .6 Thickness: 0.75 mm.
  - .7 Fastenings:
    - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
    - .2 Tacks.
    - .3 Pressure sensitive vinyl tape of matching colour.
  - .8 Special requirements:
    - .1 Indoor: 0.5.
    - .2 Outdoor: UV rated material at least 0.5 mm thick.
- .2 ABS Plastic:
  - .1 One-piece moulded type and sheet with pre-formed shapes as required.
  - .2 Colours: by Departmental Representative.
  - .3 Minimum service temperatures: -40 degrees C.
  - .4 Maximum service temperature: 82 degrees C.
  - .5 Moisture vapour transmission: 0.012 perm.
  - .6 Thickness: 0.75 mm.
  - .7 Fastenings:
    - .1 Solvent weld adhesive compatible with insulation to seal laps and joints.
    - .2 Tacks.
    - .3 Pressure sensitive vinyl tape of matching colour.
  - .8 Locations:
    - .1 For outdoor use ONLY.

- .3 Canvas:
  - .1 220 and 120 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
  - .2 Lagging adhesive: compatible with insulation.
- .4 Aluminum:
  - .1 To ASTM B209.
  - .2 Thickness: 0.50 mm sheet.
  - .3 Finish: smooth.
  - .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
  - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
  - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5mm thick at 300 mm spacing.

## **2.9 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS**

- .1 Caulking to: Section 07 92 00 - Joint Sealants.

## **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 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**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers:
  - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

### **3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES**

- .1 Application: at expansion joints, valves, primary flow measuring elements flanges and unions at equipment.
- .2 Design: to permit movement of expansion joint to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
  - .1 Insulation, fastenings and finishes: same as system.
  - .2 Jacket: high temperature fabric.

### **3.5 INSTALLATION OF ELASTOMERIC INSULATION**

- .1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

### **3.6 PIPING INSULATION SCHEDULES**

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
  - .1 Securements: Tape at 300 mm on centre.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
  - .1 Securements: Tape at 300 mm on centre.
  - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
  - .3 Installation: TIAC Code: 1501-C.
- .4 TIAC Code: A-6.
  - .1 Insulation securements: Tape.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code: 1501-C.
- .5 TIAC Code: C-2 with without vapour retarder jacket.
  - .1 Insulation securements: Tape.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code: 1501-C.
- .6 TIAC Code: A-2.
  - .1 Insulation securements: Tape.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 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.

Applica-tion	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)										
Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8	up to 175	A-1	38	50	65	75		
Hot Water Heating	60 - 94	A-1	25	38	38	38	38	38	25	25	38		
Hot Water Heating	up to 59	A-1	25	25	25	25	38	38	25	25	38		
Domestic HWS	A-1	25	25	25	38	38	38	25	25	25	38		
Refrigerated Drinking Water	A-3	25	25	25	25	25	25						
Domestic CWS	A-3	25	25	25	25	25	25	25	25	25	25		
Domestic CWS with vapour retarder	C-2	25	25	25	25	25	25	25	25	25	25		
Refrigerant hot gas liquid suction	4 - 13	A-6	25	25	25	25	25	25					
Refrigerant hot gas liquid suction	below 4	A-6	25	25	38	38	38	38					
RWL and RWP	C-2	25	25	25	25	25	25	25	25	25	25	25	25
Cooling Coil cond. drain	C-2	25	25	25	25	25	25						

.8 Finishes:

- .1 Exposed indoors: canvas jacket.
- .2 Exposed in mechanical rooms: canvas jacket.
- .3 Concealed, indoors: canvas on valves, fittings. No further finish.
- .4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
- .5 Outdoors: water-proof aluminum.
- .6 Finish attachments: SS bands, at 150 mm on centre. Seals: wing.
- .7 Installation: to appropriate TIAC code CRF/1 through CPF/4.

### **3.7 FIELD QUALITY CONTROL**

- .1 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Certified wood.
  - .8 Low-emitting materials.

### **3.8 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 GASEOUS FUEL SYSTEMS**

- .1 Operation tests:
  - .1 Measure gas pressure at gas meter outlet and at burner manifold.
  - .2 Verify details of temperature and pressure compensation at meter.
  - .3 Verify settings, operation, venting of high and low pressure cut-outs, alarms.
  - .4 Check terminals of vents for gas pressure regulators.

**1.2 POTABLE WATER SYSTEMS**

- .1 When cleaning is completed and system filled:
  - .1 Verify performance of equipment and systems as specified elsewhere in Division 23.
  - .2 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut off 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.

**1.3 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.

**1.4 SANITARY AND STORM DRAINAGE SYSTEMS**

- .1 Buried systems: perform tests prior to back-filling. Perform hydraulic tests to verify grades and freedom from obstructions.
- .2 Ensure that traps are fully and permanently primed.
- .3 Ensure that fixtures are properly anchored, connected to system.
- .4 Operate flush valves, tank and operate each fixture to verify drainage and no leakage.
- .5 Cleanouts: refer to Section 22 42 01 – Plumbing Specialties and Accessories
- .6 Roof drains:
  - .1 Refer to Section 22 42 01 – Plumbing Specialties and Accessories
  - .2 Remove caps as required.

**1.5 REPORTS**

- .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements:  
Reports, supplemented as specified herein.

**1.6 TRAINING**

- .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements:  
Training of O M Personnel, supplemented as specified herein.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **Part 1            General**

### **1.1            SUMMARY**

- .1    Section Includes:
  - .1       Materials and installation for piping, valves and fittings for gas fired equipment.
  - .2       Sustainable requirements for construction and verification:

### **1.2            REFERENCES**

- .1    American Society of Mechanical Engineers (ASME)
  - .1       ASME B16.5-latest edition, Pipe Flanges and Flanged Fittings.
  - .2       ASME B16.18-latest edition, Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3       ASME B16.22-latest edition, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
  - .4       ASME B18.2.1-latest edition, Square and Hex Bolts and Screws Inch Series.
- .2    American Society for Testing and Materials International (ASTM)
  - .1       ASTM A47/A47M-99(2004), Standard Specification for Ferritic Malleable Iron Castings.
  - .2       ASTM A53/A53M-latest edition, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
  - .3       ASTM B75M-latest edition, Standard Specification for Seamless Copper Tube Metric.
  - .4       ASTM B837-latest edition, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.
- .3    Canadian Standards Association (CSA International)
  - .1       CSA W47.1-latest edition, Certification of Companies for Fusion Welding of Steel.
- .4    Canadian Standards Association (CSA)/Canadian Gas Association (CGA)
  - .1       CAN/CSA B149.1HB-latest edition, Natural Gas and Propane Installation Code Handbook.
  - .2       CAN/CSA B149.2-latest edition, Propane Storage and Handling Code.
- .5    Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1       Material Safety Data Sheets (MSDS).

### **1.3            ACTION AND INFORMATIONAL 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.



- .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 DELIVERY, STORAGE AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Separate 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 Divert unused materials from landfill to recycling facility as approved by Departmental Representative.

### **Part 2 Products**

#### **2.1 PIPE**

- .1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:
  - .1 NPS 1/2 to 2, screwed.
  - .2 NPS 2 1/2 and over, plain end.
- .2 Copper tube: to ASTM B837.

#### **2.2 JOINTING MATERIAL**

- .1 Screwed fittings: pulverized lead paste.
- .2 Welded fittings: to CSA W47.1.
- .3 Flange gaskets: nonmetallic flat.
- .4 Brazing: to ASTM B837.

#### **2.3 FITTINGS**

- .1 Steel pipe fittings, screwed, flanged or welded:
  - .1 Malleable iron: screwed, banded, Class 150.
  - .2 Steel pipe flanges and flanged fittings: to ASME B16.5.
  - .3 Welding: butt-welding fittings.
  - .4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.
  - .5 Bolts and nuts: to ASME B18.2.1.
  - .6 Nipples: schedule 40, to ASTM A53/A53M.

- .2 Copper pipe fittings, screwed, flanged or soldered:
  - .1 Cast copper fittings: to ASME B16.18.
  - .2 Wrought copper fittings: to ASME B16.22.

## **2.4 VALVES**

- .1 Provincial Code approved, lubricated plug ball type.

## **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 datasheet.

### **3.2 PIPING**

- .1 Install in accordance with Section 23 05 05 - Installation of Pipework, applicable Provincial/Territorial Codes, CAN/CSA B149.1, CAN/CSA B149.2,, supplemented as specified.
- .2 Install drip points:
  - .1 At low points in piping system.
  - .2 At connections to equipment.

### **3.3 VALVES**

- .1 Install valves with stems upright or horizontal unless otherwise approved by Departmental Representative.
- .2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

### **3.4 FIELD QUALITY CONTROL**

- .1 Site Tests/Inspection:
  - .1 Test system in accordance with CAN/CSA B149.1 CAN/CSA B149.2 and requirements of authorities having jurisdiction.
- .2 Manufacturer's Field Services:
  - .1 Have manufacturer of products supplied under this Section review work involved in 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 Obtain reports within 3 days of review and submit immediately to Departmental Representative DCC Representative Consultant.

- .4 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Certified wood.
  - .8 Low-emitting materials.
- .5 Performance Verification:
  - .1 Refer to Section 23 08 01 - Performance Verification of Mechanical Piping Systems.

### **3.5 ADJUSTING**

- .1 Purging: purge after pressure test in accordance with CAN/CSA B149.1 CAN/CSA B149.2.
- .2 Pre-Start-Up Inspections:
  - .1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.
  - .2 Check gas trains, entire installation is approved by authority having jurisdiction.

### **3.6 CLEANING**

- .1 Cleaning: in accordance with Section CAN/CSA B149.1, CAN/CSA B149.2,, supplemented as specified.
- .2 Perform cleaning operations as specified in accordance with manufacturer's recommendations.
- .3 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            REFERENCES**

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1 ANSI/AWWA C111/A21.11-latest edition, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .2 American Society of Mechanical Engineers (ASME)
  - .1 ASME B16.1-latest edition, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
  - .2 ASME B16.3-latest edition, Malleable Iron Threaded Fittings: Classes 150 and 300.
  - .3 ASME B16.5-latest edition, Pipe Flanges and Flanged Fittings: NPS through NPS 24 Metric/Inch Standard.
  - .4 ASME B16.9-latest edition, Factory-Made Wrought Buttwelding Fittings.
  - .5 ASME B18.2.1-latest edition, Square Hex, Heavy Hex and Askew Head Bolts and Hex, Heavy Hex, Hex Flange. Loded Head and Lag Screws (Inch Series).
  - .6 ASME B18.2.2-latest edition, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
- .3 ASTM International
  - .1 ASTM A47/A47M-latest ediition, Standard Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A53/A53M-latest edition, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
  - .3 ASTM A536-84 latest edition, Standard Specification for Ductile Iron Castings.
  - .4 ASTM B61-latest edition, Standard Specification for Steam or Valve Bronze Castings.
  - .5 ASTM B62-latest edition, Standard Specification for Composition Bronze or Ounce Metal Castings.
  - .6 ASTM E202-latest edition, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.
- .4 CSA International
  - .1 CSA B242-05(R2011), Groove and Shoulder Type Mechanical Pipe Couplings.
  - .2 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
- .5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS)
  - .1 MSS-SP-67-latest edition, Butterfly Valves.
  - .2 MSS-SP-70-latest edition, Gray Iron Gate Valves, Flanged and Threaded Ends.
  - .3 MSS-SP-71-latest edition, Gray Iron Swing Check Valves Flanged and Threaded Ends.
  - .4 MSS-SP-80-latest edition, Bronze Gate, Globe, Angle and Check Valves.

- .5 MSS-SP-85-latest edition, Gray Iron Globe and Angle Valves, Flanged and Threaded Ends.

## **1.2 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 hydronic systems 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 Manitoba, Canada.
  - .2 Indicate on drawings:
    - .1 Components and accessories.

## **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 hydronic systems for incorporation into manual.
  - .1 Include special servicing requirements.

## **1.4 EXTRA STOCK MATERIALS**

- .1 Supply spare parts as follows:
  - .1 Valve seats: 1 minimum for every ten valves, each size. Minimum one.
  - .2 Discs: 1 minimum for every ten valves, each size. Minimum one.
  - .3 Stem packing: 1 minimum for every ten valves, each size. Minimum one.
  - .4 Valve handles: 2 minimum of each size.
  - .5 Gaskets for flanges: 1 minimum for every ten flanges.

## **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 off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect hydronic systems from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.

- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 PIPE**

- .1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
  - .1 To NPS 6: Schedule 40.

### **2.2 PIPE JOINTS**

- .1 NPS 2 and under: screwed fittings with PTFE tape lead-free pipe dope.
- .2 NPS 2-1/2 and over: welding fittings and flanges to CSA W48.
- .3 Roll grooved: rigid coupling to CSA B242.
- .4 Flanges: raised face, to ANSI/AWWA C111/ A21.11.
- .5 Orifice flanges: slip-on raised face, 2100 kPa.
- .6 Flange gaskets: to ANSI/AWWA C111/ A21.11.
- .7 Pipe thread: taper.
- .8 Bolts and nuts: to ASME B18.2.1 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 ASME B16.3.
- .5 Fittings for roll grooved piping: malleable iron to ASTM A47/A47M.

### **2.4 VALVES**

- .1 Connections:
  - .1 NPS 2 and smaller: screwed ends.
- .2 Gate valves: to MSS-SP-70 to MSS-SP-80 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 Globe valves: to application: throttling, flow control, emergency bypass MSS-SP- 80 85:
  - .1 NPS 2 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.
- .4 Balancing, for TAB:
  - .1 Sizes: calibrated balancing valves, as specified this section.
  - .2 NPS 2 and under:
    - .1 Mechanical Rooms: globe, with disc as specified Section 23 05 23.01 - Valves - Bronze.
    - .2 Elsewhere: globe, with disc as specified Section 23 05 23.01 - Valves - Bronze.
- .5 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
- .6 Bypass valves on globe valves NPS 8 and larger: NPS 3/4, Globe, with PTFE disc as specified Section 23 05 23.01 - Valves - Bronze.
- .7 Swing check valves: to MSS-SP-71.
  - .1 NPS 2 and under:
    - .1 Class 125, swing, with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.
- .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.
- .10 Lubricated Plug Valves
  - .1 NPS 2 and under:

### **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 hydronic systems installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative

- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 PIPING INSTALLATION**

- .1 Install pipework in accordance with Section 23 05 05 - Installation of Pipe Work.

### **3.3 CIRCUIT 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.

### **3.4 CLEANING, FLUSHING AND START-UP**

- .1 In accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

### **3.5 TESTING**

- .1 Test system in accordance with Section 21 05 01 - Common Work Results for Mechanical.

### **3.6 BALANCING**

- .1 Balance water systems to within plus or minus 5 % of design output.
- .2 In accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

### **3.7 PERFORMANCE VERIFICATION**

- .1 In accordance with Section 23 08 01 - Performance Verification Mechanical Piping Systems.

### **3.8 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 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.9 PROTECTION**

- .1 Protect installed products and components from damage during construction.



- .2 Repair damage to adjacent materials caused by hydronic systems installation.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASME
  - .1 ASME Boiler and Pressure Vessel Code (BPVC), Section VII latest edition.
- .2 ASTM International
  - .1 ASTM A47/A47M-99, Standard Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A278/A278M-01, Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (350 degrees C).
  - .3 ASTM A516/A516M-10, Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
  - .4 ASTM A536-84, Standard Specification for Ductile Iron Castings.
  - .5 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .3 CSA Group
  - .1 CSA B51-latest edition, Boiler, Pressure Vessel, and Pressure Piping Code.

**1.2 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 expansion tanks, air vents, separators, valves, and strainers 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 Manitoba, Canada.
- .4 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .5 Operation and Maintenance Data: submit operation and maintenance data for hydronic specialties for incorporation into manual.
- .6 Submit 3 copies of operation and maintenance manual.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance 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 hydronic specialties from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 AUTOMATIC AIR VENT**

- .1 Standard float vent: brass body and NPS 1/8 connection and rated at working pressure.
- .2 Industrial float vent: cast iron body and NPS 1/2 connection and rated at 860 kPa working pressure.
- .3 Float: solid material suitable for 115 degrees C working temperature.

## **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 hydronic specialties installation in accordance with manufacturer's written instructions.

### **3.2 APPLICATION**

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and data sheets.

### **3.3 GENERAL**

- .1 Run drain lines and blow off connections to terminate above nearest drain.
- .2 Maintain adequate clearance to permit service and maintenance.
- .3 Should deviations beyond allowable clearances arise, request and follow Departmental Representative's directive.
- .4 Check shop drawings for conformance of tappings for ancillaries and for equipment operating weights.

### **3.4 STRAINERS**

- .1 Install in horizontal or down flow lines.
- .2 Ensure clearance for removal of basket.
- .3 Install ahead of each pump.

- .4 Install ahead of each automatic control valve larger than NPS 1 and radiation and as indicated.

### **3.5 AIR VENTS**

- .1 Install at high points of systems.
- .2 Install gate valve on automatic air vent inlet. Run discharge to nearest drain service sink.

### **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 Waste Management: separate waste in accordance with Section 01 74 21 - Construction/Demolition Waste Management and.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASME
  - .1 ASME B16.22-latest edition, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.
  - .2 ASME B16.24-latest edition, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 600, 900, 1500 and 2500.
  - .3 ASME B16.26-latest edition, Cast Copper Alloy Fittings for Flared Copper Tubes.
  - .4 ASME B31.5-latest edition, Refrigeration Piping and Heat Transfer Components.
- .2 ASTM International
  - .1 ASTM A307-latest edition, Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rod 60,000 PSI Tensile Strength.
  - .2 ASTM B280-latest edition, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .3 CSA Group
  - .1 CSA B52-05(R2009), B52 Package, Mechanical Refrigeration Code.
- .4 Environment Canada (EC)
  - .1 EPS 1/RA/1-latest edition , Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

**1.2 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 refrigerant piping, fittings and equipment and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures. 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.

**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 refrigerant piping for incorporation into manual.
- .3 Submit 3 copies of operation and maintenance manual.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance 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 refrigerant piping, fittings and equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 TUBING**

- .1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
  - .1 Hard copper: to ASTM B280, type ACR B.
  - .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, 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.

## **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 refrigerant piping installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

### **3.3 GENERAL**

- .1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5 Section 23 05 05 - Installation of Pipework.

### **3.4 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.

### **3.5 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<sup>3</sup>/s at minimum load. Connect upstream of traps on large riser.

### **3.6 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 2 MPa and 1 MPa 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.

### **3.7 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 5 Pa 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 hours.
  - .2 Break vacuum with refrigerant to 14 kPa.
  - .3 Final to 5 Pa absolute and hold for at least 12 hours.
  - .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 to 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 Obtain reports, within 3 days of review, and submit, immediately, to Departmental Representative

### **3.8 DEMONSTRATION**

- .1 Instructions:
  - .1 Post instructions in frame with glass cover in accordance with Section 01 78 00 - Closeout Submittals and CSA B52.

### **3.9 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 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- .2 ASTM International
  - .1 ASTM A480/A480M-latest edition, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
  - .2 ASTM A635/A635M-latest edition, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
  - .3 ASTM A653/A653M-latest edition, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Green Seal Environmental Standards (GS)
  - .1 GS-36-latest edition, Standard for Adhesives for Commercial Use.
- .4 National Fire Protection Association (NFPA)
  - .1 NFPA 90A-latest edition, Standard for the Installation of Air-Conditioning and Ventilating Systems.
  - .2 NFPA 90B-latest edition, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
  - .3 NFPA 96-latest edition, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
  - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, latest edition.
  - .2 SMACNA HVAC Air Duct Leakage Test Manual, latest edition
  - .3 IAQ Guideline for Occupied Buildings Under Construction latest edition.
- .6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

**1.2 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 ducts 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 Manitoba, Canada.
- .4 Test and Evaluation Reports:
  - .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.
- .5 Sustainable Design Submittals:
  - .1 Construction IAQ Management Plan:
    - .1 Submit Indoor Air Quality (IAQ) Plan for construction pre-occupancy phases of building.
    - .2 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings Under Construction.

### **1.3 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect metal ducts from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 SEAL CLASSIFICATION**

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C
125	Unsealed

- .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 sealant tape or combination thereof. Longitudinal seams unsealed.
- .4 Unsealed seams and joints.

## **2.2 SEALANT**

- .1 Sustainability Characteristics:
  - .1 Adhesives and sealants: in accordance with Section 07 92 00 - Joint Sealants.
  - .2 Adhesives and sealants: VOC limit 30 70 250 g/L maximum to SCAQMD Rule 1168 GS-36.
- .2 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

## **2.3 TAPE**

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

## **2.4 DUCT LEAKAGE**

- .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

## **2.5 FITTINGS**

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
  - .1 Rectangular: standard radius short radius with single thickness turning vanes centreline radius: 1.5 times width of duct.
  - .2 Round: smooth radius five piece, centreline radius: 1.5 times diameter.
- .3 Branches:
  - .1 Rectangular main and branch: with 45 degrees entry on branch 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.
- .4 Transitions:
  - .1 Diverging: 20 degrees maximum included angle.
  - .2 Converging: 30 degrees maximum included angle.
- .5 Offsets:
  - .1 as indicated Full Short radiused elbows.
- .6 Obstruction deflectors: maintain full cross-sectional area.

- .1 Maximum included angles: as for transitions.

## **2.6 FIRE STOPPING**

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Fire stopping material and installation must not distort duct.

## **2.7 GALVANIZED STEEL**

- .1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to ASHRAE, SMACNA.
- .3 Joints: to ASHRAE, SMACNA.

## **2.8 STAINLESS STEEL**

- .1 To ASTM A480/A480M, Type 304.
- .2 Finish: number 4.
- .3 Thickness, fabrication and reinforcement: to ASHRAE SMACNA as indicated.
- .4 Joints: to ASHRAE SMACNA.

## **2.9 HANGERS AND SUPPORTS**

- .1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
  - .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
    - .1 Maximum size duct supported by strap hanger: 500.
  - .2 Hanger configuration: to ASHRAE SMACNA.
  - .3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE SMACNA 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.
  - .3 For steel beams: manufactured beam clamps:

**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 metal duct installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2 GENERAL**

- .1 Do work in accordance with ASHRAE SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .3 Support risers in accordance with ASHRAE SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

**3.3 HANGERS**

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with ASHRAE SMACNA as follows:

Duct Size	Spacing
(mm)	(mm)
to 1500	3000
1501 and over	2500

**3.4 WATERTIGHT DUCT**

- .1 Provide watertight duct for:
  - .1 Fresh air intake.
  - .2 Minimum 3000 mm from duct mounted humidifier in all directions.
  - .3 As indicated.
- .2 Form bottom of horizontal duct without longitudinal seams.
  - .1 Solder Weld joints of bottom and side sheets.
  - .2 Seal other joints with duct sealer.

- .3 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and valve trap primer and discharging to open funnel drain as indicated.

### **3.5 SEALING AND TAPING**

- .1 Apply sealant in accordance with SMACNA to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

### **3.6 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 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 test before performance insulation or concealment Work.

### **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.
- .3 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canada Green Building Council (CaGBC)
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
  - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, latest edition.

**1.2 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 air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate:
    - .1 Flexible connections.
    - .2 Duct access doors.
    - .3 Turning vanes.
    - .4 Instrument test ports.
- .3 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

**1.3 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 air duct accessories from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.



**Part 2 Products**

**2.1 GENERAL**

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

**2.2 FLEXIBLE CONNECTIONS**

- .1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.
- .2 Material:
  - .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m<sup>2</sup>.

**2.3 ACCESS DOORS IN DUCTS**

- .1 Non-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.
- .2 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.
- .3 Gaskets: neoprene.
- .4 Hardware:
  - .1 Up to 300 x 300 mm: two sash locks complete with safety chain.
  - .2 301 to 450 mm: four sash locks complete with safety chain.
  - .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 Hold open devices.

**2.4 TURNING VANES**

- .1 Factory or shop fabricated single thickness double thickness with without trailing edge, to recommendations of SMACNA and as indicated.

**2.5 INSTRUMENT TEST**

- .1 1.6 mm thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.

**2.6 SPIN-IN COLLARS**

- .1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.
- .2 Sheet metal thickness to co-responding round duct standards.

**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 air duct accessories installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2 INSTALLATION**

- .1 Flexible Connections:
  - .1 Install in following locations:
    - .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 Locations:
    - .1 Fire and smoke dampers.
    - .2 Control dampers.
    - .3 Devices requiring maintenance.
    - .4 Required by code.
    - .5 Reheat coils, upstream/downstream.
    - .6 Elsewhere as indicated.
- .2 Instrument Test Ports:
  - .1 General:
    - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
  - .2 Locate to permit easy manipulation of instruments.
  - .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 Turning Vanes:
  - .1 Install in accordance with recommendations of SMACNA and as indicated.
- .4 Control Dampers:
  - .1 Install control dampers as provided by 25 30 02.

### **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.
- .3 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canada Green Building Council (CaGBC)
- .2 Sheet Metal and Air Conditioning National Association (SMACNA)
  - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2013.

**1.2 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 dampers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

**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 dampers for incorporation into manual.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance 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 dampers from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 GENERAL**

- .1 Manufacture to SMACNA standards.

**2.2 SPLITTER DAMPERS**

- .1 Fabricate from same material as duct but one sheet metal thickness heavier, with appropriate stiffening.
- .2 Double thickness construction.
- .3 Control rod with locking device and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Pivot: piano hinge.
- .6 Folded leading edge.

**2.3 SINGLE BLADE DAMPERS**

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height as indicated.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside bronze end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

**2.4 MULTI-BLADED DAMPERS**

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height: as indicated.
- .4 Bearings: pin in bronze bushings.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

**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 damper installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.

- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 INSTALLATION**

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 Dampers: vibration free.
- .6 Ensure damper operators are observable and accessible.
- .7 Corrections and adjustments conducted by Departmental Representative.

### **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.
- .3 Waste Management: separate waste in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canada Green Building Council (CaGBC)
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 90A-latest edition, Standard for the Installation of Air Conditioning and Ventilating Systems.
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S112-latest edition, Standard Test Method of Fire Test of Fire Damper Assemblies.
  - .2 CAN/ULC-S112.2-latest edition, Standard Method of Fire Test of Ceiling Fire Stop Flap Assemblies.
  - .3 ULC-S505-1974, Standard for Fusible Links for Fire Protection Service.

**1.2 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 fire and smoke dampers and include product characteristics, performance criteria, physical size, finish and limitations.
  - .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.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

**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 fire and smoke dampers for incorporation into manual.

**1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials:
  - .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

- .2 Provide:
  - .1 6 fusible links of each type.

## **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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect fire and smoke dampers from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 FIRE DAMPERS**

- .1 Fire dampers: arrangement Type A, B, C, listed bear label of ULC, UL Warnock Hersey, meet requirements of authorities having jurisdiction provincial fire authority Fire Commissioner of Canada (FCC) CFFM and NFPA 90A. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.
- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
  - .1 Fire dampers: 1 hour fire rated unless otherwise indicated.
  - .2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.
- .3 Top hinged: offset, round or square; sized to maintain full duct cross section.
- .4 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.
- .5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.
- .6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.
- .7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.



- .8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.
- .9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness.
- .10 Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

## **2.2 SMOKE DAMPERS**

- .1 Smoke Dampers: to be ULC or UL listed and labelled.
- .2 Normally closed reverse action smoke vent (S/D-RASV): folding blade type, opening by gravity upon detection of smoke, and/or from remote alarm signalling device actuated by an electro thermal link as indicated. Two flexible stainless steel blade edge seals to provide required constant sealing pressure.
- .3 Normally open smoke/seal (S/D-SSSD): folding blade type, closing when actuated by means of electro thermal link and/or from remote alarm signalling device. Blade edge seals of flexible stainless steel to provide required constant sealing pressure. Provide stainless steel negator springs with locking devices to ensure positive closure for units mounted horizontally in vertical ducts.
- .4 Motorized (S/D-M): folding blade type, normally open with power on. When power is interrupted damper shall close automatically. Both damper and damper operator shall be ULC listed and labelled.
- .5 Electro thermal link (S/D-ETL): dual responsive fusible link which melts when subjected to local heat of 74 degrees C and from external electrical impulse of low power and short duration; ULC or UL listed and labelled.

## **2.3 COMBINATION FIRE AND SMOKE DAMPERS**

- .1 Damper: similar to smoke dampers specified above.
- .2 Combined actuator: electrical control system actuated from smoke sensor or smoke detection system and from fusible link.

## **2.4 FIRE STOP FLAPS**

- .1 Fire smoke flaps: ULC listed and labelled and fire tested in accordance with CAN/ULC-S112.2.
- .2 Construct of minimum 1.5 mm thick sheet steel with 1.6 mm thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.
- .3 Flaps held open with fusible link conforming to ULC-S505 and close at 74 degrees C.

## **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 fire and smoke damper installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 INSTALLATION**

- .1 Install in accordance with NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
- .5 Co-ordinate with installer of fire stopping.
- .6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
- .7 Install break-away joints of approved design on each side of fire separation.

### **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.
- .3 Waste Management: separate waste in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM C423-latest edition, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
  - .2 ASTM C916-latest edition, Standard Specification for Adhesives for Duct Thermal Insulation.
  - .3 ASTM C1071-latest edition, Standard specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
  - .4 ASTM C1338-latest edition, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
  - .5 ASTM G21-latest edition, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 90A-latest edition, Standard for the Installation of Air Conditioning and Ventilating Systems.
  - .2 NFPA 90B-latest edition, Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
- .3 North American Insulation Manufacturers Association (NAIMA)
  - .1 NAIMA AH116-latest edition, Fibrous Glass Duct Construction Standards.
- .4 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
  - .1 SMACNA, HVAC Duct Construction Standards, Metal and Flexible-latest edition.
  - .2 SMACNA IAQ Guideline for Occupied Buildings Under Construction-2007.
- .5 Underwriter's Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

**1.2 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 duct liners 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 duct liners 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:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect duct liners from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 DUCT LINER**

- .1 General:
  - .1 Mineral Fibre duct liner: air surface coated mat facing.
  - .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102 NFPA 90A NFPA 90B.
  - .3 Recycled Content: EcoLogo certified with minimum 35 by weight recycled content .
  - .4 Fungi resistance: to ASTM C1338 ASTM G21.
- .2 Rigid:
  - .1 Use on flat surfaces where indicated.
  - .2 25 mm thick, to ASTM C1071 Type 2, fibrous glass rigid board duct liner.
  - .3 Density: 48 kg/m<sup>3</sup> minimum.
  - .4 Thermal resistance to be minimum 0.76 (m<sup>2</sup>. degrees C)/W for 25 mm thickness 1.15 (m<sup>2</sup>.degrees C)/W for 38 mm thickness 1.53 (m<sup>2</sup>.degrees C)/W for 50 mm thickness when tested in accordance with ASTM C177, at 24 degrees C mean temperature.
  - .5 Maximum velocity on faced air side: 20.3 m/s.
  - .6 Minimum NRC of 0.70 at 25 mm thickness based on Type A mounting to ASTM C423.

- .7 Recycled Content: EcoLogo certified containing minimum 45 by weight recycled content .
- .3 Flexible:
  - .1 Use on round or oval surfaces indicated.
  - .2 25 mm thick, to ASTM C1071 Type 1, fibrous glass blanket duct liner.
  - .3 Density: 24 kg/m<sup>3</sup> minimum.
  - .4 Thermal resistance to be minimum 0.37 (m<sup>2</sup>.degrees C)/W for 12 mm thickness 0.74 (m<sup>2</sup>.degrees C)/W for 25 mm thickness 1.11 (m<sup>2</sup>.degrees C)/W for 38 mm thickness 1.41 (m<sup>2</sup>.degrees C)/W to 50 mm thickness when tested in accordance with ASTM C177, at 24 degrees C mean temperature.
  - .5 Maximum velocity on coated air side: 30.5 m/s.
  - .6 Minimum NRC of 0.65 at 25 mm thickness based on Type A mounting to ASTM C423.

## **2.2 ADHESIVE**

- .1 Adhesive: to NFPA 90A and NFPA 90B ASTM C916.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29 degrees C to plus 93 degrees C.
- .3 Water-based fire retardant type.

## **2.3 FASTENERS**

- .1 Weld pins 2.0 mm diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm square.

## **2.4 JOINT TAPE**

- .1 Poly-Vinyl treated open weave fiberglass membrane 50 mm wide.

## **2.5 SEALER**

- .1 Meet requirements of NFPA 90A NFPA 90B.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68 degrees C to plus 93 degrees C.

## **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 duct liner installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 GENERAL**

- .1 Do work in accordance with SMACNA HVAC Duct Construction Standard NAIMA AH116 except as specified otherwise.
- .2 Line inside of ducts where indicated.
- .3 Duct dimensions, as indicated, are clear inside duct lining.

### **3.3 DUCT LINER**

- .1 Install in accordance with manufacturer's recommendations, and as follows:
  - .1 Fasten to interior sheet metal surface with 100% coverage of adhesive to ASTM C916.
    - .1 Exposed leading edges and transverse joints to be factory coated or coated with adhesive during fabrication.
  - .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres to compress duct liner sufficiently to hold it firmly in place.
    - .1 Spacing of mechanical fasteners in accordance with SMAC HVAC Duct Construction Standard NAIMA AH116.
- .2 In systems, where air velocities exceeds 20.3 m/s, install galvanized sheet metal nosing to leading edges of duct liner.

### **3.4 JOINTS**

- .1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:
  - .1 Bed tape in sealer.
  - .2 Apply 2 coats of sealer over tape.
- .2 Replace damaged areas of liner at discretion of Departmental Representative
- .3 Protect leading and trailing edges of duct sections with sheet metal nosing having 15 mm overlap and fastened to duct.

### **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 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)
  - .1 ANSI/AMCA Standard 99-latest edition, Standards Handbook.
  - .2 ANSI/AMCA Standard 210-latest edition/(ANSI/ASHRAE 51-07), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
  - .3 ANSI/AMCA Standard 300-latest edition, Reverberant Room Method for Sound Testing of Fans.
  - .4 ANSI/AMCA Standard 301-latest edition, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

**1.2 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 HVAC fans 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 Manitoba, Canada.
  - .2 Provide:
    - .1 Fan performance curves showing point of operation, bhp kW and efficiency.
    - .2 Sound rating data at point of operation.
  - .3 Indicate:
    - .1 Motors, sheaves, bearings, shaft details.
    - .2 Minimum performance achievable.

**1.3 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials:
  - .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
    - .1 Provide:
      - .1 Matched sets of belts.
      - .2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:
        - .1 Bearings and seals.
        - .2 Addresses of suppliers.



- .3 List of specialized tools necessary for adjusting, repairing or replacing.

#### **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 HVAC fans from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section
- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal Section.

### **Part 2 Products**

#### **2.1 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 in force.
  - .2 Capacity: flow rate, total static pressure, bhp W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
  - .3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99.
  - .4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300. Supply unit with ANSI/AMCA certified sound rating seal.
  - .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210. Supply unit with ANSI/AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

#### **2.2 FANS GENERAL**

- .1 Motors:
  - .1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment supplemented as specified herein.
  - .2 For use with variable speed controllers.
  - .3 Sizes as specified.
  - .4 Two speed with two windings and speeds as indicated

- .5 Two speed with split winding, constant horsepower constant or variable torque and speeds as indicated.
- .2 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet outlet safety screens as indicated and as specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment, inlet outlet dampers and vanes and as indicated.
- .3 Factory primed before assembly in colour standard to manufacturer.
- .4 Scroll casing drains: as indicated.
- .5 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .6 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
- .7 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

## **2.3 CENTRIFUGAL FANS**

- .1 Fan wheels:
  - .1 Welded steel aluminum construction.
  - .2 Maximum operating speed of centrifugal fans not more than 50% of first critical speed.
  - .3 Forward curved blades, as indicated.
- .2 Bearings: heavy duty grease lubricated ball or roller self-aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 100,000 hours.
- .3 Housings:
  - .1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, for smaller wheels, braced, and with welded supports.
  - .2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.
  - .3 Provide bolted latched airtight access doors with handles.

## **2.4 CABINET FANS - GENERAL PURPOSE**

- .1 Fan characteristics and construction: as centrifugal fans.
- .2 Cabinet hung single or multiple wheel with DWID centrifugal fans in factory fabricated casing complete with vibration isolators and seismic control measures, motor, V-belt drive and guard inside outside casing.
- .3 Fabricate casing of zinc coated or phosphate treated steel of reinforced and braced for rigidity. Provide removable panels for access to interior. Paint uncoated, steel parts with corrosion resistant paint to MPI #18. Finish inside and out, over prime coat, with rust resistant enamel. Internally line cabinet with 50 mm thick rigid acoustic insulation, pinned and cemented.

## **2.5 UTILITY SETS**

- .1 Characteristics and construction: for centrifugal fans.
- .2 Preassemble single width centrifugal fan with removable weatherproof protective hood with vents, and automatic spring loaded back draft dampers 12 mm mesh birdscreens.
- .3 Provide belt driven sets with adjustable motor bed plate.

## **2.6 IN-LINE CENTRIFUGAL FANS**

- .1 Characteristics and construction: as for centrifugal fan wheels, with axial flow construction and belt drive.
- .2 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.

## **2.7 PROPELLER FANS**

- .1 Fabricate multibladed propellers of sheet steel aluminum of airfoil shape within bell mouth entrance on integral mounts, with grease lubricated ball bearings, with extended lubrication fittings, suited for operating in any position, belt driven, complete with motor as indicated.
- .2 Provide blade guards, bird screen and automatic back draft dampers on discharge, with gasketed edges.

## **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 HVAC fans installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 FAN INSTALLATION**

- .1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.
- .2 Provide sheaves and belts required for final air balance.
- .3 Bearings and extension tubes to be easily accessible.
- .4 Access doors and access panels to be easily accessible.

**3.3 ANCHOR BOLTS AND TEMPLATES**

- .1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified.

**3.4 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 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canada Green Building Council (CaGBC)

**1.2 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 diffusers, registers and grilles and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate following:
    - .1 Capacity.
    - .2 Throw and terminal velocity.
    - .3 Noise criteria.
    - .4 Pressure drop.
    - .5 Neck velocity.
- .3 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

**1.3 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Include:
    - .1 Keys for volume control adjustment.
    - .2 Keys for air flow pattern adjustment.

**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 diffuser, registers and grilles from nicks, scratches, and blemishes.

- .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance.
- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 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.

### **2.2 GENERAL**

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
  - .1 Full perimeter gaskets.
  - .2 Plaster frames where set into plaster or gypsum board and as specified.
  - .3 Concealed fasteners.
- .3 Concealed manual volume control damper operators.
- .4 Colour: Refer to Drawing schedules.

### **2.3 MANUFACTURED UNITS**

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

### **2.4 SUPPLY GRILLES AND REGISTERS**

- .1 General: Refer to Drawing schedules.

### **2.5 RETURN AND EXHAUST GRILLES AND REGISTERS**

- .1 General: Refer to Drawing schedules.

### **2.6 DIFFUSERS**

- .1 General: Refer to Drawing schedules.

**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 diffuser, register and grille installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2 INSTALLATION**

- .1 Install in accordance with manufacturers instructions.
- .2 Install with screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place.

**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.
- .3 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM E90-Latest Edition , Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 96-Latest Edition , Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .4 Society of Automotive Engineers (SAE)

**1.2 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 louvers, intakes and vents and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate following:
    - .1 Pressure drop.
    - .2 Face area.
    - .3 Free area.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Test Reports: submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

**1.3 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect louvers, intakes and vents from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.



- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 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.

### **2.2 GRAVITY ROOF OUTSIDE AIR INTAKES AND RELIEF VENTS**

- .1 Factory manufactured aluminum galvanized steel.
  - .1 Complete with integral birdscreen of 2.7 mm diameter aluminum ss wire.
  - .2 Vertical Horizontal backdraft dampers on 4 faces.
  - .3 Maximum throat velocity: 3.3 m/s intake.
  - .4 Maximum loss through unit: 15 Pa exhaust static pressure.
  - .5 Maximum velocity through damper area: 1.5 m/s.
- .2 Birdscreens:
  - .1 Complete with integral birdscreen of 2.7 mm diameter aluminum ss wire. Use 12 mm mesh on exhaust 19 mm mesh on intake.

### **2.3 GOOSENECK HOODS**

- .1 Thickness: to ASHRAE SMACNA.
- .2 Fabrication: to ASHRAE SMACNA.
- .3 Joints: to ASHRAE SMACNA.
- .4 Supports: as indicated.
- .5 Complete with integral birdscreen of 2.7 mm diameter aluminum wire. Use 12 mm mesh on exhaust 19 mm mesh on intake.
- .6 Vertical Horizontal backdraft dampers on 4 faces.

### **2.4 FIXED LOUVRES - ALUMINUM**

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy 6063-T5.
- .3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.
- .4 Frame, head, sill and jamb: 150 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.
- .5 Mullions: at 1500 mm maximum centres.

- .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: to Departmental Representative's approval.

## **2.5 FIXED LOUVRES**

- .1 General: copper in welded steel frame, complete with anchors.
- .2 Blades:
  - .1 24 ounce cold rolled copper set at 45 degrees, Z-shaped with drip lips.
  - .2 Stormproof design for outside air intakes.
  - .3 Maximum length without mullions of same material: 1250 mm.
- .3 Frame: galvanized structural steel, welded construction. Paint welds after construction to Section 09 91 13 - Exterior Painting.
- .4 Screen: 12 mm exhaust 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.
- .5 Finish: factory applied enamel. Colour: to Departmental Representative's approval.

## **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 louvres, intakes and vents installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **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 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 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standard Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
  - .1 ANSI/ASHRAE 52.2-Latest Edition, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size (ANSI approved).
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-115.10-Latest Edition, Disposable Air Filters for the Removal of Particulate Matter from Ventilating Systems.
  - .2 CAN/CGSB-115.11-Latest Edition, Filters, Air, High Efficiency, Disposable, Bag Type.
  - .3 CAN/CGSB-115.12-Latest Edition, Filters, Air, Medium Efficiency, Disposable, Bag Type.
  - .4 CAN/CGSB-115.13-Latest Edition, Filter Media, Automatic Roll.
  - .5 CAN/CGSB-115.14-Latest Edition, High Efficiency Cartridge Type Supported Air Filters for the Removal of Particulate Matter from Ventilating Systems.
  - .6 CAN/CGSB-115.15-Latest Edition, High Efficiency Rigid Type Air Filters for Removal of Particulate Matter from Ventilating Systems.
  - .7 CAN/CGSB-115.16-Latest Edition Activated Carbon for Odor Removal from Ventilating Systems.
  - .8 CAN/CGSB-115.18-Latest Edition, Filter, Air, Extended Area Panel Type, Medium Efficiency.
  - .9 CAN/CGSB-115.20-Latest Edition, Polarized Media Air Filter.
- .3 International Organization of Standardization (ISO)
  - .1 ISO 14644-1-Latest Edition, Clean Rooms and Associated Controlled Environments - Part 1: Classification of Air Cleanliness.
- .4 National Fire Protection Association (NFPA)
  - .1 NFPA 96-Latest Edition, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .5 Underwriters' Laboratories of Canada (ULC)
  - .1 ULC -S111-07, Standard Method of Fire Tests for Air Filter Units.

**1.2 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 HVAC filters 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 Manitoba, Canada.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

### **1.3 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra 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.
  - .3 Spare filters: in addition to filters installed immediately prior to acceptance by Departmental Representative, supply 2 complete sets of filters for each.

### **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 indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect HVAC filters from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 Media: suitable for air at 100% RH and air temperatures between -40 and 50 degrees 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.

### **2.2 ACCESSORIES**

- .1 Holding frames: construction of galvanized steel 1.6 mm thick, except where specified.
- .2 Seals: to ensure leakproof operation.

- .3 Blank-off plates: as required, to fit all openings and of same material as holding frames.
- .4 Access and servicing: through doors/panels on each side and/or from upstream 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 diameter hinged wire mesh screen.
- .3 Performance: to MERV 16
- .4 Fire rated: to ULC -S111.
- .5 Nominal thickness: 25 to 50 mm. Refer also to drawing equipment schedules.

## **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 filter installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 INSTALLATION GENERAL**

- .1 Install in accordance with manufacturer's recommendations and with adequate space for access, maintenance and replacement.

### **3.3 REPLACEMENT MEDIA**

- .1 Replace media with new upon acceptance.
- .2 Filter media new and clean, as indicated by pressure gauge, at time of acceptance.

### **3.4 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 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
  - .1 ASHRAE 84-Latest Edition, Method of Testing Air-to-Air Heat/Energy Exchangers (ANSI approved).

**1.2 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 energy recovery equipment 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 Manitoba, Canada.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Test Reports:
  - .1 Catalogued or published ratings: obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
  - .2 Provide confirmation of testing.
- .6 Manufacturers' Instructions: submit manufacturer's installation instructions.
  - .1 Departmental Representative will make available 3 copies of systems supplier's installation instructions.

**1.3 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Extra Materials:
  - .1 Furnish list of individual manufacturer's recommended spare parts for equipment include:
    - .1 Bearings and seals.
    - .2 Addresses of suppliers.
  - .2 List of specialized tools necessary for adjusting, repairing or replacing.



**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 indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect energy recovery equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 GENERAL**

- .1 Comply with ASHRAE 84.

**2.2 SENSIBLE HEAT TYPE AIR TO AIR ROTARY HEAT EXCHANGER**

- .1 Horizontal air flow unit: complete with drain pan with NPS 1 1/2 drain connection.
- .2 Performance characteristics: as indicated.

**2.3 AIR TO AIR FIXED PLATE EXCHANGER**

- .1 Casing: 0.8 mm thick galvanized steel.
- .2 Heat transfer surfaces: corrugated aluminum, edge sealed and bonded to casing.
- .3 Condensate drain.
- .4 Removable access panels.
- .5 Performance characteristics: as indicated.
- .6 Electric defrost control (DFC), winter operating conditions to -40 C.
- .7 Capable for economiser mode with air handler system.
- .8 Electric heat coil as indicated on drawing schedule.

**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 energy recovery equipment installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2 INSTALLATION**

- .1 Install in accordance with manufacturers recommendations.
- .2 Support independently of adjacent ductwork with flexible connections.
- .3 Install access doors in accordance with Section 23 33 00 - Air Duct Accessories for access to coils, dampers.

**3.3 FIELD QUALITY CONTROL**

- .1 Tests:
  - .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

**3.4 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 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute/Air-Conditioning, Heating and Refrigeration Institute (ANSI/AHRI)
  - .1 ANSI/AHRI 430-Latest Edition, Performance Rating of Central Station Air-Handling Units.
- .2 American National Standards Institute/American Society of Heating, Refrigeration and Air Condition Engineers/Illuminating Engineering Society (ANSI/ASHRAE/IES)
  - .1 ANSI/ASHRAE 52.2-Latest Edition, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
  - .2 ANSI/ASHRAE/IES 90.1-Latest Edition, Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .3 Green Seal (GS)
  - .1 GS-11-Latest Edition, Standard for Paints and Coatings.
  - .2 GS-36-Latest Edition, Standard for Adhesives for Commercial Use.
- .4 South Coast Air Quality Management District (SCAQMD)
  - .1 SCAQMD Rule 1113-Latest Edition, Architectural Coatings.
  - .2 SCAQMD Rule 1168-Latest Edition, Adhesives and Sealants.

**1.2 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 insulation, filters, adhesives, and paints 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 Manitoba, Canada.
  - .2 Indicate on drawings: fan, fan curves showing point of operation motor drive bearings filters mixing box dampers; include performance data.

**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 air handling equipment for incorporation into manual.
- .3 Include following: fan bearings motor damper, air volume, total cooling, sensible cooling, EDB, EWB, OAT.

#### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide 12 spare sets of filters.
- .3 Provide list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.
- .4 Spare filters: in addition to filters installed immediately prior to acceptance by Departmental Representative, supply 12 complete sets of filters for each filter unit or filter bank.

#### **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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect air handling equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 GENERAL - INDOOR**

- .1 Factory assembled components to form units supplying air at designed conditions, as indicated. Example product for AHU-1; Lennox CBX25UH.
- .2 Certify ratings: to ANSI/AHRI 430 with AHRI seal.
- .3 Horizontal, split DX Cooling with electrical heat, having air tight modular components consisting of casing, fan section with motor and drive, filter section, dampers, electric heating coil, cooling coil, mixing box, economiser, transformer and blower relay, tool-less filter access, refrigerant line connections, digital thermostat – DDC compatible.

#### **2.2 CASINGS**

- .1 Phosphate treated zinc coated prepainted, reinforced and braced for rigidity, insulated.
  - .1 Removable panels: provide access for maintenance of internal parts.
  - .2 Finish unit inside and out, with rust resistant enamel.

- .3 Two layer painted surface to protect from rust and corrosion.
- .4 Two part cabinet construction with rubber gasket between sections.

## **2.3 DRAIN PANS**

- .1 Construction: Dual position, stainless steel, polymer plastic, rounded corners, antimicrobial.
- .2 Connect drain to hub drain.

## **2.4 FANS**

- .1 Cabinet hung AMCA-rated for sound and performance centrifugal fans with forward curved wheels.
  - .1 Provide internally mounted motor as indicated.
  - .2 Motor: Multiple blower speed as indicated.
- .2 Maximum sound power levels, as indicated.
- .3 Internally mounted motor and fan.

## **2.5 VIBRATION ISOLATION**

- .1 Flexible connections at inlet and outlet of fan: to Section 23 33 00 - Air Duct Accessories.
- .2 Vibration isolators on fan section: in accordance with Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

## **2.6 FILTER**

- .1 Material to match casing. For flat type filter arrangement:
  - .1 Provide access to filter through hinged door removable panels with suitable hardware.
- .2 Filters: in accordance with Section 23 44 00 - HVAC Air Filtration.
  - .1 Minimum Efficiency Reporting Value (MERV) value 16 filtration media to ANSI/ASHRAE 52.2, to be used on return air section of air handling unit.
  - .2 Immediately prior to occupancy, replace filtration media with new filtration media with Minimum Efficiency Reporting Value (MERV) of 16 in accordance with ANSI/ASHRAE 52.2.

## **2.7 MIXING BOX – WITH ECONOMISER**

- .1 Material to match casing and produce uniformly mixed air temperature within plus or minus 5 degrees C of design across face of outlet.
- .2 Dampers for mixing boxes: Section 23 33 15 - Dampers - Operating.

## **2.8 COILS**

- .1 Capacity: as indicated.

- .2 Ratings: AHRI certified, high efficient.
- .3 Construction:
  - .1 Casings: 1.5 mm thick galvanized sheet steel.
    - .1 Supports of galvanized steel channel double angle frames.
    - .2 Blank-off plates. Insulated sandwich construction.
  - .2 Direct expansion refrigerant coils:
    - .1 Serpentine type, Straight tube type arranged to prevent trapping of oil.
      - .1 Liquid distributors to ensure even distribution of liquid refrigerant to all circuits.
      - .2 Silver solder or braze joints in refrigerant tubing.
      - .3 Evacuate and charge coil with nitrogen and seal before sending to site.
    - .2 Tubes: copper.
    - .3 Fins: copper aluminum plate spiral wound.
    - .4 Headers: copper.
    - .5 Check and thermostatic expansion valve, factory provided.
    - .6 Pressure tests: to Canadian Refrigeration Code. Dehydrated. Sealed with nitrogen charge.

### **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 air handling equipment installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

#### **3.2 INSTALLATION**

- .1 Provide appropriate protection apparatus.
- .2 Install units in accordance with manufacturer's instructions and as indicated.
- .3 Ensure adequate clearance for servicing and maintenance.

#### **3.3 FANS**

- .1 Install fan sheaves required for final air balance.
- .2 Install flexible connections at fan inlet and fan outlets.
- .3 Install vibration isolators.

### **3.4 DRIP PANS**

- .1 Install deep seal P-traps and trap seal primer on drip lines.
  - .1 Depth of water seal to be 1.5 times static pressure at this point.

### **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 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1            General**

**1.1            REFERENCES**

- .1 American Gas Association (AGA)
- .2 American National Standards Institute/Air-Conditioning, Heating and Refrigeration Institute (ANSI/AHRI)
  - .1 ANSI/AHRI 210/240-Latest Edition, Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
  - .2 ANSI/AHRI 270-Latest Edition, Sound Rating of Outdoor Unitary Equipment.
- .3 CSA Group
  - .1 CSA B52-Latest Edition, Mechanical Refrigeration Code.
  - .2 CSA C22.1-Latest Edition, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
- .4 National Fire Protection Association (NFPA)
  - .1 NFPA 90A-Latest Edition, Standard for the Installation of Air Conditioning and Ventilating Systems.
- .5 Underwriters Laboratories (UL)
  - .1 UL 1995-Latest Edition, Standard for Heating and Cooling Equipment.

**1.2            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 outdoor HVAC equipment 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 Manitoba, Canada.
  - .2 Drawings to indicate project layout and dimensions; indicate:
    - .1 Equipment, piping, and connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware, and recommended ancillaries which are mounted, wired and piped ready for final connection to building system, its size and recommended bypass connections.
    - .2 Piping, valves, fitting shipped loose showing final location in assembly.
    - .3 Control equipment shipped loose, showing final location in assembly.



- .4 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads.
  - .5 Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices of ancillaries, accessories, controllers.
  - .6 Pump and fan performance curves.
  - .7 Details of vibration isolation.
  - .8 Estimate of sound levels to be expected across individual octave bands in dB referred to A rating.
  - .9 Type of refrigerant used.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .5 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
  - .6 Manufacturer's Field Reports:
    - .1 Submit manufacturer's field reports specified.

### **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 outdoor HVAC equipment for incorporation into manual.
  - .1 Indicate: brief description of unit, indexed, with details of function, operation, control, and service for components.
  - .2 Provide for units, manufacturer's name, type, year, number of units, and capacity.

### **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 indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect outdoor HVAC equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.

- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **1.5 WARRANTY**

- .1 For Work of this Section 23 74 00 - Packaged Outdoor HVAC Equipment, 12 months warranty period is extended to 24 months.
- .2 Contractor hereby warrants that packaged rooftop HAVC units and refrigeration compressors will function and operate in accordance with CCDC 2 GC 24, but for 24 60 months.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 Roof mounted, self-contained single zone unit with electric heating elements and DX refrigeration and bear label of, FM, UL ULC.
- .2 Units to consist of cabinet and frame, supply fan, heater control, air filter, refrigerant cooling coil, compressor, condenser coil and fans, motorized outside air damper, return damper, motorized gravity exhaust damper.
- .3 Prefabricated 16 gauge roof curb to conform to requirements of National Roofing Contractors Association (NRCA), minimum height 425 mm.
- .4 Conform to ANSI/AHRI 210/240, rating for unit larger than 40 kW nominal.

### **2.2 UNIT CABINET**

- .1 Unit cabinet shall be constructed of phosphated, zinc--coated, prepainted steel. Normal service shall be through removable cabinet panels. The unit shall be constructed on a rust proof unit base that has an externally trapped, integrated sloped drain. Evaporator fan compartment top surface shall be insulated with minimum ½ in. (12.7 mm) thick, flexible fiberglass insulation, coated on the air side and retained by adhesive and mechanical means. The evaporator wall sections will be insulated with a minimum semi rigid foil faced board capable of being wiped clean. Aluminum foil faced fiberglass insulation shall be used in the entire indoor air cavity section. Unit shall have a field supplied condensate trap.
- .2 Economizer; Factory installed Economizer with solid state controls and barometric relief dampers including filter racks. Economizer controls to be capable of providing free cooling using outside air and equipped with low leakage dampers not to exceed 3%leakage, at 250 pa (1.0 IN. W.C.) pressure differential. Spring return motor shuts off outdoor damper on power failure. Manual Outside Air Damper, bird screen, and rain hood.
- .3 Filter Rack Kit - Include 25mm (1 in.) filter, to MERV-13, maximum pressure drop 250 pa (0.08 in. W.C.).
- .4 Louvered Grille; factory installed to provide hail guard and vandalism protection.

- .5 Electric Heaters (see Drawing Schedules); Heater elements shall be open wire type, adequately supported and insulated with ceramic bushings. Electric heater packages must provide single point power connection capability.
- .6 Fan Wheel to be made from steel, be double inlet type with forward curved blades with corrosion resistant finish. Fan wheel shall be dynamically balanced.
- .7 Thermostatic Expansion Valve -A hard shutoff, balance port TXV to maintain constant superheat at the evaporator exit (cooling cycle) for higher overall system efficiency.
- .8 Refrigerant system; provide Liquid filter driers, Puron (R-410A) full refrigerant charge, Refrigerant service connections.
- .9 Compressor Start Kit (single phase units): Shall provide additional starting torque for single—phase compressors.
- .10 Thermostat: To provide for one stage heating and cooling in addition manual or automatic changeover and indoor fan control.
- .11 Crankcase Heater: Shall provide anti-flood back protection for low--load cooling applications.
- .12 Controls and Safeties: Unit controls shall be complete with a self-contained low voltage control circuit. Units shall incorporate high and low pressure switches.
- .13 Operating Characteristics: Unit shall be capable of starting and running at 125 F (51 C) ambient outdoor temperature per maximum load criteria of AHRI Standard 210.
- .14 Compressor with standard controls shall be capable of operation down to 40 F (4 C) ambient outdoor temperature.
- .15 LOSS--OF--CHARGE / LOW—PRESSURE SWITCH (Liquid Line) (psig) cut--out Reset (auto)
- .16 HIGH--PRESSURE SWITCH (psig) Cut--out Reset (Auto)
- .17 Unit shall be provided with 60 second fan time delay after the thermostat is satisfied.
- .18 Electrical Requirements: All unit power wiring shall enter the unit cabinet at a single location. Motors: Compressor motors shall be of the refrigerant cooled type with line break thermal and current overload protection. All fan motors shall have permanently lubricated bearings, and inherent, automatic reset, thermal overload protection. Condenser fan motor shall be totally enclosed. Evaporator fan motor to be ECM Motor.
- .19 Compressor: Fully hermetic compressors with factory--installed vibration isolation. Scroll compressors.
- .20 Coils: Evaporator and condenser coils shall have aluminum plate fins mechanically bonded to seamless copper tubes with all joints brazed. Tube sheet openings shall be belled to prevent tube wear.

**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 outdoor HVAC equipment installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative .
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative .

**3.2 INSTALLATION**

- .1 Install as per manufacturers' instructions on roof curbs provided by manufacturer
- .2 Manufacturer to certify installation, supervise start-up and commission unit.
- .3 Run drain line from cooling coil condensate drain pan to discharge over roof drain.

**3.3 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Have manufacturer of products supplied under this Section review work involved in 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.
- .2 Obtain reports within 3 days of review and submit immediately to Departmental Representative .
- .3 Performance Verification:
  - .1 General:
    - .1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems, supplemented as specified herein.
  - .2 Rooftop Air Handling Units:
    - .1 Set zone mixing dampers for full cooling, except that where diversity factor forms part of design set that percentage of zone dampers to full heating.
    - .2 Set outside air and return air dampers for minimum outside air.
    - .3 Set face and bypass dampers so face dampers are fully open and bypass dampers are fully closed.
    - .4 Check for smooth, vibration less correct rotation of supply fan impeller.
    - .5 Measure supply fan capacity.

- .6 Adjust impeller speed as necessary and repeat measurement of fan capacity.
- .7 Measure pressure drop each component of air handling unit.
- .8 Set outside air and return air dampers for the percentage of outside air required by design and repeat measurements of fan capacity.
- .9 OAD: verify for proper stroking, interlock with RAD.
- .10 Measure DBT, WBT of SA, RA, EA.
- .11 Measure air cooled condenser discharge DBT.
- .12 Measure flow rates (minimum and maximum) of SA, RA, EA, relief air.
- .13 Simulate maximum cooling load and measure refrigerant hot gas and suction temperatures and pressures.
- .14 Simulate maximum heating load and:
  - .1 Verify temperature rise across heat coil.
- .15 Measure radiated and discharge sound power levels under maximum heating demand and under maximum cooling demand with compressors running.
- .16 Verify operating control strategies, including:
  - .1 Heat coil operating and high limit.
  - .2 Early morning warm-up cycle.
  - .3 Freeze protection.
  - .4 Economizer cycle operation, temperature of change-over.
  - .5 Alarms.
  - .6 Voltage drop across thermostat wiring.
  - .7 Operation of remote panel including pilot lights, failure modes.
- .17 Set zone mixing dampers for full heating and repeat measurements.
- .18 Measure leakage past zone mixing dampers by taking temperature measurements. Reduce leakage to less than 5%.
- .19 Check capacity of heating unit.
- .20 Measure DX refrigeration system performance.
- .21 Refer to other sections of these specifications for PV procedures for other components.
- .3 Start-Up:
  - .1 General: in accordance with Section 23 08 01 – Performance Verification Mechanical Piping Systems.
- .4 Verify accessibility, serviceability of components including motorized dampers, filters coils, fans, motors, operators, humidifiers, sensors, electrical disconnects.
- .5 Verify accessibility, clean ability, drainage of drain pans for coils.
- .4 Commissioning Reports:
  - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: reports supplemented as specified herein. Include:
    - .1 Report forms as specified Section 01 91 13 - General Commissioning (Cx) Requirements: Report Forms and Schematics.

**3.4 DEMONSTRATION**

- .1 Training: in accordance with Section 01 91 13 - General Commissioning (Cx)  
Requirements: Training of O M Personnel, supplemented as specified.

**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 Perform cleaning operations in accordance with manufacturer's recommendations.
- .4 Waste Management: separate waste in accordance with Section 01 74 21 - Construction/Demolition Waste Management .
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Not applicable.

**1.2 REFERENCES**

- .1 American National Standards Institute/American Society of Heating, Refrigeration and Air-Conditioning Engineers (ANSI/ASHRAE)
  - .1 ANSI/ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size.
  - .2 ANSI/ASHRAE 127-, Method of Testing for Rating Computer and Data Processing Room Unitary Air-Conditioners.
- .2 ASTM International
  - .1 ASTM C547-11, Specification for Mineral Fiber Pipe Insulation.
- .3 CSA International
  - .1 CSA B52, Mechanical Refrigeration Code.
  - .2 CAN/CSA-C656, Performance Standard for Single Package Central Air-Conditioners and Heat Pumps.

**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 air conditioning components and accessories 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 Manitoba, Canada.
  - .2 Indicate on drawings:
    - .1 Major components and accessories including sound power levels of units.
    - .2 Type of refrigerant used.

**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 air conditioning components 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect air conditioning components from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal..

## **1.6 WARRANTY**

- .1 For computer room air conditioning 12 months warranty period is extended to 60 months.
- .2 Contractor hereby warrants that computer room air conditioning will not spall or show visible evidence of cracking, except for normal hairline shrinkage cracks, in accordance with CCDC 2 General Conditions.

## **Part 2 Products**

### **2.1 SUMMARY**

- .1 These specifications describe requirements for an environmental control system. The system shall be designed to control temperature and relative humidity conditions within the room.
- .2 The manufacturer shall design and furnish all equipment in the quantities and configurations shown on the project drawings.
- .3 Standard 60Hz units are CSA Certified to the harmonized U. S. and Canadian product safety standard CSA C22.2 No 236/UL 1995 for "Heating and Cooling Equipment" and are marked with the CSA c-us logo.

### **2.2 DESIGN REQUIREMENTS**

- .1 The environmental control system shall be a factory assembled unit. On direct expansion models, the refrigeration system shall be self-contained or shall be split, with the compressor located in a remote air-cooled condensing unit.
- .2 The self-contained and split evaporator units shall be designed for above-dropped-ceiling installation and serviceable from the front and bottom of the system. Condensing unit for split system shall be designed for outdoor installation.



- .3 The system shall have a total cooling capacity of 14,100 Btu/hr (4.15kW), and a sensible cooling capacity of 11,500 Btu/hr (3.35kW), based on the entering air condition of 72°F (22°C) dry bulb, and 60°F (15.5°C) wet bulb.
- .4 The unit is to be supplied for operation using a 208 volt, 1 phase, 60 Hz power supply.

## **2.3 SUBMITTALS**

- .1 Submittals shall be provided with the proposal and shall include: Single-Line Diagrams; Dimensional, Electrical and Capacity data; Piping and Electrical Connection Drawings.

## **2.4 QUALITY ASSURANCE**

- .1 The specified system shall be factory-tested before shipment. Testing shall include, but shall not be limited to: Quality Control Checks, "HiPot" Test (two times rated voltage plus 1000 volts, per NRTL agency requirements) and Metering Calibration Tests. The system shall be designed and manufactured according to world class quality standards. The manufacturer shall be ISO 9001 certified.

## **2.5 CABINET CONSTRUCTION**

- .1 The cabinet and chassis shall be constructed of heavy gauge galvanized steel and designed for easy installation and service access from front and bottom of unit only (water cooled units require end access). Mounting brackets shall be factory-attached to the cabinet. Internal cabinet insulation shall meet ASHRAE 62.1 requirements for Mold Growth, Humidity & Erosion, tested per UL 181 and ASTM 1338 standards.

## **2.6 AIR DISTRIBUTION**

- .1 The air distribution system shall be constructed with a quiet, direct-drive fan assembly equipped with double-inlet blower, self-aligning ball bearings and lifetime lubrication. Fan motor shall be 1/5hp (149W), permanent-split capacitor, high efficiency type, equipped with two speeds for air flow modulation for precise dehumidification control. Dehumidification shall utilize the lower fan speed.
- .2 Air delivery shall be minimum 600 CFM (1019 CMH) at high fan speed. For ducted applications air delivery shall be 600 CFM (1019 CMH) at 0.3" (8 mm) external static pressure.
- .3 System shall be suitable for plenum or ducted air distribution.

## **2.7 MICROPROCESSOR CONTROL**

- .1 The control system shall be microprocessor-based, factory-wired into the system and tested prior to shipment. The wall-mounted control enclosure shall include a 2-line by 16-character LCD providing continuous display of operating status and alarm condition. An 8-key membrane keypad for setpoint/ program control, fan speed selection and unit On/Off shall be located below the display. The control display shall be field-wired to the control board using 4-conductor field-supplied thermostat wire.
- .2 Temperature and humidity sensors shall be located in the wall box, which shall be capable of being located up to 300 ft (91.4m) from the evaporator unit.

## **2.8 MONITORING**

- .1 The LCD shall provide On/Off indication, operating mode indication (cooling, heating, humidifying, dehumidifying), fan speed indication and current day, time, temperature and humidity (if applicable) indication. The monitoring system shall be capable of relaying unit operating parameters and alarms to the Liebert® SiteScan® monitoring system.

## **2.9 CONTORL SETPOINT PARAMENTERS**

- .1 Temp. Setpoint 65-85°F (18-29°C)
- .2 Temp. Sensitivity 1-9.9 °F (1-5°C)
- .3 Humidity Setpoint 20-80% RH
- .4 Humidity Sensitivity 1-30% RH

## **2.10 COMPRESSOR SHORT-CYCLE CONTROL**

- .1 The control system shall prevent compressor short-cycling by a 3-minute timer from compressor stop to the next start.

## **2.11 COMMON ALARM AND REMOTE ON/OFF**

- .1 A common alarm relay shall provide a contact closure to a remote alarm device. Two (2) terminals shall also be provided for remote On/Off control. Individual alarms shall be “enabled” or “disabled” from reporting to the common alarm.

## **2.12 SETBACK CONTROL**

- .1 The control shall be user-configurable to use a manual setpoint control or a programmable, time-based setback control. The setback control will be based on a 5 day/2 day programmed weekly schedule with capability of accepting 2 events per program day.

## **2.13 TEMPERATURE CALIBRATION**

- .1 The control shall include the capabilities to calibrate the temperature and humidity sensors and adjust the sensor response delay time from 10 to 90 seconds. The control shall be capable of displaying temperature values in °F or °C.

## **2.14 SYSTEM AUTO RESTART**

- .1 For startup after power failure, the system shall provide automatic restart with a programmable (up to 9.9 minutes in 6-second increments) time delay. Programming can be performed either at the wall-mounted controller or from the central, site-monitoring system.

## **2.15 UNIT ALARMS**

- .1 The control system shall monitor unit operation and activate an audible and visual alarm in the event of the following factory preset alarm conditions:
  - .1 High Temperature
  - .2 Low Temperature

- .3 High Humidity
- .4 Low Humidity
- .5 High Water Alarm - Lockout Unit Operation
- .6 High Head Pressure
- .7 Loss of Power
- .8 Compressor Short Cycle

**2.16 CUSTOM ALARMS (2X)**

- .1 Humidifier Problem
- .2 Filter Clog
- .3 Water Detected

**2.17 AUDIBLE ALARM**

- .1 The audible alarm shall annunciate any alarm that is enabled by the operator.

**2.18 COMMON ALARM**

- .1 A programmable common alarm shall be provided to interface user selected alarms with a remote alarm device. Alarms shall be enabled or disabled from reporting to the common alarm.

**2.19 EVAPORATOR UNIT – AC-2A**

- .1 The evaporator section shall include evaporator coil, thermostatic expansion valve and filter drier. The evaporator coil shall have 2.4 sq.ft. (0.23 sq.m) face area, 2 rows deep. It shall be constructed of copper tubes and aluminum fins and have a maximum face velocity of 232 ft. per minute (1.2 m/s) at minimum 400 CFM (679 CMH). An externally equalized thermostatic expansion valve shall control refrigerant flow. The evaporator coil shall be factory-charged with R-407C refrigerant and sealed. The coil shall be provided with a condensate drain pan with an internally trapped drain line. The evaporator drain pan shall include a factory-installed float switch to shut down the evaporator upon high water condition.

**2.20 OUTDOOR AIR-COOLED PROPELLER FAN CONDENSING UNIT – CU-2A**

- .1 Condensing unit components shall include a condenser coil, a direct-drive propeller-type fan, a (scroll) (reciprocating) compressor with vibration-isolating grommets, high pressure switch, Liebert® Lee Temp™ receiver and head pressure control valve, hot gas bypass system and liquid line solenoid valve. The condenser coil shall be constructed of copper tubes and aluminum fins.
- .2 A hot gas bypass system shall be provided to reduce compressor cycling and improve operation under low load conditions.
- .3 All components shall be factory-assembled, charged with R-407C refrigerant, sealed and be capable of being connected to the evaporator section using pre-charged refrigerant line sets. No internal piping, brazing, dehydration or charging shall be required. Condensing

unit shall be designed for 95°F (35°C) ambient and be capable of operation to -30°F (-34.4°C).

- .4 Provide crankcase heater.

## **2.21 STEAM GENERATING HUMIDIFIER**

- .1 The environmental control system shall be equipped with a steam generating humidifier that is controlled by the microprocessor control system. It shall be complete with disposable canister, all supply and drain valves, 1" (25.4mm) air gap on fill line, inlet strainer, steam distributor and electronic controls. The need to change canister shall be annunciated on the microprocessor wall box control panel. The humidifier shall have a capacity of 2.5 lb/hr (1.1 kg/h). An LED light on the humidifier assembly shall indicate cylinder full, overcurrent detection, fill system fault and end of cylinder life conditions.

## **2.22 ELECTRIC REHEAT**

- .1 The electric reheat shall be low-watt density, 304/304 stainless steel, finned-tubular and shall be capable of maintaining room dry bulb temperature conditions when the system is calling for dehumidification. The reheat section shall include a UL-approved safety switch to protect the system from overheating. The capacity of the reheat coils shall be 12,160Btu/hr (3.6kW), with unit input voltage of 208 V, controlled in one stage.

## **2.23 DISCONNECT SWITCH, NON –LOCKING**

- .1 The non-automatic, non-locking, molded case circuit interrupter shall be factory mounted in the high voltage section of the electrical panel. The switch handle shall be accessible from the unit front and mounted on the indoor cooling unit.

## **2.24 FILTER BOX AND DUCT KIT**

- .1 A return air filter box shall be provided with hinged filter access, and 1" (25.4 mm) duct flange. A 1" (25.4 mm) duct flange shall also be provided for air discharge. Filters shall be 1" x 16" x 20" (25.4mm x 406mm x 508mm) MERV 8 per ASHRAE 52.2-2007.

## **2.25 DUCT COLLAR KIT**

- .1 1" (25.4 mm) duct flanges shall be provided for each of the discharge and return air openings. Filters and filter box must be field supplied.

## **2.26 REFRIGERANT LINE SWEAT ADAPTER KIT**

- .1 Provide a sweat adapter kit to permit field brazing of refrigerant line connections for application to air cooled split systems.

## **2.27 REFRIGERANT CHARGE**

- .1 Charge refrigerant system at factory, seal and test.
- .2 Holding charge of refrigerant applied at factory.

**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 air conditioning components installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Departmental Representative.

**3.2 GENERAL**

- .1 Install air conditioning unit in accordance with manufacturer's installation instructions. Install unit plumb and level, firmly anchored in location indicated, and maintain manufacturer's recommended clearances.

**3.3 ELECTRICAL WIRING**

- .1 Install and connect electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's electrical connection diagram submittal to electrical contractor. Install and wire per local and national codes.

**3.4 PIPING CONNECTIONS**

- .1 Install and connect devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's piping connection diagram submittal to piping contractor.

**3.5 SUPPLY AND DRAIN WATER PIPING**

- .1 Connect water supply and drains to air conditioning unit. Unit drain shall be trapped internally and shall not be trapped externally.

**3.6 FIELD-SUPPLIED PAN**

- .1 A field-supplied pan with drain shall be installed beneath ducted cooling units.

**3.7 FIELD QUALITY CONTROL**

- .1 Startup air conditioning unit in accordance with manufacturer's startup instructions. Test controls and demonstrate compliance with requirements.

**3.8 EQUIPMENT PREPARATION**

- .1 Provide services of manufacturer's field engineer to set and adjust equipment for operation as specified.

**3.9 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 Waste Management: separate waste materials In accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.10 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by computer room air conditioning installation.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM E84-Latest Edition, Standard Test Method for Surface Burning Characteristics of Building Materials.
  - .2 ASTM C916-1985 Latest Edition, Standard Specification for Adhesives for Duct Thermal Insulation.
  - .3 ASTM C1071-Latest Edition, Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 90A-Latest Edition, Standard for the Installation of Air Conditioning and Ventilating Systems.
  - .2 NFPA 90B-Latest Edition, Standard for the Installation of Warm Air Heating and Air Conditioning Systems (ANSI).
- .3 Underwriters' Laboratories (UL) Inc.
  - .1 UL 2021-Latest Edition, Fixed and Location-Dedicated Electric Room Heaters.

**1.2 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 unit heaters and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, cleaning procedures.
- .4 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
  - .2 Indicate on drawings:
    - .1 Equipment, capacity and piping connections.
    - .2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.

**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 unit heaters 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:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect unit heaters from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 UNIT HEATERS**

- .1 Cabinet Unit Heaters: to UL 2021.
- .2 Cabinet: type as indicated, steel with rounded exposed corners and edges, removable panels, and integral air outlet and inlet.
- .3 Finish with factory applied primer coat.
- .4 Special cabinets: as indicated.
- .5 Fans: centrifugal double width wheels, statically and dynamically balanced, direct driven, sleeve bearings, resilient mounted.
- .6 Motor: multi-speed, tapped wound permanent split capacitor type with sleeve bearings, built-in thermal overload protection and resilient rubber isolation mounting.
- .7 Capacity: as indicated.
- .8 Control:
  - .1 On-off 2 speed switch key operated with integral overloads in cabinet wall mounted.
  - .2 Control thermostat: integral room electric, line low voltage, electronic, Energy Star Certified, rating to suit cabinet unit heater, locking cover, set point locking device, concealed adjustment, plastic brushed aluminum stainless steel cover and guard, thermometer in cover.

#### **2.2 HORIZONTAL UNIT HEATERS – GAS FIRED**

- .1 Gas-fired, separated combustion horizontal unit heaters
  - .1 Provide (90%+) high-efficiency, separated-combustion, power vented, condensing, gas-fired unit heaters.



- .2 Unit heaters shall be ETL Listed for commercial or industrial installation and installed in accordance with CSA B149 Installation Codes.
- .3 Gas connection shall be external to the cabinet
- .2 Burner:
  - .1 The units shall incorporate a single, one piece burner assembly with a single orifice. The burner shall have a continuous wound close pressed stainless steel ribbon separating the flame from the burner interior. All units shall have a single venturi tube and orifice supplying fuel to a one-piece burner housing. Each heat exchanger cell shall use balanced draft induction to maintain optimum flame control
- .3 Controls:
  - .1 Controls shall include a single-stage gas valve; direct spark multi-try ignition with electronic flame supervision with timed lockout integrally controlled via a printed circuit control board. The control board shall also incorporate diagnostic lights, DIP switches for fan overrun settings, and a relay for fan only operation. All units shall be equipped with a safety limit switch.
  - .2 All controls shall be enclosed in the sealed control compartment to protect them from accidental damage, dust, and atmospheric corrosion.
- .4 Combustion Air and Venting:
  - .1 The unit shall have a factory-installed power venter device to draw combustion air from outside of the building. The outside air shall enter the unit through a factory-installed round inlet air terminal on the rear of the heater. The control compartment shall be sealed and the access door shall be gasketed to prevent dirt, lint, dust, or other contaminants present in the heated space from entering the unit. The control compartment door shall be equipped with a safety interlock switch to prevent operation when the door is open.
  - .2 The combustion air supply pipe and flue exhaust pipe all PVC vent pipe must be approved to ULC S636. All venting and drain parts shall be run in parallel from the heater to a factory supplied concentric adapter assembly, which allows for a single wall or roof penetration, to the vertical air inlet and vent terminal. A 4" PVC clean out cap drilled and tapped for attaching a vent condensate drain is included with the vent/combustion air kit.
  - .3 The combustion air/venting system shall include a vibration isolated power venter motor and wheel assembly and a combustion air pressure switch.
- .5 Primer, Cement, and Applicator Requirements
  - .1 Primer for joints shall conform to ASTM F 656.
  - .2 Cement for joints shall conform to ASTM D 2564.
- .6 Electrical:
  - .1 Operation shall be controlled by an integrated circuit board that includes LED diagnostic indicator lights. Supply voltage connections shall be made in a sealed junction box. 24-volt control connections shall be made on an externally mounted terminal strip with connections (W1, W2, R, and G). All internal

wiring, both line and control voltages, shall be terminated by insulated terminal connectors to minimize shock hazard during service. Each unit shall be equipped for use with 115/1 volt power supply. All units will be equipped with a built-in disconnect switch.

.7 Cabinet:

- .1 The cabinet shall be low profile with a pre-coat or powder coat RAL 1001 paint finish. Finish shall be a minimum 80 gloss on G30 galvanized steel. The cabinet shall be constructed so that screws are not visible from the bottom, front, or sides, except for service panel and accessories. Unit construction shall incorporate a beveled front corner on control side for additional cabinet rigidity. All units shall be manufactured with a tooled drawn supply air orifice on the rear panel to reduce fan inlet noise.
- .2 The unit shall be designed for ceiling suspension featuring 3/8"-16 female threads (hanger kits for 1" pipe) at 4-point locations with no additional adapter kits. The cabinet shall be equipped with painted, roll-formed horizontal louvers. Louvers shall be spring held and adjustable for directing airflow.
- .3 The cabinet shall be equipped with a full safety fan guard. The (open drip proof) (enclosed) motor and fan assembly shall be resiliently mounted to the cabinet to reduce vibration and noise. The unit shall be designed with a full opening service access panel complete with screw closure attachment and lifting handle for removal. Service panel shall be fully gasketed and equipped with a safety interlock switch.
- .4 All components in the gas train, all standard electrical controls, and the power venter shall be within the sealed service compartment.
- .5 Minimum top clearance from combustibles shall be 4". Minimum bottom clearance from combustibles shall be 1". Minimum clearance from combustibles on non-service side shall be 2". Casing: 1.6 mm thick cold rolled steel, gloss enamel finish, with threaded connections for hanger rods.

Fan: direct drive propeller type, factory balanced, with anti-corrosive finish and fan guard.

- .8 Motor: speed as indicated continuous duty, built-in overload protection, and resilient motor explosion proof supports.
- .9 Air outlet: adjustable louvres.
- .10 Capacity: as indicated
- .11 Control room thermostat: electric, low voltage, electronic, Energy Star Certified, locking cover, set point locking device, concealed adjustment, cover and guard.

**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 unit heaters installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative DCC Representative Consultant.
- .2 Inform Departmental Representative DCC Representative Consultant of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative DCC Representative Consultant.

### **3.2 INSTALLATION**

- .1 Install in accordance with manufacturer's instructions.
- .2 Include double swing pipe joints as indicated.
- .3 Check final location with Departmental Representative if different from that indicated prior to installation.
  - .1 Should deviations beyond allowable clearances arise, request and follow Departmental Representative's directive.
- .4 Provide supplementary suspension steel as required.
- .5 Install thermostats in locations indicated.
- .6 Before acceptance, set discharge patterns to suit requirements.

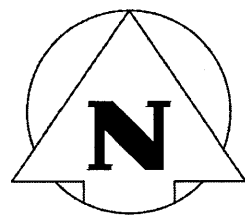
### **3.3 CLEANING**

- .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.
- .3 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.4 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by unit heaters installation.

**END OF SECTION**



MATCH EXISTING PAVEMENTS  
ADJUST LIMITS AS REQUIRED TO  
PREVENT PONDING & MEET  
EXISTING CONCRETE JOINTS

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MATCH EXISTING PAVEMENTS  
ADJUST LIMITS AS REQUIRED TO  
PREVENT PONDING & MEET  
EXISTING CONCRETE JOINTS

## TERTIARY BUILDING: GEOMETRIC LAYOUT

SCALE: 1:125

### PROPERTY LIMITS DELINEATION

DELINEATION OF PROPERTY  
LIMITS AS SHOWN ON THIS DWG  
DOES NOT REPRESENT A "LEGAL  
SURVEY". KGS GROUP MAKES  
NO REPRESENTATION OR  
WARRANTY AS TO THE ACCURACY  
OF PROPERTY LIMITS DELINEATED  
ON THIS DWG, NOR ON THE  
DIMENSIONAL ACCURACY OF DWG  
FEATURES RELATIVE TO THOSE  
PROPERTY LIMITS.

### UNDERGROUND STRUCTURES

LOCATION OF UNDERGROUND STRUCTURES AS  
SHOWN ARE BASED ON THE BEST INFORMATION  
AVAILABLE BUT NO GUARANTEE IS GIVEN THAT ALL  
EXISTING UTILITIES ARE SHOWN OR THAT THE  
GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF  
EXISTENCE AND EXACT LOCATION OF ALL SERVICES  
MUST BE OBTAINED FROM THE INDIVIDUAL UTILITIES  
BEFORE PROCEEDING WITH CONSTRUCTION.

### NOTES:

- FIELD VERIFY ALL UTILITY LOCATIONS AND  
BOUNDARIES PRIOR TO COMMENCING WORK.
- INCLUDE ALL TESTING, TELEVISION,  
COMMISSIONING AND/OR PERMITS  
ASSOCIATED WITH THE WORKS.
- ADJUST LIMITS AS REQUIRED TO ACHIEVE  
2.0% SLOPE AWAY FROM BUILDING FOR THE  
FIRST TWO METERS & 0.5% MIN SLOPE  
BEYOND THE TWO METERS.
- ALL CURB DIMENSIONS ARE TO BACK OF  
CURB.
- LANE MARKINGS TO BE INSTALLED PARALLEL  
TO THE NORTH & SOUTH EXTENTS OF THE  
BUILDING.

Public Works and  
Government Services  
Canada

REAL PROPERTY SERVICES  
Western Region  
SERVICES IMMOBILIERS  
Région de l'ouest

VERNE REIMER  
ARCHITECTURE  
INCORPORATED

KGS  
GROUP  
CONSULTING  
ENGINEERS

EXISTING	LEGEND-PLAN	PROPOSED
250 WWS	WASTEWATER SEWER	250 WWS
150 WM	WATERMAIN	150 WM
	HYDRO	
	TELEPHONE	
+	HYDRANT	+
+	VALVE	+
+	MAINTENANCE HOLE	+
+	CATCH BASIN	+
+	POLES	+
+	GUY WIRE	+
+	EDGE OF ROAD	+
+	CULVERT	+
+	DITCH	+
+	PROPERTY LINE	+
+	TREE	+
+	SURVEY BAR	+
231.33	ELEVATION	(242.23)
	CONCRETE	
	ASPHALT	
	TOPSOIL & SEED	
	RIPRAP	

### DO NOT SCALE DRAWINGS

Revision/ Édition	Description/Description	Date/Date
3	REISSUED FOR CONSTRUCTION	16/12/12
2	ISSUED FOR CONSTRUCTION	16/11/02

PUBLIC WORKS  
GOVERNMENT SERVICES  
CANADA

Project title/Titre du projet  
EMERSON, MANITOBA  
HIGHWAY 75, UNITED STATES BORDER  
EXPANSION AND  
REDEVELOPMENT OF THE  
EMERSON PORT OF ENTRY

Approved by/Approuvé par

CR

Designed by/Concepté par

EMS/GES

Drawn by/Dessiné par

GEL/GES

PWGS Project Manager/Administrateur de Projets TPSC

JAMES HUTCHINGS

PWGS, Architectural and Engineering Resources Manager/  
Ressources Architectural et de Directeur d'ingénierie, TPSC

Client/Client

Drawing title/Titre du dessin

TERTIARY GARAGE EXPANSION

GEOMETRIC LAYOUT

Project No./No. du projet

R.068431.001

Sheet/Fauille

C22

OF C23

Revision no./  
Révision no.

3

### METRIC

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DECIMALIZED NUMBERS INDICATE METRES

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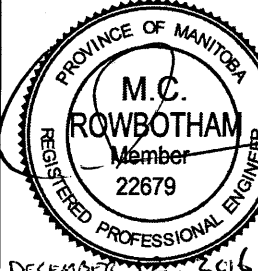
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Certificate of Authorization

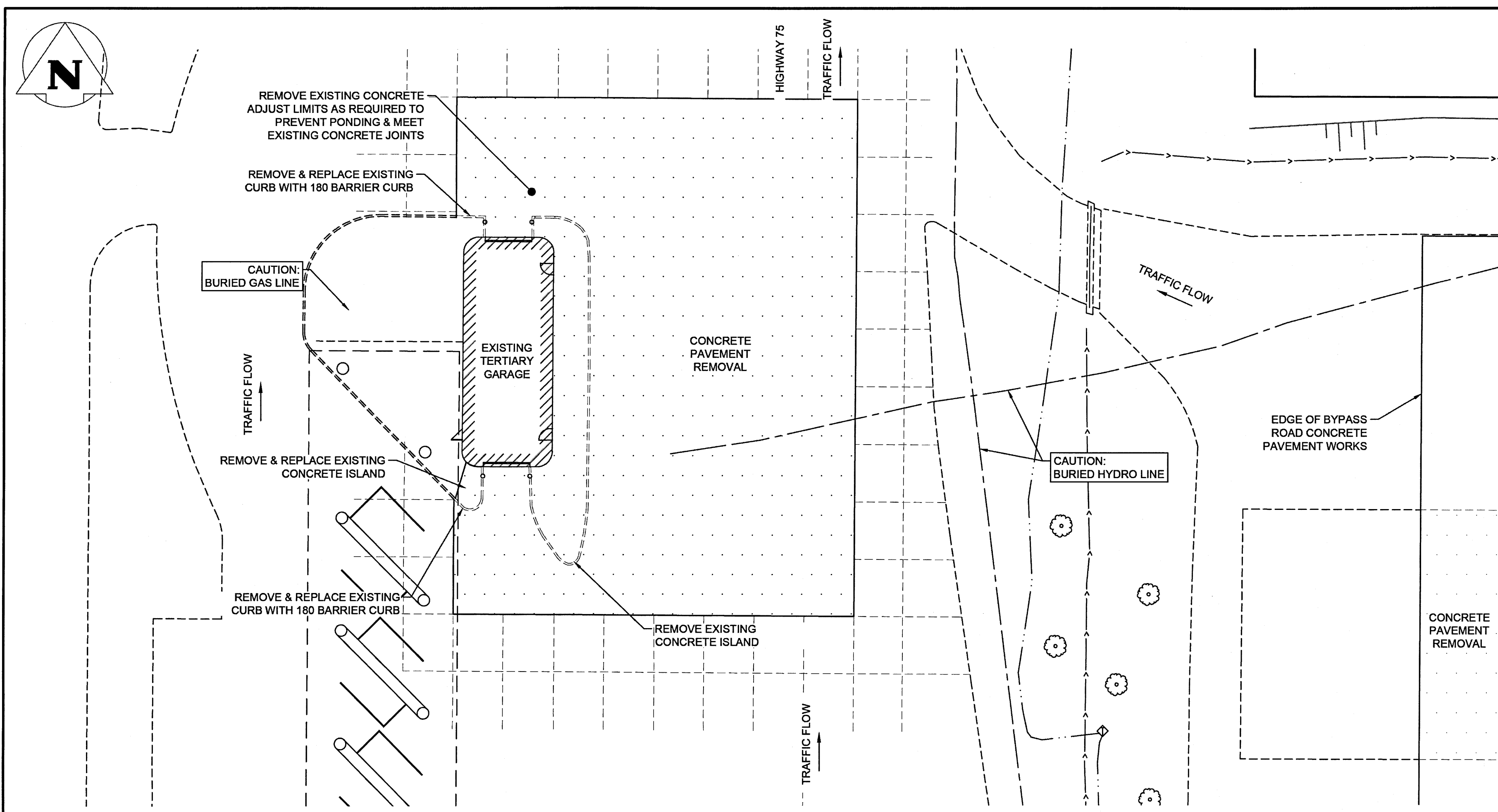
KGS Group

No. 245

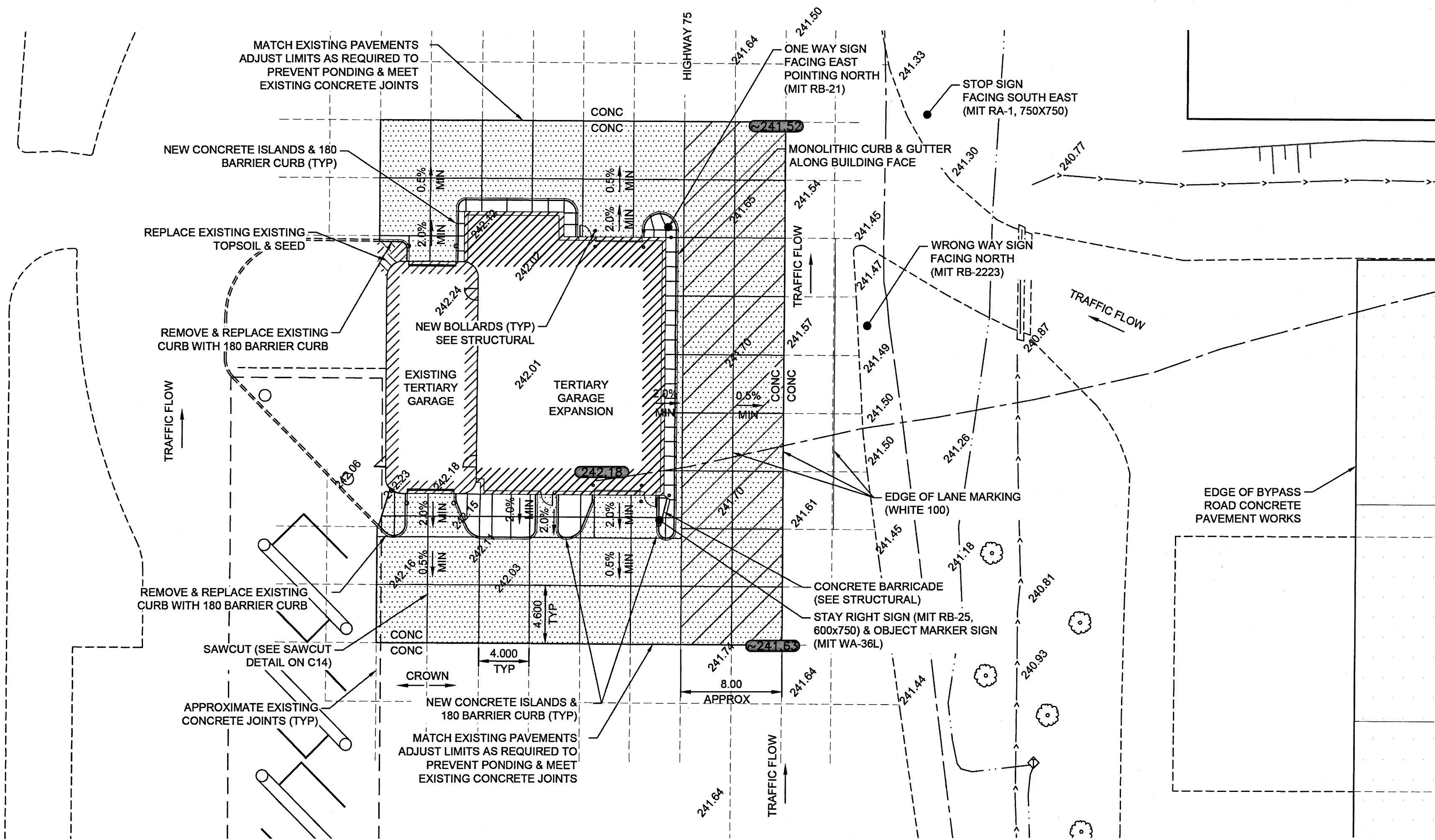




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**TERTIARY BUILDING: REMOVALS**  
SCALE: 1:250



**TERTIARY BUILDING: SURFACE WORKS**  
SCALE: 1:250

**NOTES:**

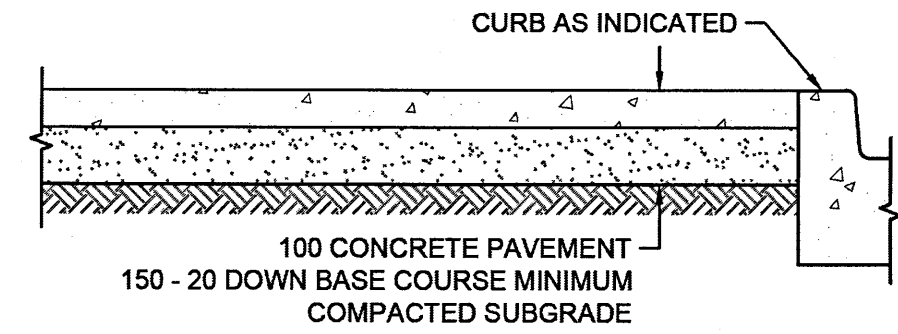
1. FIELD VERIFY ALL UTILITY LOCATIONS AND BOUNDARIES PRIOR TO COMMENCING WORK.
2. INCLUDE ALL TESTING, TELEVISIONING, COMMISSIONING AND/OR PERMITS ASSOCIATED WITH THE WORKS.
3. ADJUST LIMITS AS REQUIRED TO ACHIEVE 2.0% SLOPE AWAY FROM BUILDING FOR THE FIRST TWO METERS & 0.5% MIN SLOPE BEYOND THE TWO METERS.
4. ALL CURB DIMENSIONS ARE TO BACK OF CURB.
5. LANE MARKINGS TO BE INSTALLED PARALLEL TO THE NORTH & SOUTH EXTENTS OF THE BUILDING.

**PROPERTY LIMITS DELINEATION**

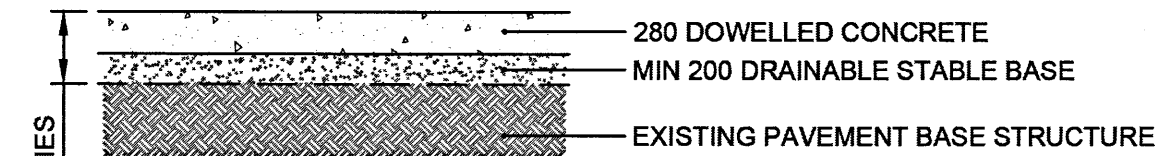
DELINEATION OF PROPERTY LIMITS AS SHOWN ON THIS DWG DOES NOT REPRESENT A "LEGAL SURVEY". KGS GROUP MAKES NO REPRESENTATION OR WARRANTY AS TO THE ACCURACY OF PROPERTY LIMITS DELINEATED ON THIS DWG, NOR ON THE DIMENSIONAL ACCURACY OF DWG FEATURES RELATIVE TO THOSE PROPERTY LIMITS.

**UNDERGROUND STRUCTURES**

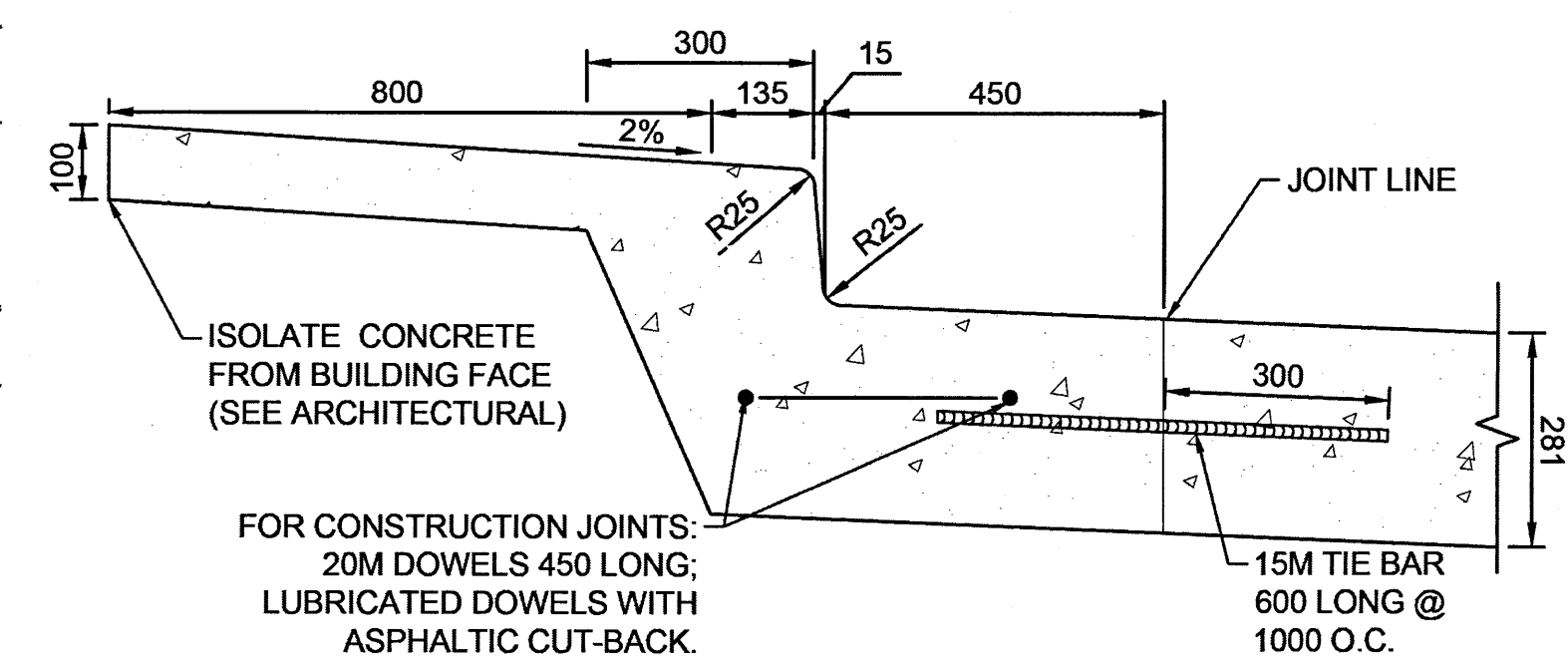
LOCATION OF UNDERGROUND STRUCTURES AS SHOWN ARE BASED ON THE BEST INFORMATION AVAILABLE BUT NO GUARANTEE IS GIVEN THAT ALL EXISTING UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL SERVICES MUST BE OBTAINED FROM THE INDIVIDUAL UTILITIES BEFORE PROCEEDING WITH CONSTRUCTION.



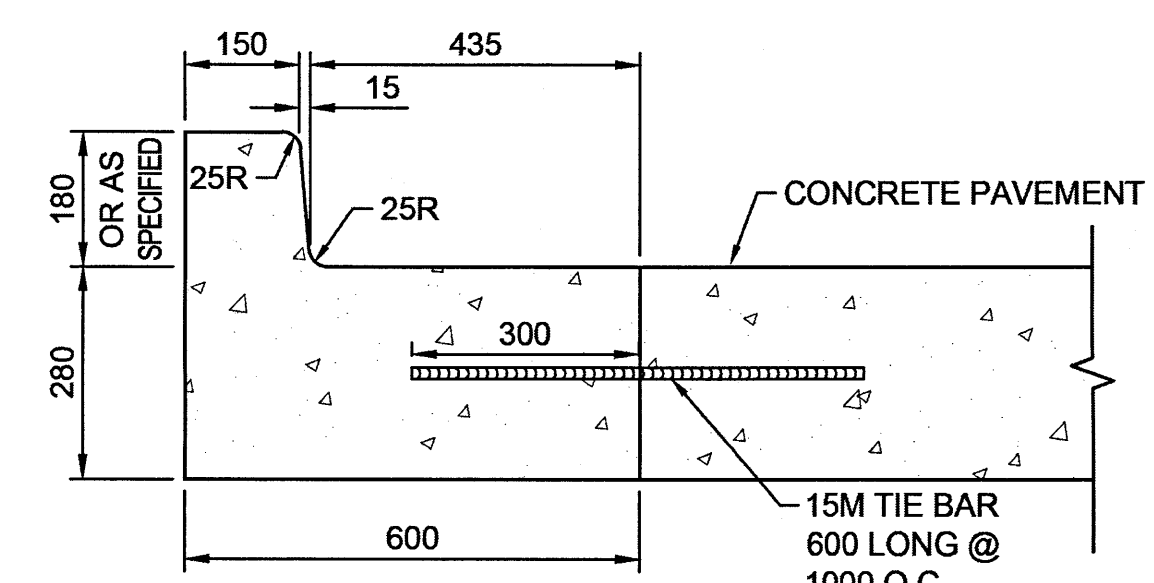
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SCALE: 1:20



**CONCRETE PAVEMENT: PARTIAL STRUCTURE**  
SCALE: 1:50



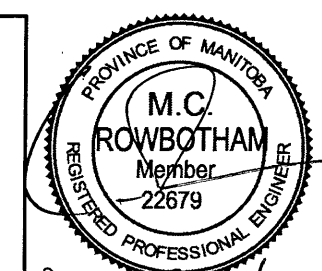
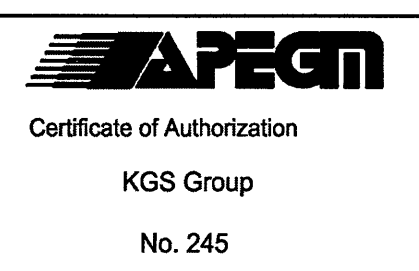
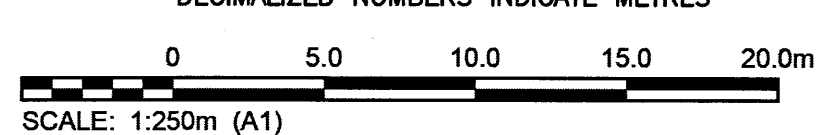
**MONOLITHIC CURB & GUTTER FOR CONCRETE PAVEMENTS**  
SCALE: 1:10



**CURB & GUTTER FOR CONCRETE PAVEMENTS**  
SCALE: 1:10

**METRIC**

WHOLE NUMBERS INDICATE MILLIMETRES  
DECIMALIZED NUMBERS INDICATE METRES



EXISTING	LEGEND-PLAN	PROPOSED
250 WWS	WASTEWATER SEWER	250 WWS
150 WM	WATERMAIN	150 WM
	HYDRO	
	TELEPHONE	
+	HYDRANT	+
o	VALVE	o
o	MAINTENANCE HOLE	o
□	CATCH BASIN	■
•	POLES	
—	GUY WIRE	
—	EDGE OF ROAD	
—	CULVERT	
—	DITCH	
—	PROPERTY LINE	
+	TREE	
+	SURVEY BAR	+
231.33	ELEVATION	(242.231)
	CONCRETE	
	24-HR CONCRETE	
	ASPHALT	
	TOPSOIL & SEED	
	RIPRAP	

**DO NOT SCALE DRAWINGS**

3	REISSUED FOR CONSTRUCTION	16/12/12
2	ISSUED FOR CONSTRUCTION	16/11/02
Revision/Revisão	Description/Description	Date/Date

**PUBLIC WORKS  
GOVERNMENT SERVICES  
CANADA**

Project title/Titre du projet  
EMERSON, MANITOBA  
HIGHWAY 75, UNITED STATES BORDER

**EXPANSION AND  
REDEVELOPMENT OF THE  
EMERSON PORT OF ENTRY**

Approved by/Approuvé par  
CR

Designed by/Concept par  
GES

Drawn by/Dessiné par  
GEL/GES

PWGSC Project Manager/Administrateur de Projets TPSC  
JAMES HUTCHINGS

PWGSC, Architectural and Engineering Resources Manager/  
Ressources Architectural et de Directeur d'ingénierie, TPSC

Client/client

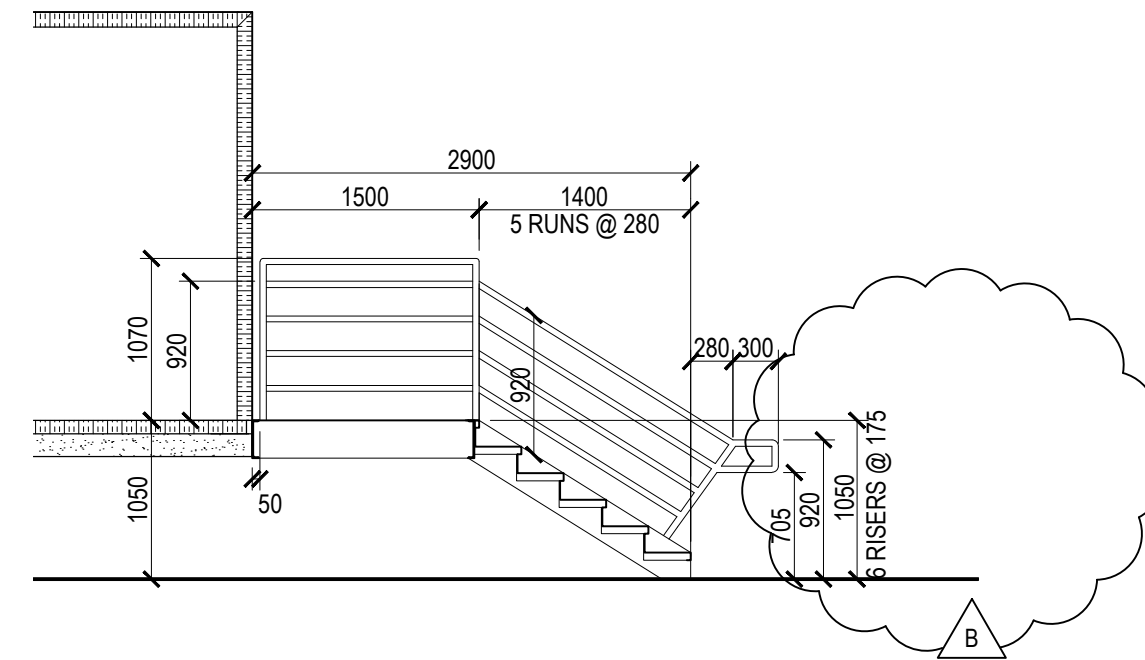
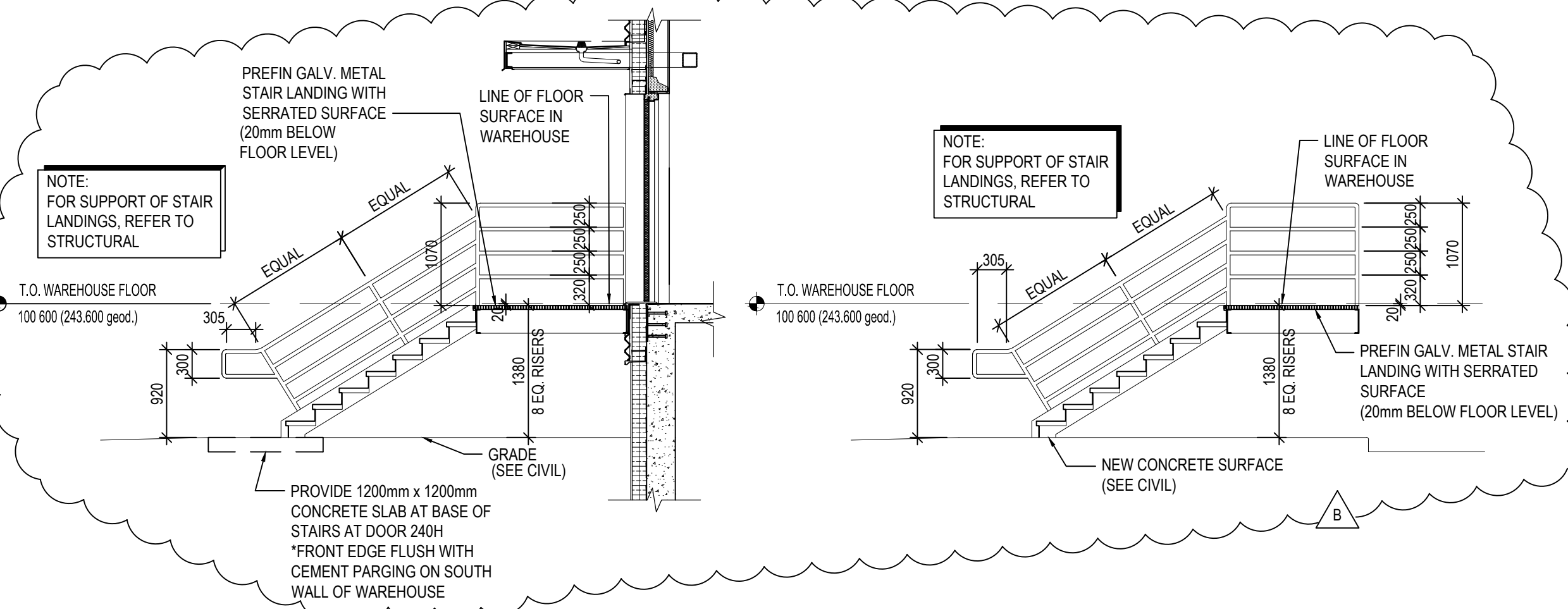
Drawing title/Titre du dessin  
**TERTIARY GARAGE EXPANSION  
REMOVALS & SURFACE WORKS PLAN**

Project No./No. du projet  
R.068431.001

Sheet/Fauille  
**C23**  
OF C23

Revision no./  
La Révision no.  
**3**



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150

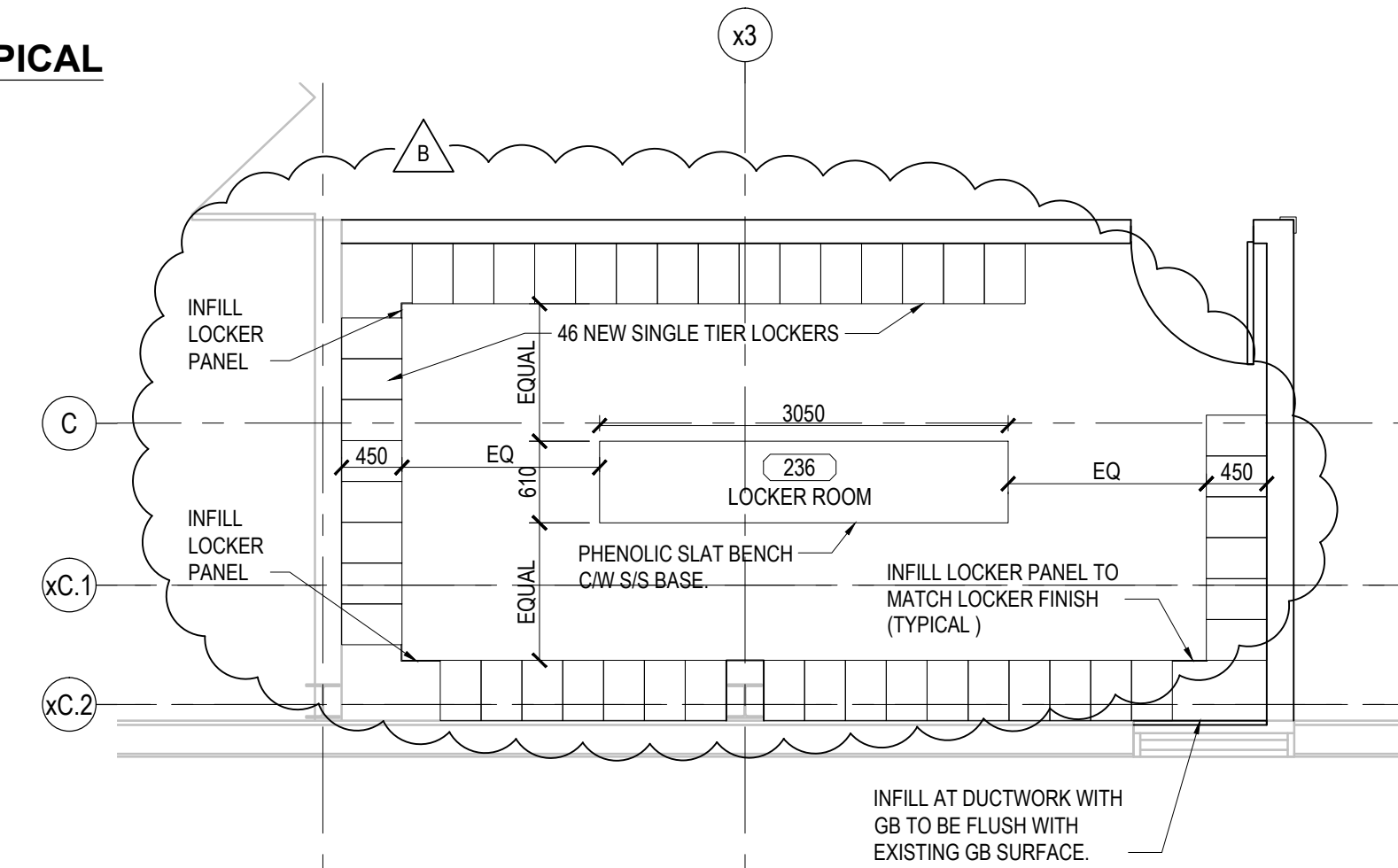
A1.2 A4.0

A2

B

T.O. WAREHOUSE FLOOR  
100.600 (243.600 geod.)

STAIR CONNECTION TO STRUCTURE BY  
STEEL STAIR  
SUPPLIER



Architectural floor plan of a building section. The plan shows a large central area with a cloud-like boundary. Key features include:

- Top Center:** A north arrow pointing up, labeled "9 A4.0".
- Top Left:** A circular callout "X0" and a rectangular callout "1".
- Top Right:** A circular callout "2".
- Top Edge:** Dimensions "1500" and "1500" are shown.
- Top Edge Labels:** "2 TR. AT 280" and "3 EQ. RI." are indicated.
- Left Edge:** A circular callout "P6" and a rectangular callout "038 MOUNTED WINDOW." are shown.
- Left Edge Labels:** "150" and "280" are indicated.
- Center:** A large rectangular area labeled "OPEN SERRATED STEEL GRATING DECK & TREADS." with a dimension of "2300".
- Center Labels:** "DOWN" and "840" are indicated.
- Center Right:** A circular callout "W1" and a rectangular callout "B" are shown.
- Center Right Labels:** "4 RI. AT 152.5" and "600" are indicated.
- Bottom Left:** A circular callout "P3" and a rectangular callout "240J" are shown.
- Bottom Left Labels:** "238B" and "240A" are indicated.
- Bottom Center:** A rectangular callout "NEW EXTERIOR GLAZING IN EXISTING. REFER TO W3, DRAWING 7/A6.0." is shown.
- Bottom Center Labels:** "RWL FROM ROOF DRAIN OVER C/W PRE-CAST CONCRETE SPLASH PAD BELOW METAL GRATE LANDING" and "SLIDING WINDOW AS PER SCHEDULE REFER TO W1, DRAWING 6/A6.0." are indicated.
- Bottom Right:** A rectangular callout "A2" and a circular callout "B" are shown.
- Bottom Right Labels:** "1500" and "1500" are indicated.

Architectural floor plan of a building section showing a staircase and various rooms. The plan includes dimensions, room labels, and structural notes. Key features include a staircase with 8 treads at 280mm, a STL STAIR LANDING, a CONC. PAD (SEE STRUCT.), and rooms labeled 243 and 243A. A north arrow is present, pointing towards the top right. The plan is bounded by a cloud line, with dimensions 900 and 90 indicating a minimum clearance. A dashed line labeled "N.A." is at the top. A dashed line labeled "D" is on the left. A dashed line labeled "C" is on the right. A dashed line labeled "1" is at the top left. A dashed line labeled "2" is at the top right. A dashed line labeled "B" is at the top center. A dashed line labeled "A" is at the top right. A dashed line labeled "A4.0" is at the top right. A dashed line labeled "243" is at the top right. A dashed line labeled "ELECT. ROOM" is at the top right. A dashed line labeled "915X915X2108" is at the top right. A dashed line labeled "SERVER RACK" is at the top right. A dashed line labeled "243A" is at the top right. A dashed line labeled "430" is at the top right. A dashed line labeled "200H" is at the top right. A dashed line labeled "2060" is at the top right. A dashed line labeled "3335" is at the top right. A dashed line labeled "815" is at the top right. A dashed line labeled "1850" is at the top right. A dashed line labeled "1960" is at the top right. A dashed line labeled "8 TREADS AT 280" is at the top right. A dashed line labeled "CONC. PAD (SEE STRUCT.)" is at the top right. A dashed line labeled "900" is at the top right. A dashed line labeled "MINIMUM CLR 90" is at the top right.

Architectural drawing of a warehouse interior, showing a staircase and a pit. The drawing includes dimensions for the staircase (7 treads at 280, 8 risers at 171, 1960 total height) and the pit (T/O PIT, FLR, 98'7 1/2" +/-, FD). A section line A1.2-A4.0 is shown at the top. A north arrow is present. The drawing is labeled "240 WAREHOUSE" and "240G".

C		
B	ADDENDUM NO. 02 - GENERAL REVISIONS	2016/12/09
A	ISSUED FOR CONSTRUCTION	2016/11/02
Revision/Revision	Description/Description	Date/Date

project title/Titre du projet  
EMERSON, MANITOBA  
HIGHWAY 75, UNITED STATES BORDER

Approved by/Approuve par

Designed by/Concept par  
MJC

Drawn by/Dessiné par  
DWH

TPSGC Project Manager/Administrateur de Projets TPSGC  
JAMES HUTCHINGS

TPWGSC, Architectural and Engineering Resources Manager/  
Ressources Architectural et de Directeur d'Ingénierie, TPSGC

Client/client

Drawing title/Titre du dessin

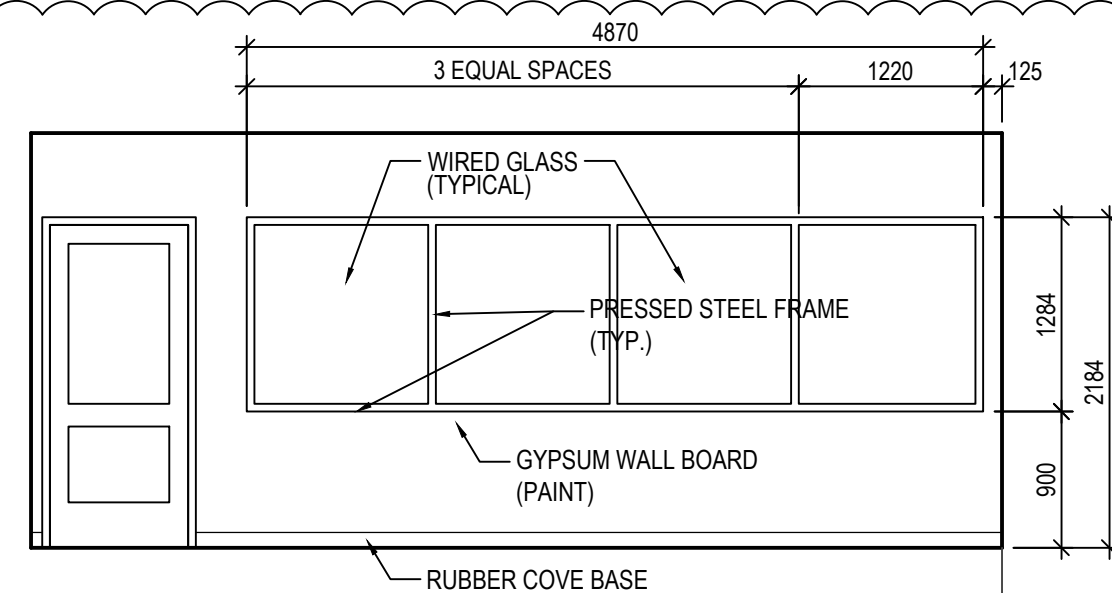
## ENLARGED PLANS & STAIR DETAILS

Project No./No. du	Sheet/Feuille	Revision no./ la Révision
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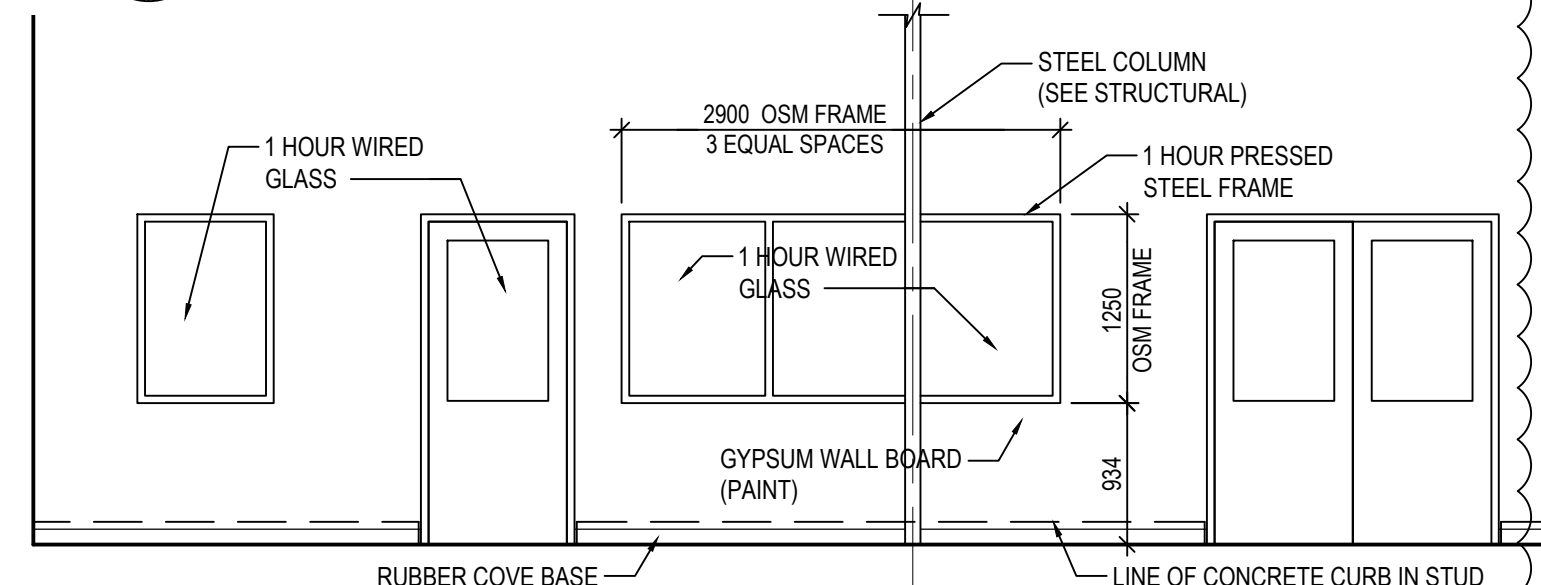
Projet		Ld Revision no.
E 060424 001	A 1 0	B

R.068431.001	A4.0	B
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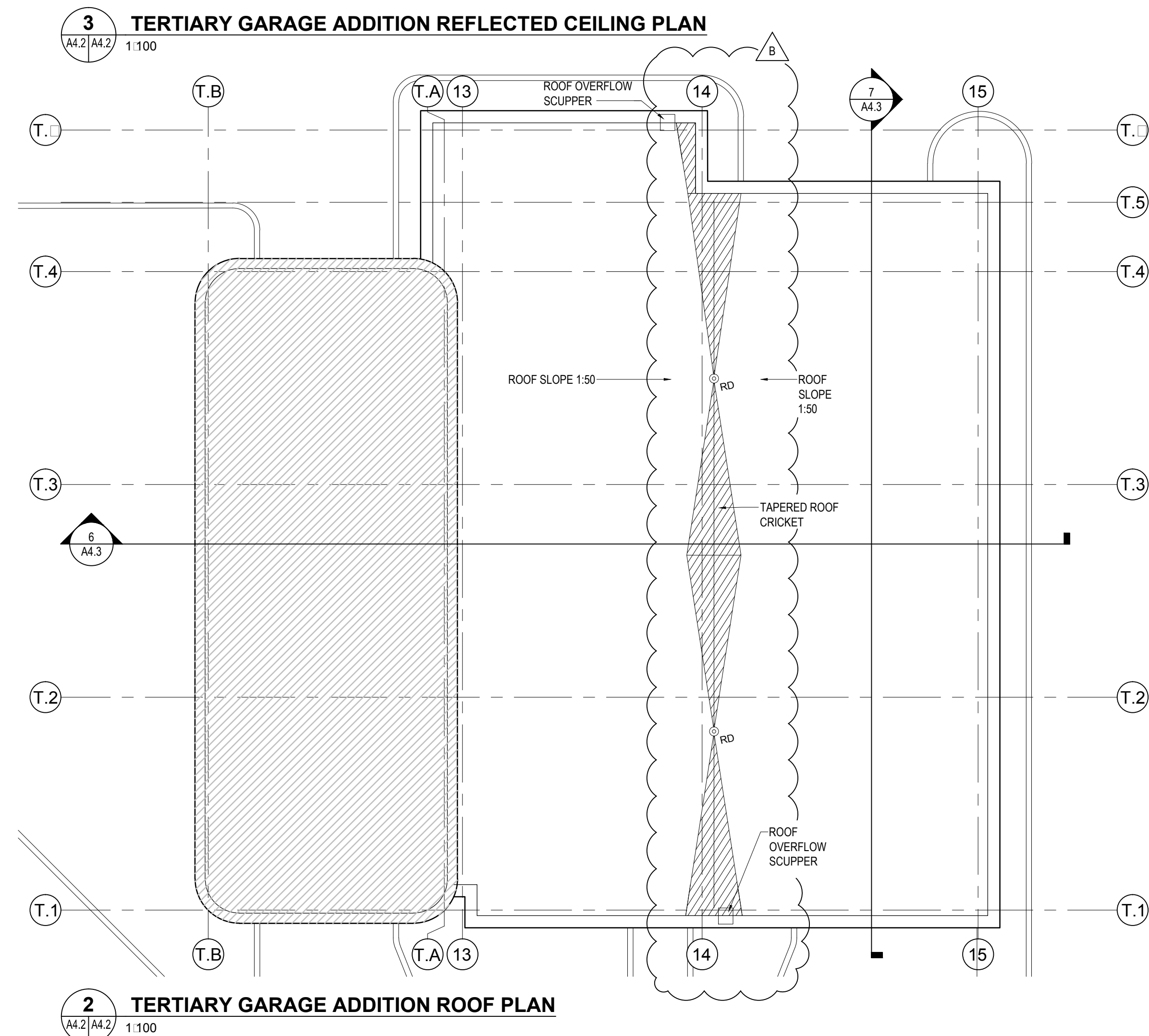




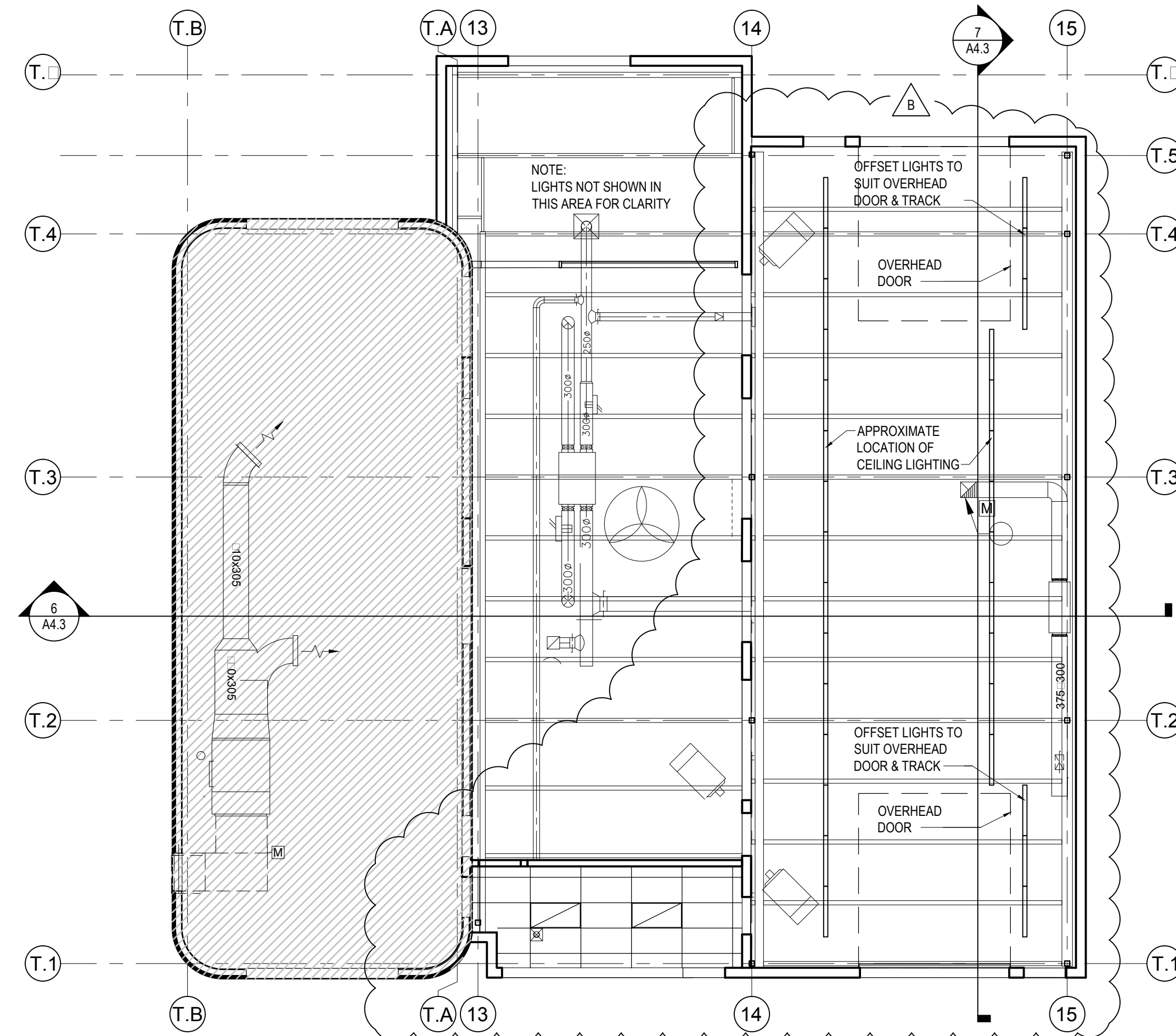
**5 OFFICE AREA ELEVATION**  
 A4.2 A4.2 1 50



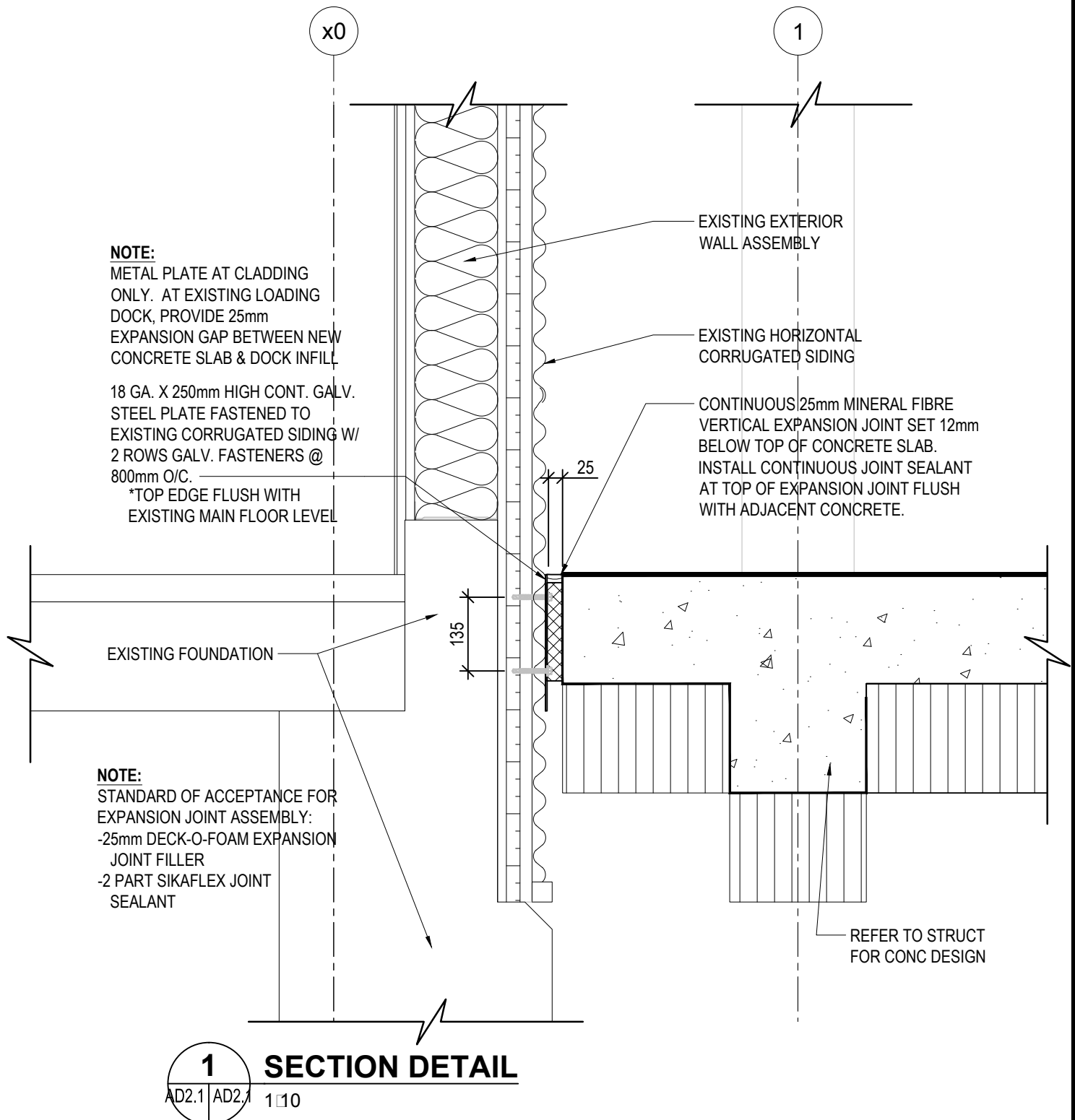
**7 GARAGE ADDITION ELEVATION**



**2 TERTIARY GARAGE ADDITION ROOF PLAN**



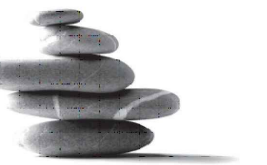
**3 TERTIARY GARAGE ADDITION REFLECTED CEILING PLAN**



Project title	Expansion and Redevelopment of the Emerson Point of Entry Emerson, Manitoba		
Drawing title	Tertiary Building Floor Expansion Joint Detail Between Existing & New Construction		

Drawn by	AWN	PWGSC Project Manager James Hutchings		
Designed by	RB	Project no. 15-013100		
Approved by	RB	Date 2016-12-09	Sheet AD2.1	Revision 0





Crosier Kilgour  
& Partners Ltd.  
CONSULTING STRUCTURAL ENGINEERS

ORIGINAL DRAWING  
SEALED BY  
K.J. PRATT  
AND DATED  
2016-11-02

DO NOT SCALE DRAWINGS

Revision/	Description/Description	Date/Date
B	ADDENDUM NO. 2 - GENERAL REVISIONS	2016/12/06
A	ISSUED FOR CONSTRUCTION	2016/11/02

Revision/	Description/Description	Date/Date
B	ADDENDUM NO. 2 - GENERAL REVISIONS	2016/12/06
A	ISSUED FOR CONSTRUCTION	2016/11/02

Client/client

**PUBLIC WORKS  
AND GOVERNMENT  
SERVICES AGENCY**

Project title/Titre du projet  
EMERSON, MANITOBA  
HIGHWAY 75, UNITED STATES BORDER  
**EXPANSION AND  
REDEVELOPMENT OF THE  
EMERSON PORT OF ENTRY**

Approved by/Approuvé par  
KJP

Designed by/Concept par  
JAL/KJP

Drawn by/Dessiné par  
MPP

PWGSC Project Manager/Administrateur de Projets TPSGC  
James Hutchings

PWGSC, Architectural and Engineering Resources Manager/  
Ressources Architectural et de Directeur d'Ingénierie, TPSGC

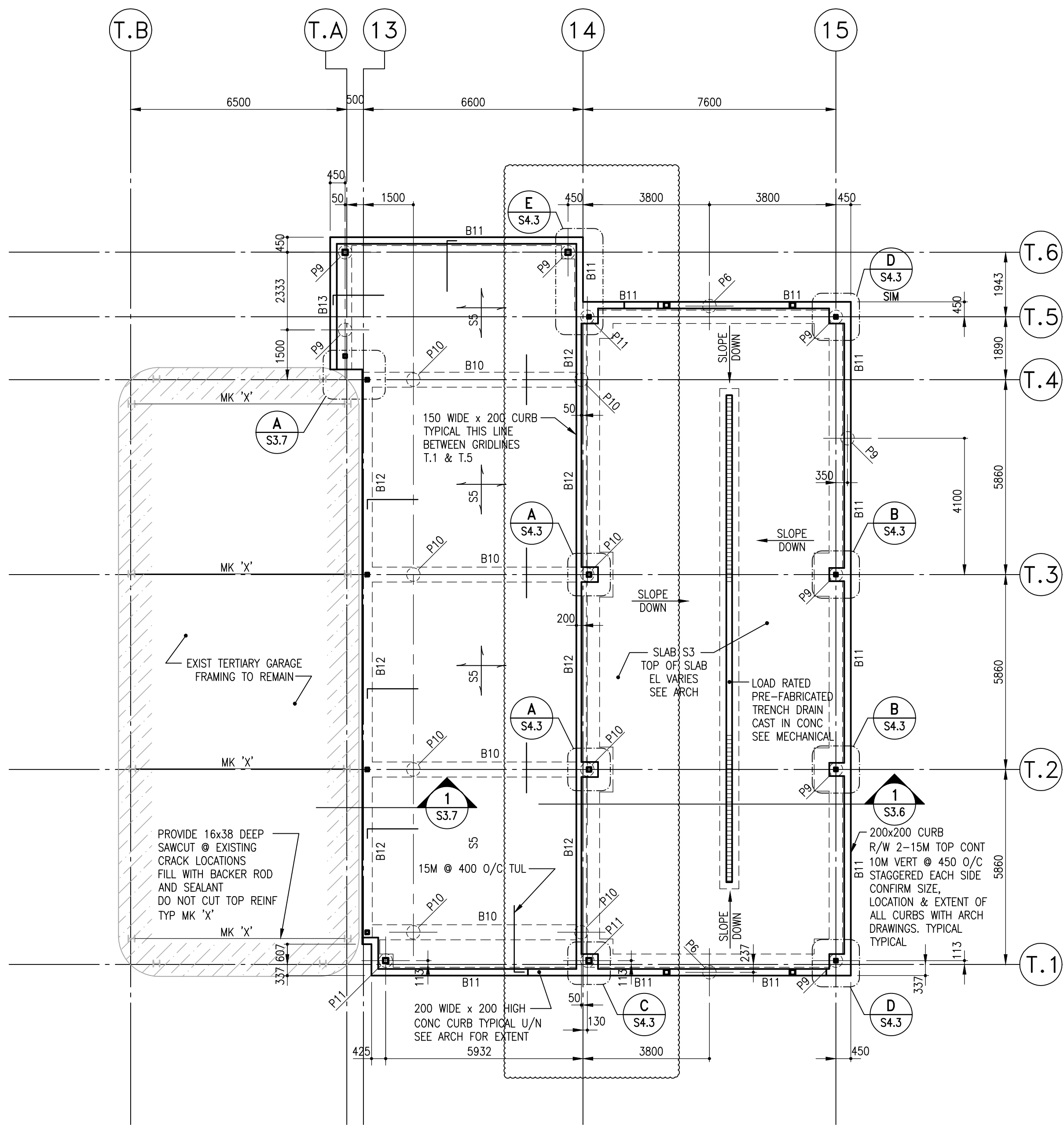
Client/client

Drawing title/Titre du dessin  
**TERTIARY GARAGE  
MAIN FLOOR & ROOF  
FRAMING PLANS  
STORAGE BUILDING SLAB  
SECTION**

Project No./No. du  
projet  
**R.068431.001**

Sheet/Feuille  
**S1.5**  
OF 17

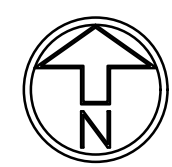
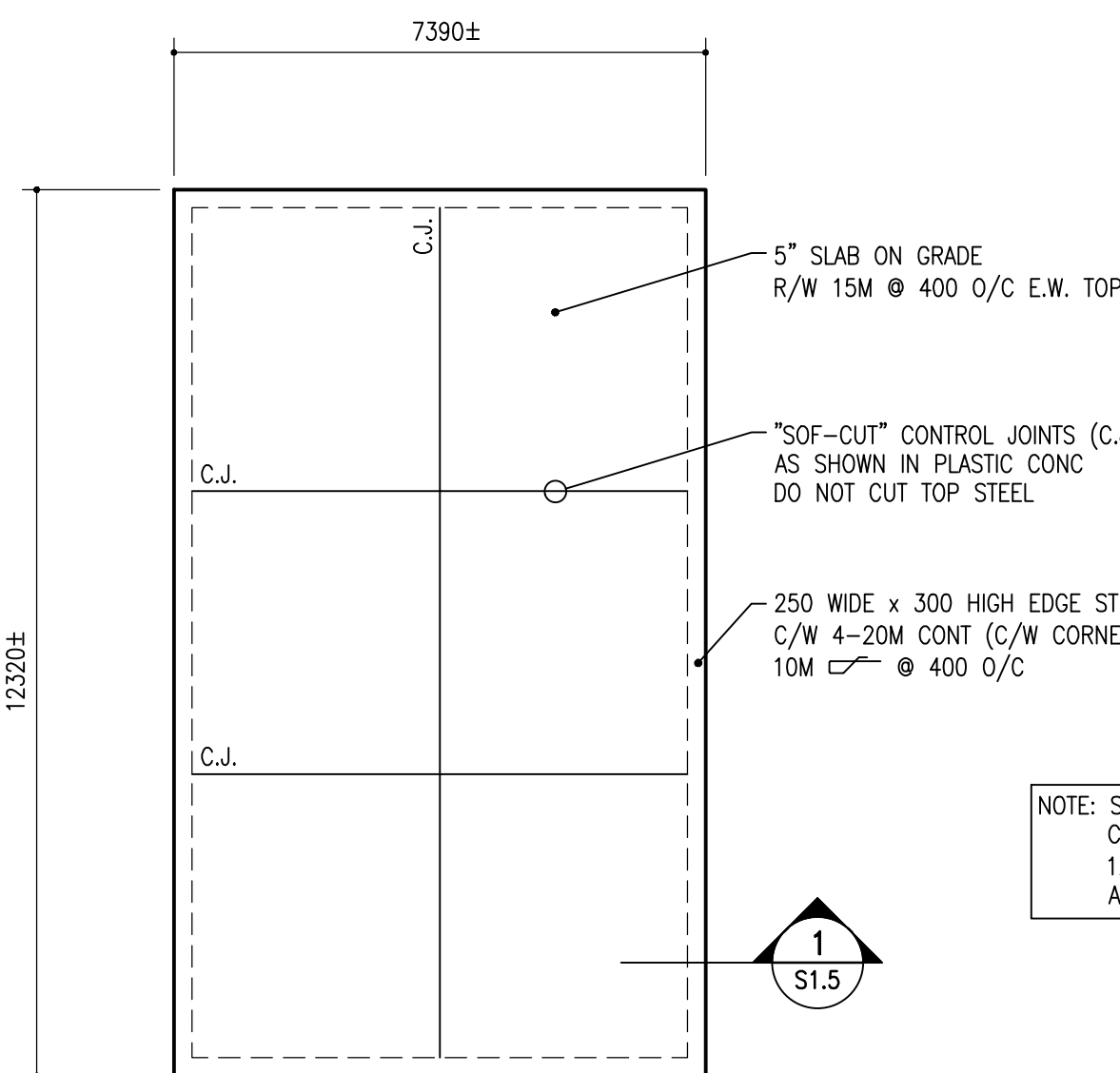
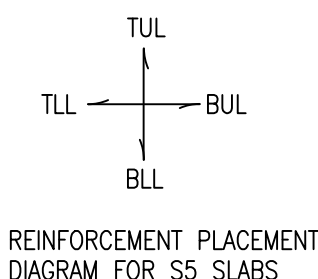
Revision no./  
La Révision  
no.  
**B**



TERTIARY GARAGE FOUNDATION PLAN

1 : 100

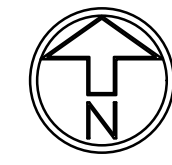
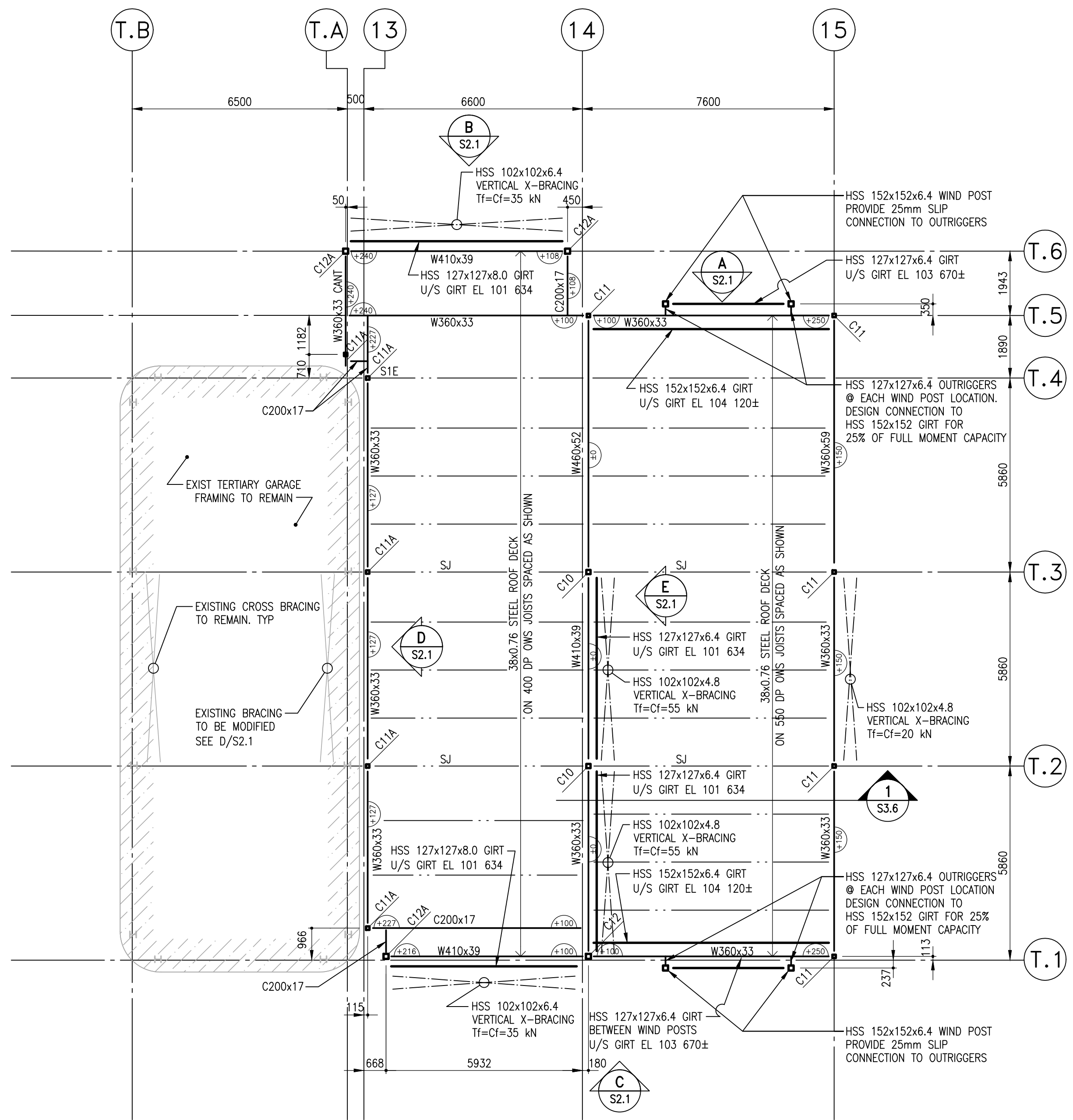
- DESIGN LIVE LOAD = 4.8 kPa.
- TOP OF SLAB ELEVATION = 99 450 U/N
- TOP OF PILE ELEVATIONS TO BE AT EL 98 850 TYPICAL
- ENTIRE TERTIARY GARAGE
- CRANK ALL SECONDARY BEAM BOTTOM STEEL TO REST ON PRIMARY BEAM BOTTOM STEEL TYPICAL
- SEE DRAWING S1.0 FOR GENERAL NOTES.
- SEE DRAWING S1.2 FOR PILE SCHEDULE.
- SEE DRAWING S1.3 FOR SLAB SCHEDULE.



STORAGE BUILDING SLAB

1 : 100

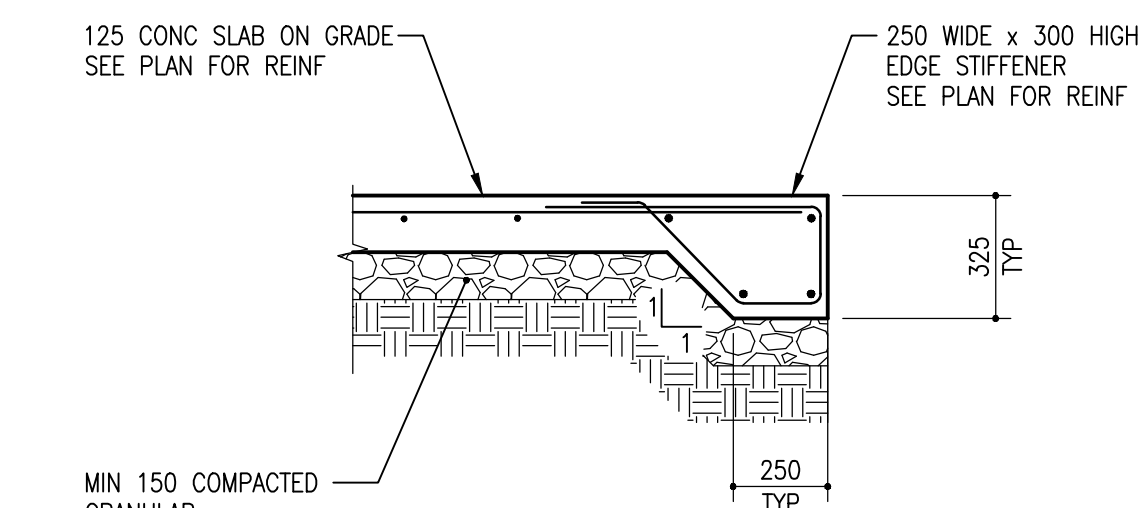
- PREPARE SUB-GRADE AND GRANULAR BASE AS PER GEOTECHNICAL REPORT
- COORDINATE WITH EXISTING SUPER STRUCTURE



TERTIARY GARAGE ROOF FRAMING PLAN

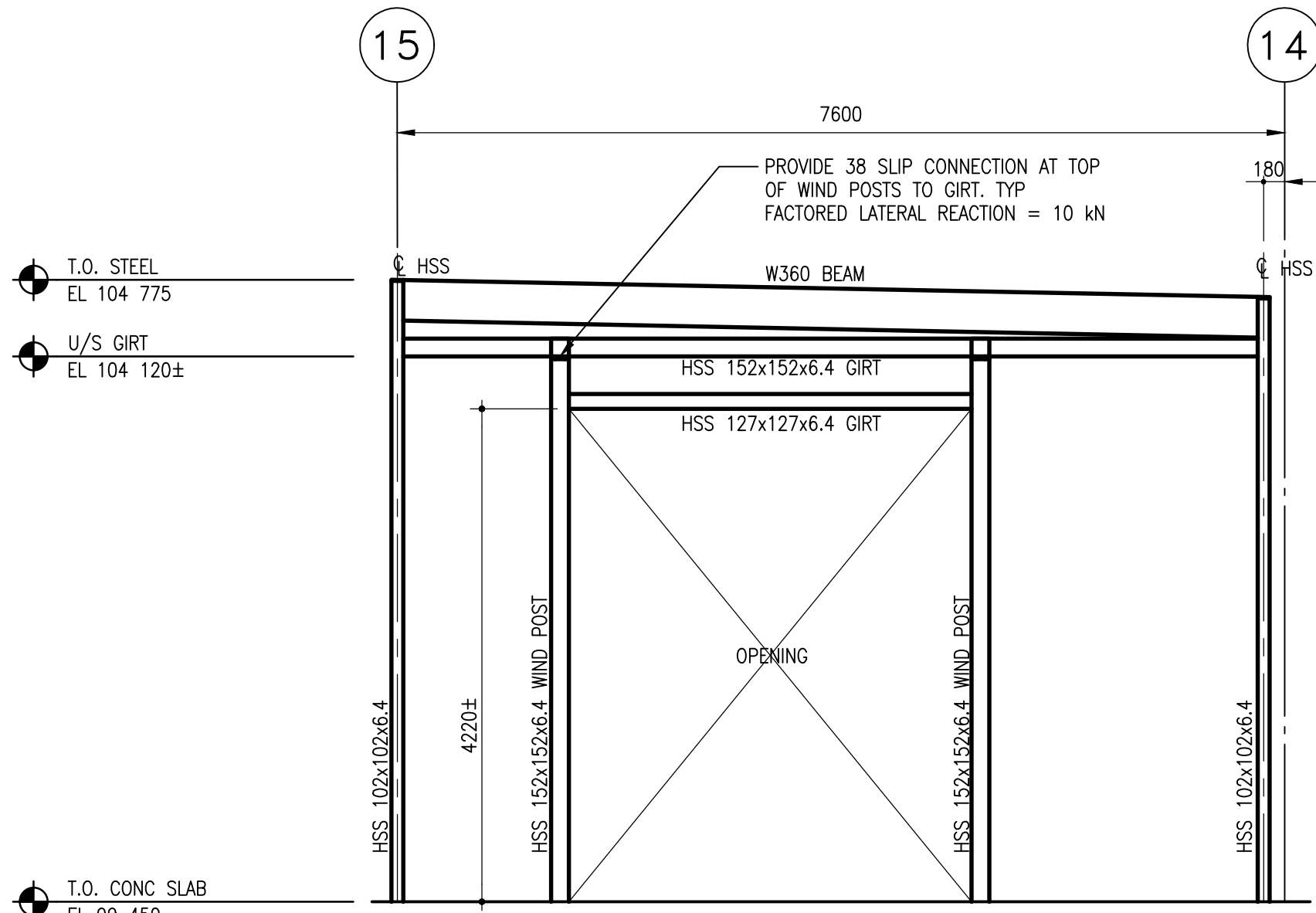
1 : 100

- DESIGN LIVE LOAD = 2.0 kPa SNOW & RAIN
- DESIGN DEAD LOAD = 0.72 kPa
- TOP OF STEEL = ELEVATION 104 525
- U/N THUS (±) ON PLAN.
- SEE DRAWING S1.0 FOR GENERAL NOTES.
- SEE DRAWING S1.4 FOR COLUMN SCHEDULE.
- ALL JOIST SEAT DEPTHS TO BE 100 DEEP.
- SJ DENOTES STRUT JOIST TO BE DESIGNED FOR A MIN TENSION OR COMPRESSION OF 20kN
- S1E DENOTES STRUT TIE ONE END

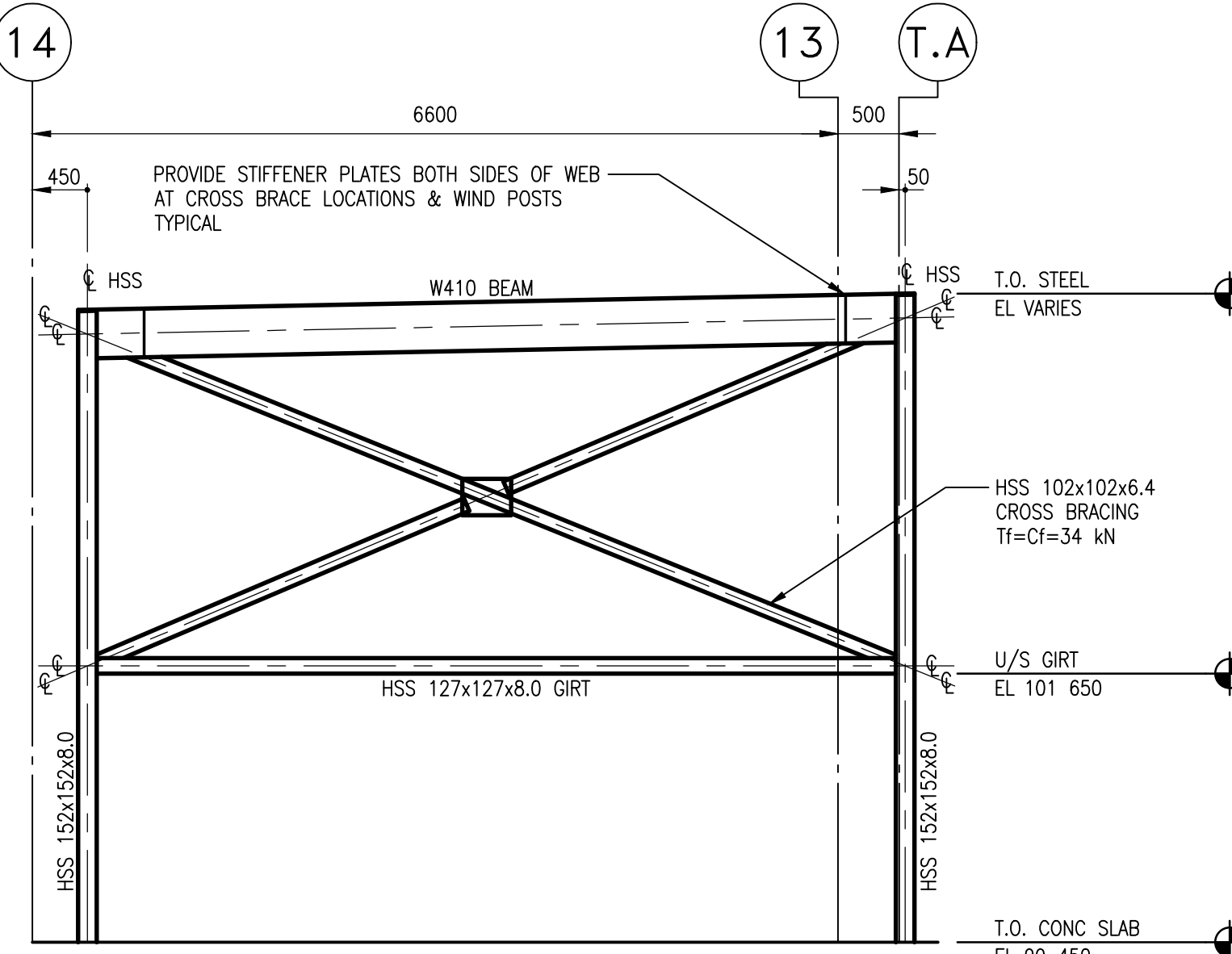


1 SECTION  
S1.5 1 : 20

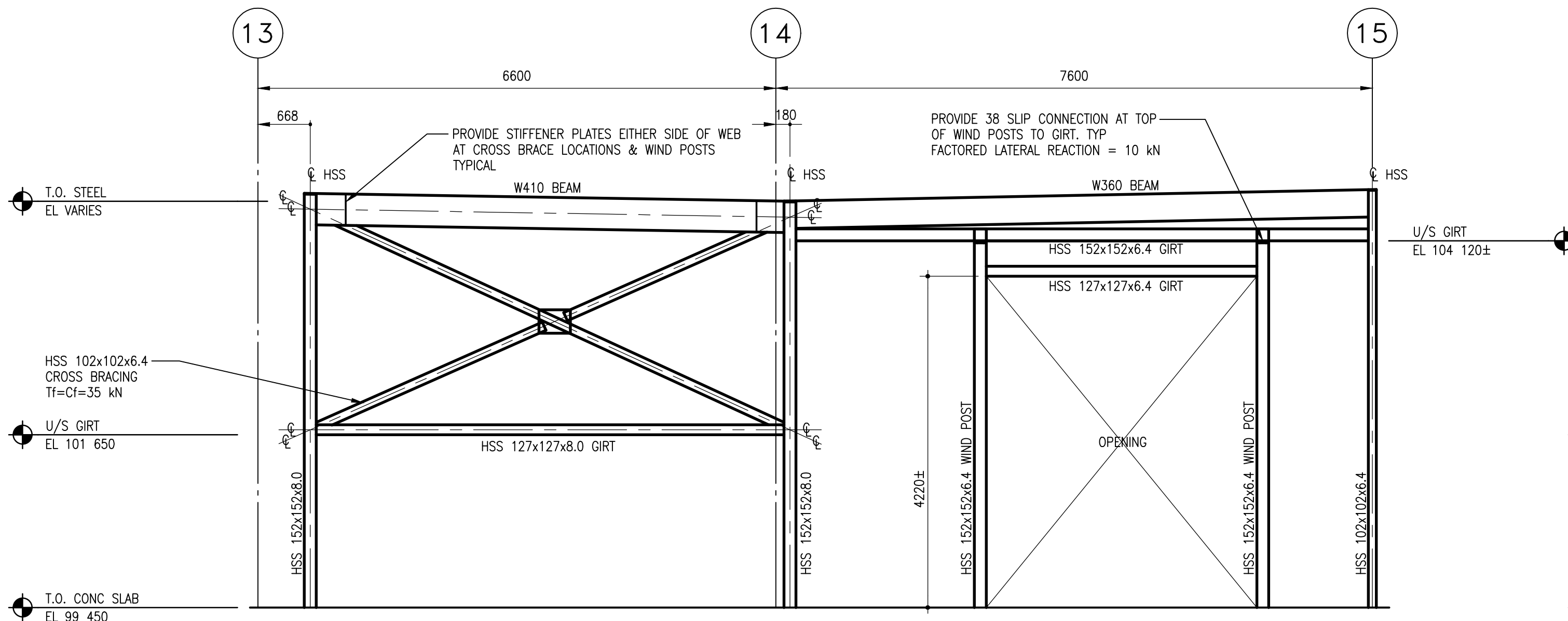




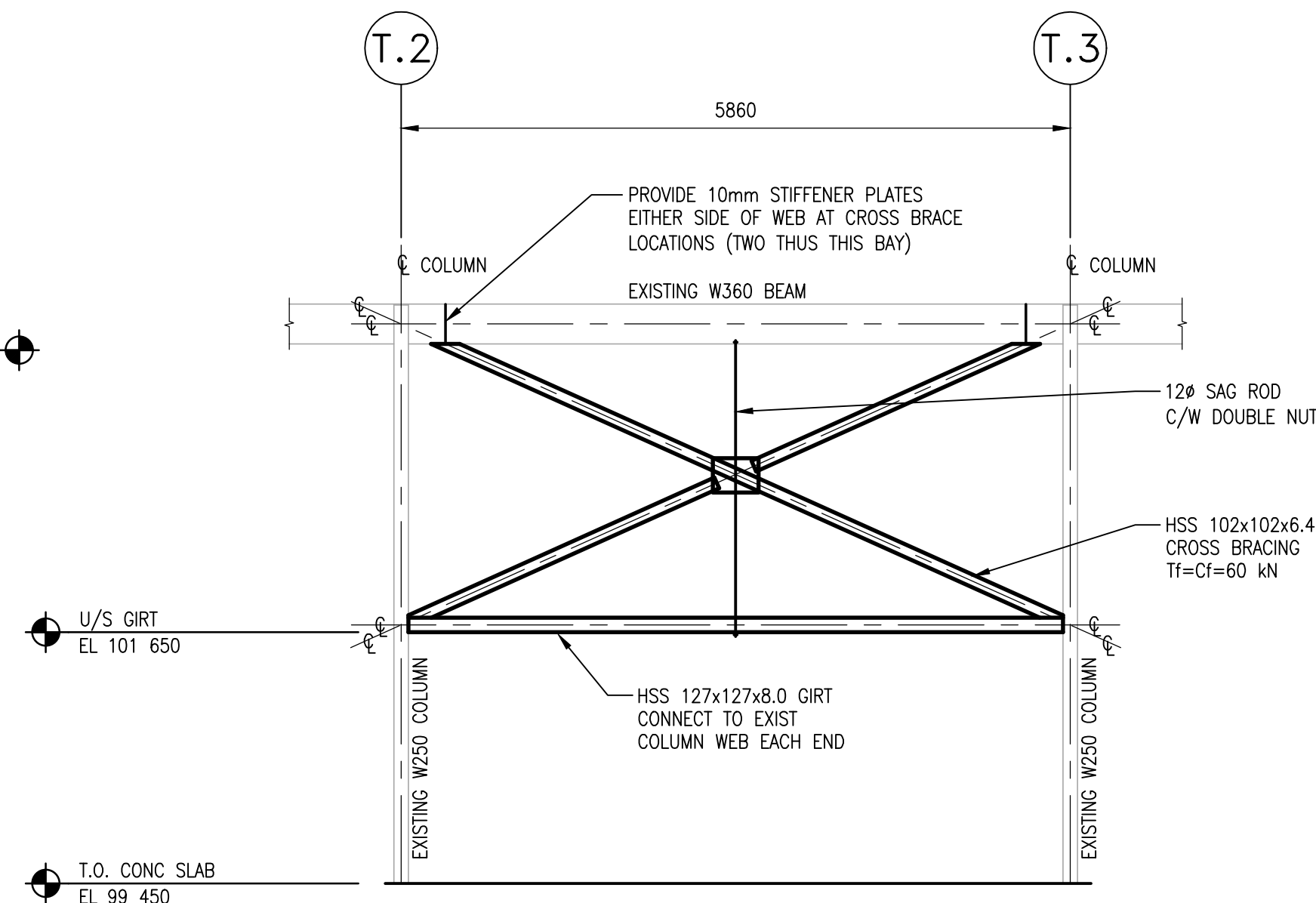
**A PARTIAL NORTH ELEVATION**  
S2.1 1 : 50  
• 1890 NORTH OF GRIDLINE T.4



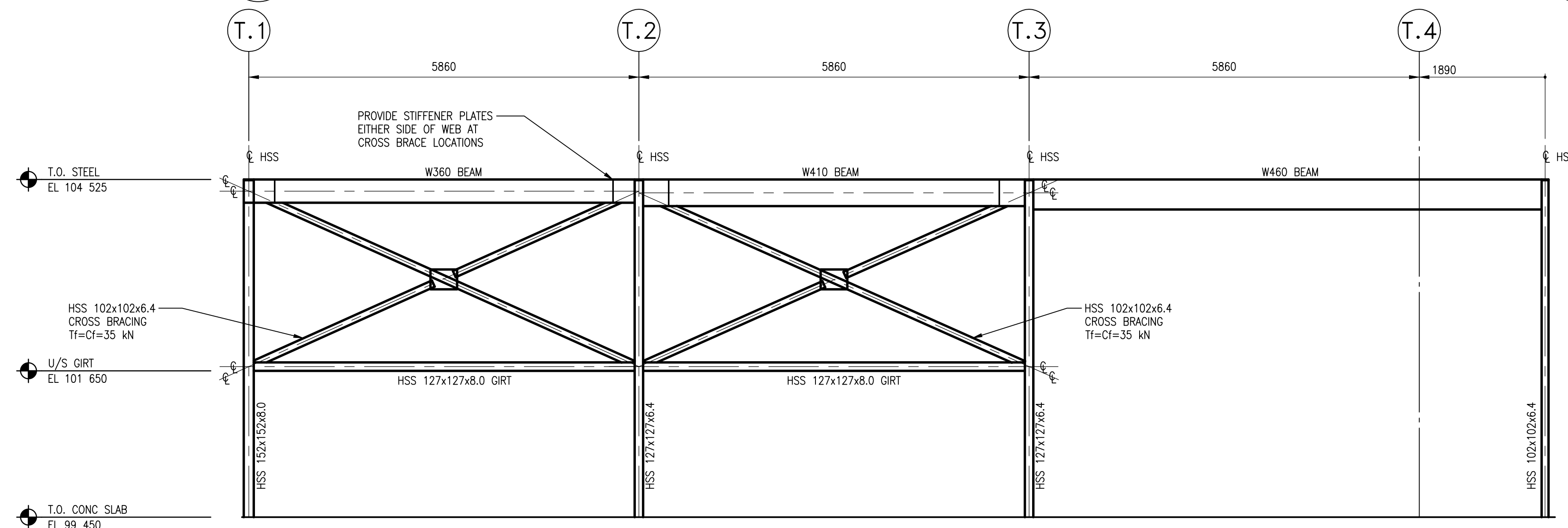
**B PARTIAL NORTH ELEVATION**  
S2.1 1 : 50  
• 3833 NORTH OF GRIDLINE T.4



**C SOUTH ELEVATION**  
S2.1 1 : 50



**D PARTIAL EAST ELEVATION**  
S2.1 1 : 50  
• TEMPORARILY BRACE 1 BAY THIS LINE.  
EXISTING FLAT BAR BRACE TO BE REMOVED.



**E EAST ELEVATION**  
S2.1 1 : 50

DO NOT SCALE DRAWINGS

Revision/	Description/Description	Date/Date
B	ADDENDUM NO. 2 - GENERAL REVISIONS	2016/12/06
A	ISSUED FOR CONSTRUCTION	2016/11/02
Revision/	Description/Description	Date/Date
Client/client		

PUBLIC WORKS  
AND GOVERNMENT  
SERVICES AGENCY

Project title/Titre du projet  
EMERSON, MANITOBA  
HIGHWAY 75, UNITED STATES BORDER  
EXPANSION AND  
REDEVELOPMENT OF THE  
EMERSON PORT OF ENTRY

Approved by/Approuvé par  
KJP

Designed by/Concept par  
JAL/KJP

Drawn by/Dessiné par  
MPP

PWGC Project Manager/Administrateur de Projets TPSGC  
James Hutchings

PWGC, Architectural and Engineering Resources Manager/  
Ressources Architectural et de Directeur d'Ingénierie, TPSGC

Client/client

Drawing title/Titre du dessin  
TERTIARY GARAGE  
ELEVATIONS

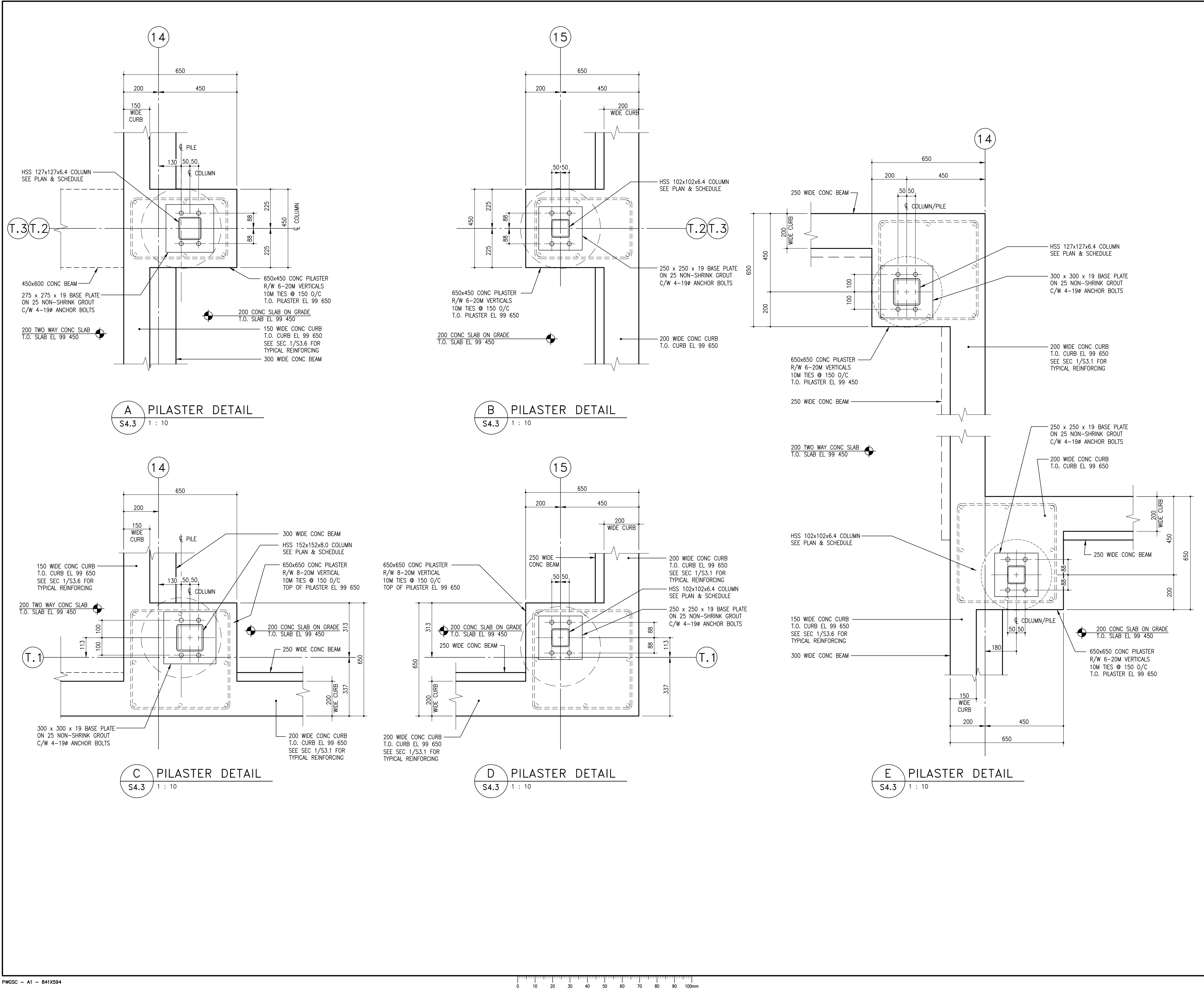
Project No./No. du projet  
R.068431.001

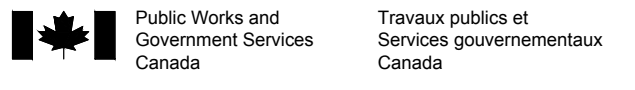
Sheet/Feuille  
S2.1  
OF 17

Revision no./  
La Révision  
no.  
B











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Winnipeg, Manitoba R3C 5R6  
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F 204-943-7507  
2015-0458



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CONSULTING STRUCTURAL ENGINEERS

ORIGINAL DRAWING  
SEALED BY  
K.J. PRATT  
AND DATED  
2016-11-02

DO NOT SCALE DRAWINGS		
Revision/	Description/Description	Date/Date
B	ADDENDUM NO. 2 - GENERAL REVISIONS	2016/12/06
A	ISSUED FOR CONSTRUCTION	2016/11/02

PUBLIC WORKS  
AND GOVERNMENT  
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Project title/Titre du projet

EMERSON, MANITOBA  
HIGHWAY 75, UNITED STATES BORDER

EXPANSION AND  
REDEVELOPMENT OF THE  
EMERSON PORT OF ENTRY

Approved by/Approuvé par  
KJP

Designed by/Concept par  
JAL/KJP

Drawn by/Dessiné par  
MPP

PWGSC Project Manager/Administrateur de Projets TPSGC  
James Hutchings

PWGSC, Architectural and Engineering Resources Manager/  
Ressources Architectural et de Directeur d'Ingénierie, TPSGC

Client/client

Drawing title/Titre du dessin

DETAILS

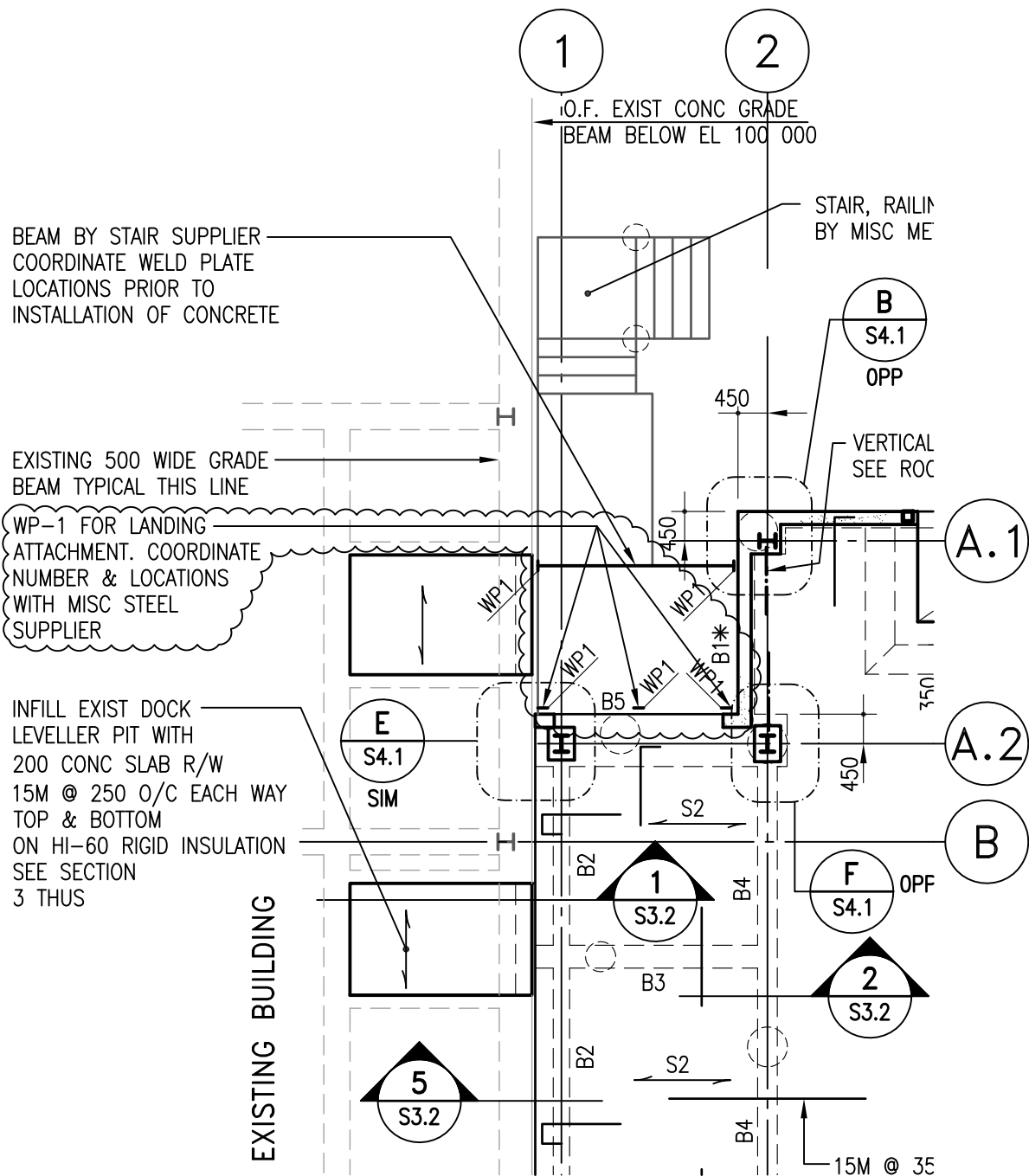
Project No./No. du projet	Sheet/Feuille	Revision no./ La Révision no.
R.068431.001	S4.3 OF 17	B

2015-0458\_S4.1-S4.3

PWGSC - A1 - 841X594

0 10 20 30 40 50 60 70 80 90 100mm

2015-0458\_S4.1-S4.3



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2015-0458



Crosier Kilgour  
& Partners Ltd.

CONSULTING STRUCTURAL ENGINEERS

Project title

**Expansion and Redevelopment of the  
Emerson Port of Entry**

**Emerson,**

**Manitoba**

TO BE READ IN CONJUNCTION WITH S1.3

Drawing title

**MAIN FLOOR FRAMING PLAN  
WELD PLATE ADDITIONS**

Drawn by

**MPP**

PWGSC Project Manager

**James Hutchings**

Designed by

**JAL**

Project no.

**R.068431.001**

Approved by

**JAL**

Date

**2016-12-06**

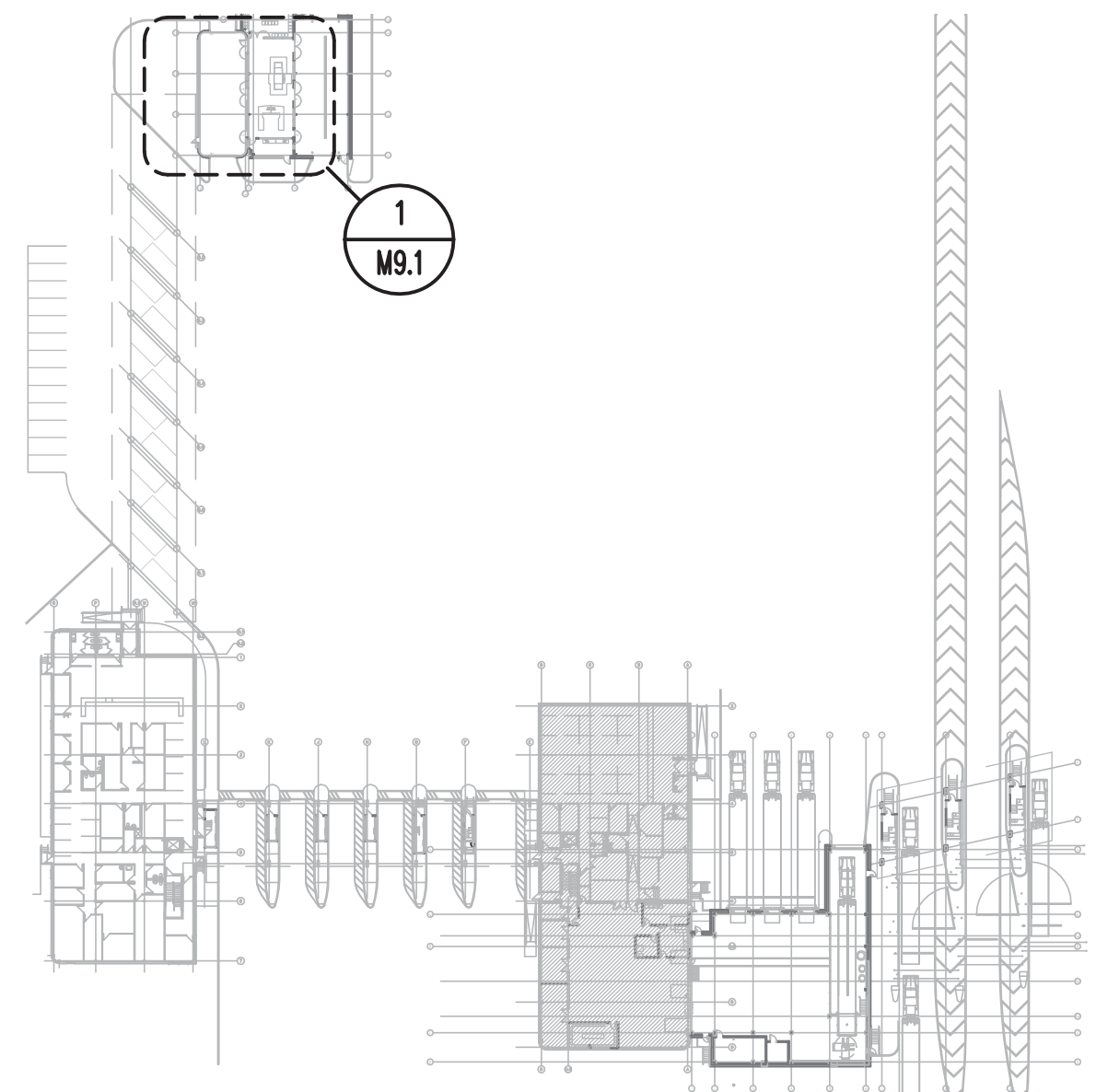
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**RS-1**

Revision

**0**





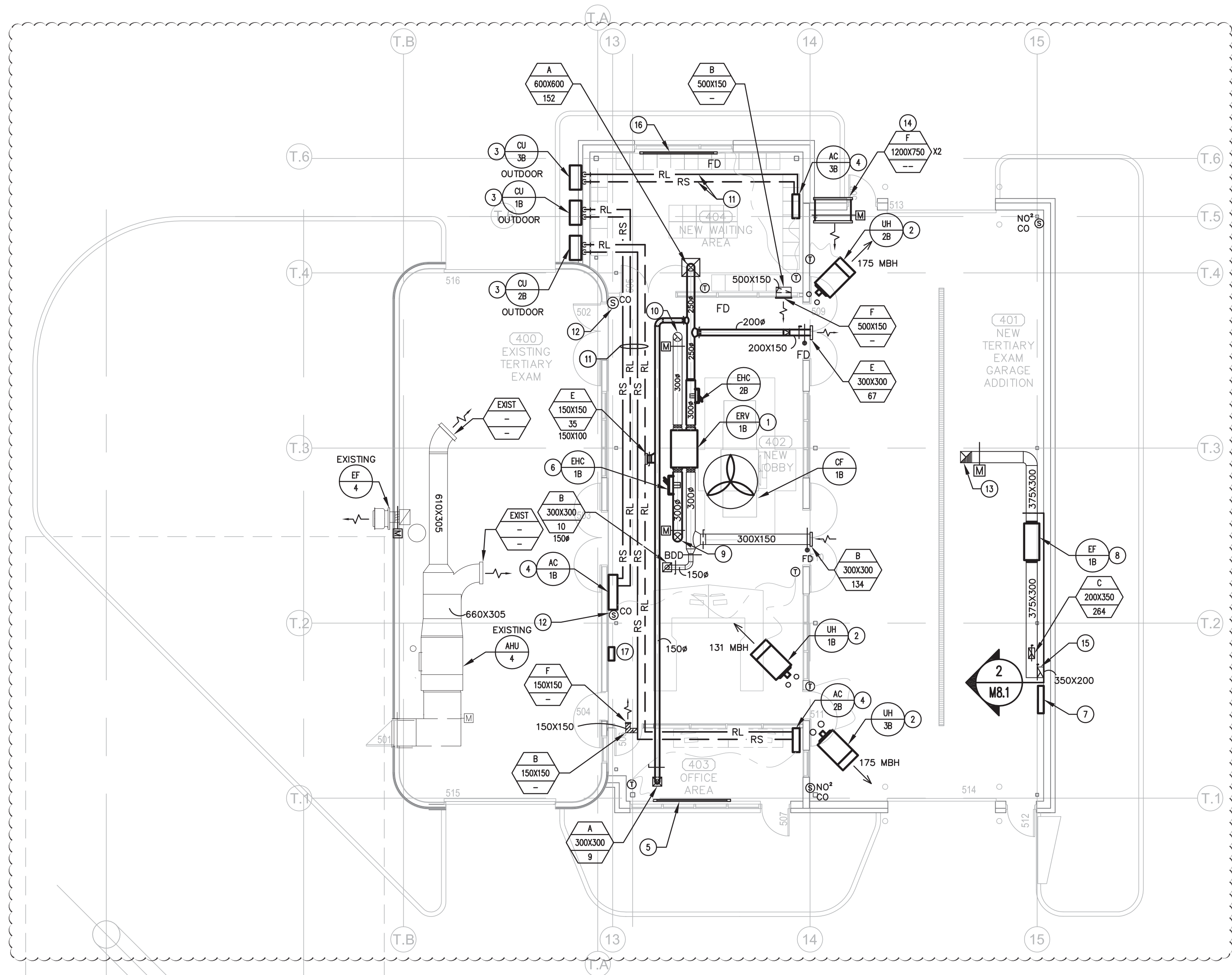
2 KEY PLAN  
M8.1 SCALE: NTS

GENERAL NOTES:

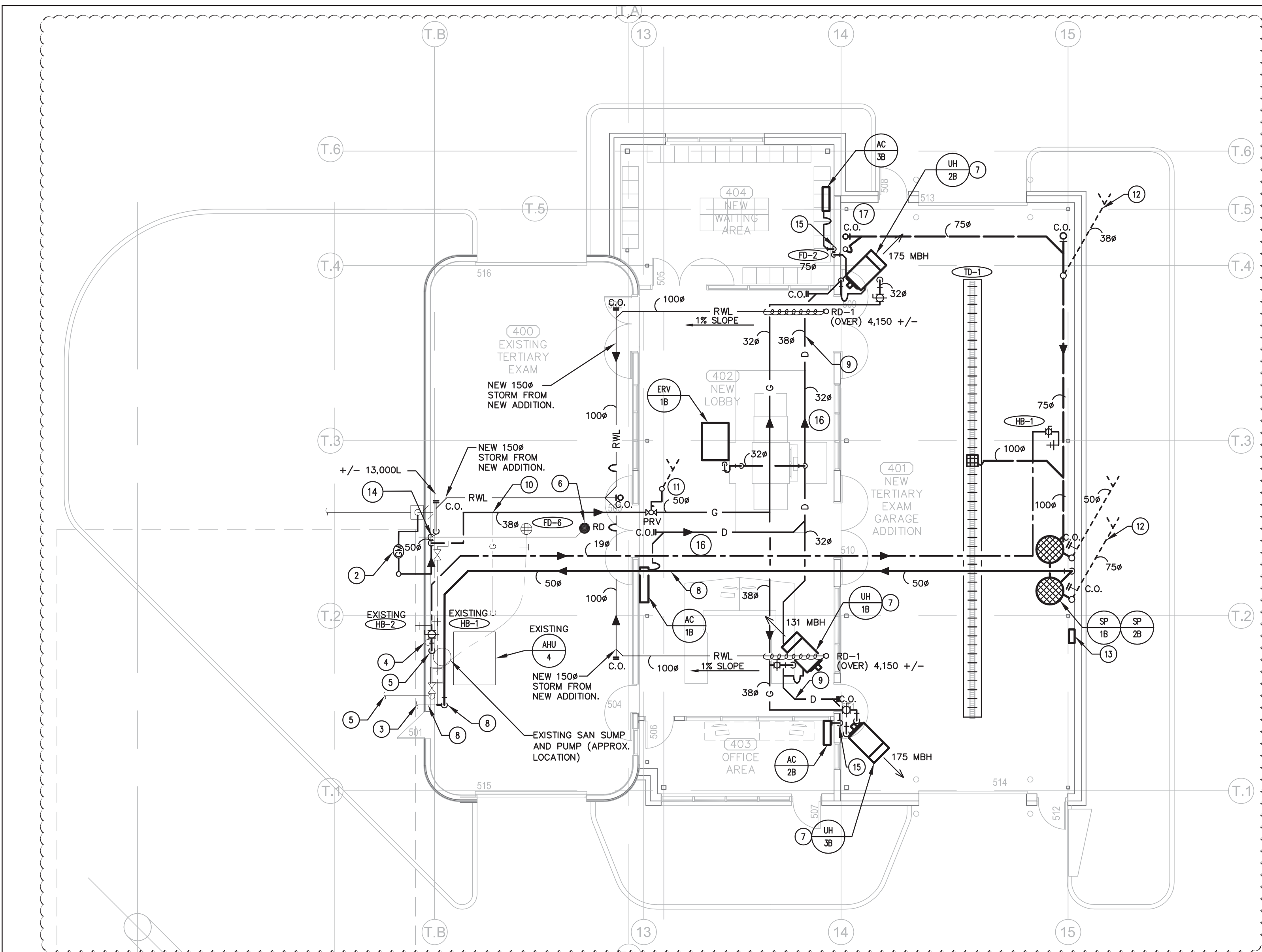
- THIS DRAWING IS DIAGRAMMATIC ONLY. DO NOT SCALE.
- THE MECHANICAL SYSTEMS SHOWN ARE APPROXIMATE IN LOCATION ONLY. CONTRACTOR TO VERIFY EXACT LOCATION OF SYSTEMS BEING MODIFIED ON SITE PRIOR TO COMMENCEMENT OF WORK.
- ALL WORK SHALL COMPLY WITH THE MOST CURRENT VERSION OF ALL APPLICABLE CODES AND STANDARDS, WHICH SHALL BE CONSIDERED PART OF THIS SPECIFICATION. IN THE CASE OF CONFLICTING REQUIREMENTS, THE MOST STRINGENT REGULATION SHALL PREVAIL.
- CONTRACTOR TO MAINTAIN DIGITAL PHOTOGRAPHIC RECORD OF ALL INSTALLATIONS PRIOR TO CONCEALMENT BY SUPPORTING TRADES.
- COORDINATE FINAL LOCATION OF SUPPLY, RETURN AND EXHAUST DIFFUSERS ON SITE WITH FINAL LIGHTNING LAYOUT, ARCHITECTURAL CEILING, STRUCTURAL, ELECTRICAL, FIRE PROTECTION AND MECHANICAL SYSTEMS.
- ALL DUCT DIMENSIONS DENOTED REFER TO INTERNAL OPEN AREA OF THE DUCT.
- PROVIDE FIRE DAMPERS AT EACH LOCATION WHERE A DUCT PENETRATES A FIRE SEPARATION OR FIRE WALL. REFER TO ARCHITECTURAL FOR LOCATIONS OF FIRE SEPARATIONS AND FIRE WALLS, AND THEIR RATINGS.
- PROVIDE CEILING DAMPERS FOR ALL DIFFUSER, GRILLES, OR REGISTERS LOCATED IN FIRE RATED CEILINGS. REFER TO ARCHITECTURAL FOR LOCATIONS OF FIRE RATED CEILINGS, DIFFUSERS, GRILLES, AND REGISTERS TO BE PROTECTED BY CK 2000 THERMAL BLANKET WHERE REQUIRED.
- PROVIDE INSULATED BACKS FOR THERMOSTATS WHERE REQUIRED AT UNIT HEATERS.

DRAWING NOTES:

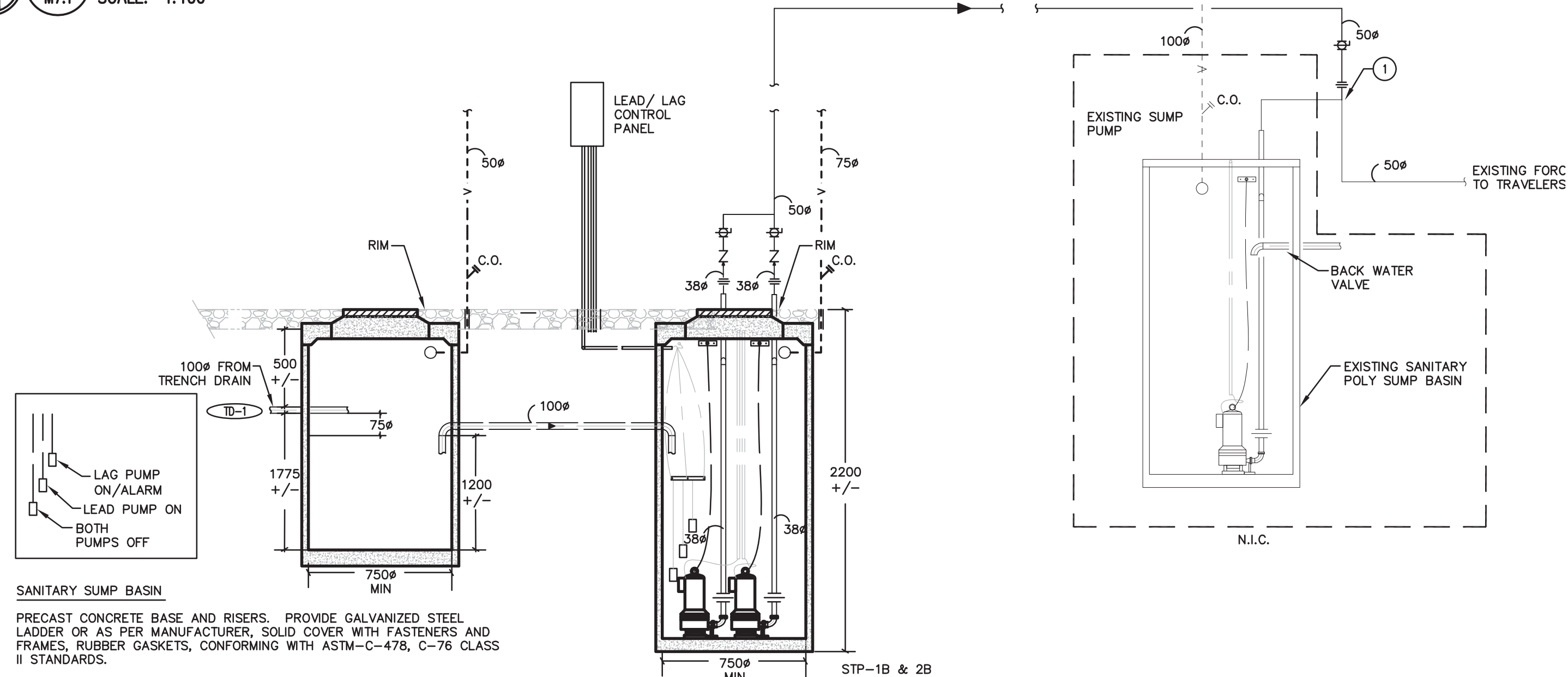
- ERV SUSPENDED AT HIGH LEVEL.
- NEW GAS FIRED CONDENSING UNIT HEATERS AT HIGH LEVEL. MAINTAIN 4.0M ABOVE FINISHED FLOOR CLEAR TO UNDERSIDE OF HEATER. COMPLETE WITH SEALED COMBUSTION VENTING UP THROUGH ROOF. REFER TO DETAIL 7/M6.1.
- MOUNT CONDENSING UNITS AT 1 METER ABOVE FINISHED GRADE. ON WALL MOUNTED, PAINTED, STEEL BRACKETS.
- NEW WALL MOUNTED AIR CONDITIONER UNIT +/- 240MM ABOVE FINISHED FLOOR.
- ELECTRIC BASEBOARD 2 KW (REFER TO ELECTRICAL).
- ELECTRIC DUCT HEATER 6 KW.
- CARBON MONOXIDE AND NITROGEN DIOXIDE CONTROL PANELS AND SENSORS COMPLETE WITH MANUAL AUDIBLE ALARM SILENCE (VISUAL ALARM REMAIN ON).
- EXHAUST FAN AT HIGH LEVEL. MOUNT TO STRUCTURE. MAINTAIN 4.0M ABOVE FINISHED FLOOR FOR CLEARANCE.
- OUTDOOR INLET TO ERV-1B THROUGH GOOSENECK ON ROOF.
- EXHAUST OUTLET FROM ERV-1B THROUGH GOOSENECK ON ROOF. TO BE A MINIMUM OF 10'-0" (3.1M) DISTANCE AWAY FROM ANY BUILDING EXHAUSTS, VENTS, OR OPENINGS.
- REFRIGERATION PIPING AT HIGH LEVEL.
- CARBON MONOXIDE DETECTOR AND ALARM, REFER TO ELECTRICAL.
- 375X300 EXHAUST UP TO GOOSENECK IN ROOF.
- AIR TRANSFER INSULATED DUCT AT HIGH LEVEL ABOVE DOOR COMPLETE WITH EXTERIOR LOUVRE AND INSULATED, LOW LEAK CONTROL DAMPER.
- DUCT DROP TO BE AS CLOSE TO WALL AS POSSIBLE.
- ELECTRIC BASEBOARD 3 KW (REFER TO ELECTRICAL).
- ERV-1B CONTROL PANEL.







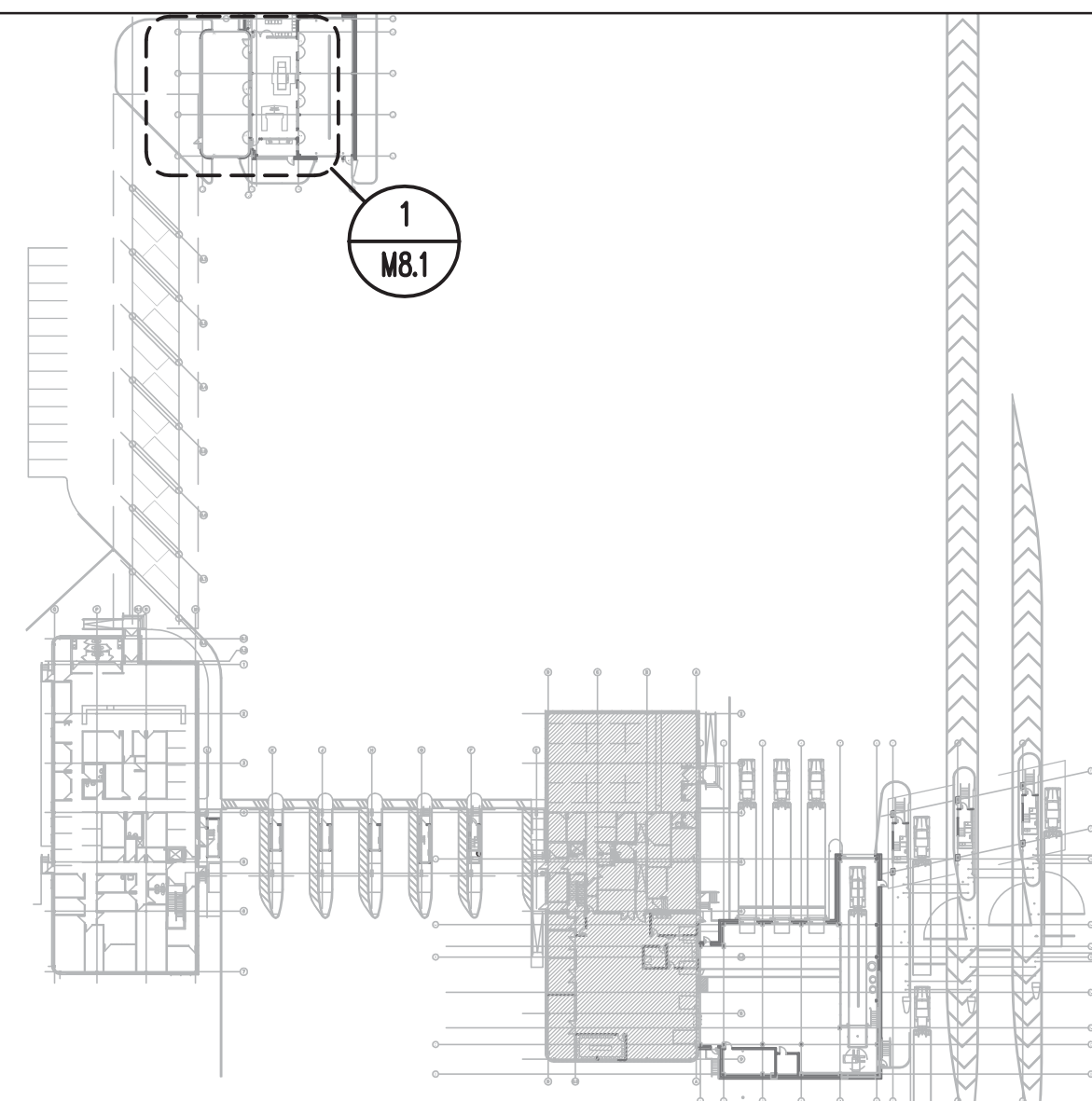
**1 TERTIARY EXAM GARAGE – PLUMBING RENOVATION PLAN**  
M7.1 SCALE: 1:100



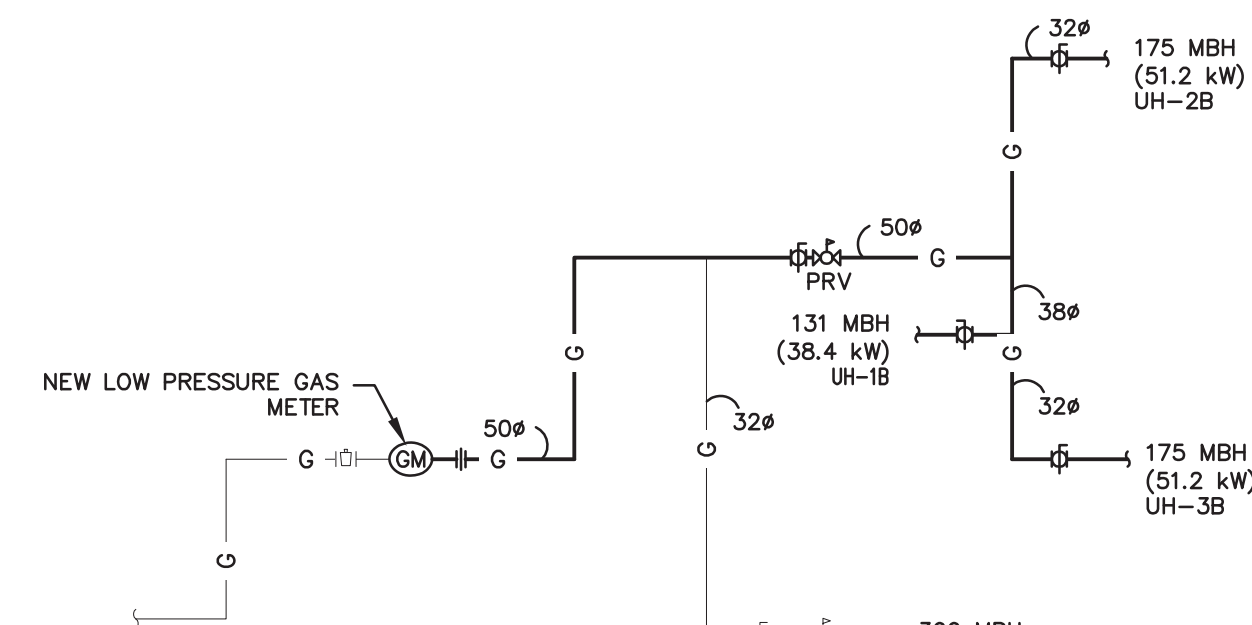
**2 TERTIARY EXAM GARAGE – LEAD/LAG SANITARY SUMP**  
M7.1 SCALE: NTS

- GENERAL NOTES:**
- THIS DRAWING IS DIAGRAMMATIC ONLY. DO NOT SCALE.
  - THE MECHANICAL SYSTEMS SHOWN ARE APPROXIMATE IN LOCATION ONLY. CONTRACTOR TO VERIFY EXACT LOCATION OF SYSTEMS BEING MODIFIED ON SITE PRIOR TO COMMENCEMENT OF WORK.
  - ALL WORK SHALL COMPLY WITH THE MOST CURRENT VERSION OF ALL APPLICABLE CODES AND STANDARDS, WHICH SHALL BE CONSIDERED PART OF THIS SPECIFICATION. IN THE CASE OF CONFLICTING REQUIREMENTS, THE MOST STRINGENT REGULATION SHALL PREVAIL.
  - CONTRACTOR TO MAINTAIN DIGITAL PHOTOGRAPHIC RECORD OF ALL INSTALLATIONS PRIOR TO CONCEALMENT BY SUPPORTING TRADES.
  - PROVIDE CAP ON ALL DOMESTIC SUPPLIES AND SANITARY LINES UNTIL LINES ARE READY TO BE CONNECTED TO FIXTURES.
  - PROVIDE CLEANOUTS WHERE REQUIRED BY CODE AND SHOWN ON DRAWING. CLEANOUTS INSTALLED IN FLOOR SHALL BE BRASS AND INSTALLED FLUSH WITH FLOOR.

- DRAWING NOTES:**
- SANITARY SUMP PIT SP-1B, SP-2B, DISCHARGE PIPE TO CONNECT TO EXISTING SANITARY 50mm FORCE MAIN.
  - EXISTING LOW PRESSURE GAS METER TO BE REPLACED WITH NEW. COORDINATE NEW METER SET CONNECTION WITH LOCAL GAS AUTHORITY. REWORK PIPING AT EXTERIOR WALL AS REQUIRED.
  - EXISTING 50mm SANITARY FORCE MAIN TO TRAVELERS BUILDING.
  - EXISTING SANITARY SUMP BASIN VENT THROUGH ROOF.
  - EXISTING WATER SUPPLY FROM TRAVELERS BUILDING. CONNECT NEW 19mm HOSEBIB SUPPLY AT WATER ENTRY COMPLETE WITH NEW ISOLATION VALVE.
  - EXISTING ROOF DRAIN TO REMAIN.
  - NEW GAS FIRED CONDENSING UNIT HEATERS.
  - NEW 50mm SUMP DISCHARGE TO CONNECT TO EXISTING 50mm DISCHARGE LINE AT WALL OF EXISTING TERTIARY BUILDING, EXAM 400.
  - 32mm CONDENSATE DRAIN TO FLOOR FUNNEL DRAIN AND SUMP PIT.
  - NEW 50mm GAS SUPPLY TO NEW GAS METER SET. RECONNECT EXISTING AHU-4 32mm GAS SUPPLY PIPING.
  - NEW GAS REGULATOR VENT THROUGH ROOF.
  - TERMINATE ALL VENTING THROUGH ROOF COMPLETE WITH PIPE SIZE INCREASE FOR FROST, MINIMUM SIZE 75MM. ALL VENT TERMINALS.
  - SANITARY PUMP LEAD/LAG PANEL MOUNTED ON WALL.
  - REMOVE AND REPLACE EXISTING 150mm STORM RISER WITH NEW 200mm RISER WITH CLEAN OUT. RECONNECT EXISTING 150mm STORM LEADER.
  - 32mm CONDENSATE DRAIN CONCEALED IN WALL.
  - MAINTAIN 32mm CONDENSATE DRAIN AT HIGH LEVEL (APPROX. 3M AFF). SPLIT A/C WALL CASSETTE UNITS SHALL HAVE PUMPED CONDENSATE UNITS.
  - KEEP FUNNEL DRAIN TIGHT TO WALL AND GRADE BEAM. KEEP FUNNEL DRAIN OUT OF WALK WAY.



**4 KEY PLAN**  
M7.1 SCALE: NTS



**3 TERTIARY EXAM GARAGE – GAS LOAD SCHEMATIC**  
M7.1 SCALE: NTS

**GAS LOAD CHART**

NO.	EQUIPMENT	INPUT CAPACITY MBH (kW)
AHU-4	EXISTING AIR HANDLING UNIT	300 (87.9)
UH-1B	NEW UNIT HEATER	131 (38.4)
UH-2B	NEW UNIT HEATER	175 (51.2)
UH-3B	NEW UNIT HEATER	175 (51.2)
TOTAL		781 (228.9)

**DO NOT SCALE DRAWINGS**

Revision/Revisions	Description/Description	Date/Date
1-	ISSUED FOR ADD#03ME	2016/12/08
0	ISSUED FOR CONSTRUCTION	2016/11/02

Client/client

**PUBLIC WORKS AND GOVERNMENT SERVICES AGENCY**

Projet title/Titre du projet  
EMERSON, MANITOBA  
HIGHWAY 75, UNITED STATES BORDER

**EXPANSION AND REDEVELOPMENT OF THE EMERSON PORT OF ENTRY**

Approved by/Approuvé par  
AL

Designed by/Concept par  
CD/AL

Drawn by/Dessiné par

PWSC Project Manager/Manager de Projets TPSC  
JAMES HUTCHINGS

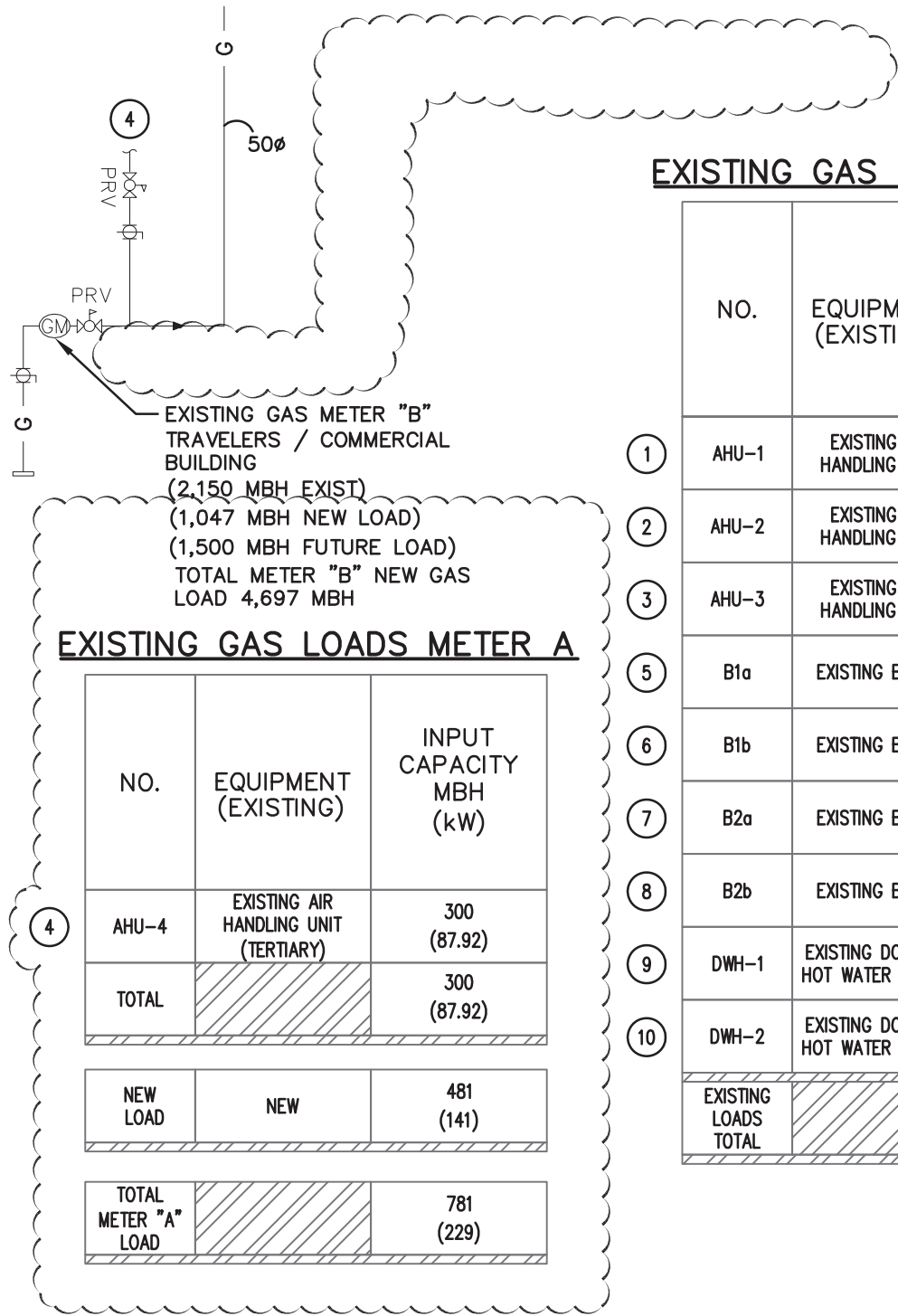
PWSC Architectural and Engineering Resource Manager/  
Ressources Architectural et de Génie d'Ingénierie, TPSC

Client/client

Drawing title/Titre du dessin  
TERTIARY EXAM GARAGE ADDITION -  
PLUMBING RENOVATION PLAN

Projet No./No. de projet	Sheet/Feuille	Revision no./ La Révision no.
R.068431.001	RM-03 10 OF 11	0

PLOTTED ON 2016-12-08 BY: CDEB, A. DME  
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EXISTING GAS LOADS METER A

NO.	EQUIPMENT (EXISTING)	INPUT CAPACITY MBH (kW)
AHU-4	EXISTING AIR HANDLING UNIT (TERTIARY)	300 (87.92)
TOTAL		300 (87.92)
NEW LOAD	NEW	481 (141)
TOTAL METER "A" LOAD		781 (229)

EXISTING GAS LOADS METER B

NO.	EQUIPMENT (EXISTING)	INPUT CAPACITY MBH (kW)
1	AHU-1	EXISTING AIR HANDLING UNIT 250 (73.2)
2	AHU-2	EXISTING AIR HANDLING UNIT 200 (58.6)
3	AHU-3	EXISTING AIR HANDLING UNIT 100 (29.3)
5	B1a	EXISTING BOILER 210 (61.5)
6	B1b	EXISTING BOILER 210 (61.5)
7	B2a	EXISTING BOILER 550 (161.1)
8	B2b	EXISTING BOILER 550 (161.1)
9	DWH-1	EXISTING DOMESTIC HOT WATER HEATER 40 (11.7)
10	DWH-2	EXISTING DOMESTIC HOT WATER HEATER 40 (11.7)
EXISTING LOADS TOTAL		2,150 (630)

NEW GAS LOADS METER B

NO.	EQUIPMENT (NEW)	INPUT CAPACITY MBH (kW)
11	UH-8A	NEW UNIT HEATER 175 (51.2)
12	UH-9A	NEW UNIT HEATER 175 (51.2)
13	UH-10A	NEW UNIT HEATER 175 (51.2)
14	UH-11A	NEW UNIT HEATER 260 (76.20)
15	UH-12A	NEW UNIT HEATER 131 (38.4)
16	UH-13A	NEW UNIT HEATER 131 (38.4)
TOTAL NEW LOAD		1,047 MBH (307)
COMBINED NEW AND EXISTING LOADS TOTAL		3,197 MBH (937)
FUTURE LOAD	FUTURE	1,500 MBH (440)
TOTAL METER "B" LOAD		4,697 MBH (1,376)

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PROJECT: EXPANSION AND REDEVELOPMENT OF EMERSON PORT OF ENTRY

DESCRIPTION: GAS LOAD RE-CALCULATED

DATE: 2016-12-08

DRAWN BY: C.DEB.

SCALE: N.T.S.

REF. DWG. NO.

M6.3

DWG. NO.

RM-04

ISSUED WITH:

ADD#03ME