IFR Upgrades

PROJECT NO. 7212283

SPECIFICATIONS

Issued for Tender
2018/05/18

Peter J. Kindree Architect

SPECIFICATIONS

DIVISION 23 HEATING, VENTILATION AND AIR-CONDITIONING (HVAC)

DIVISION 26 ELECTRICAL

DRAWINGS

ARCHITECTURAL:

A001 COVER PAGE; DRAWING LIST
A111 DEMOLITION PLAN
A121 CONSTRUCTION PLAN
A201 BUILDING SECTION
A202 DETAILS

ELECTRICAL DRAWINGS:

E1 ELECTRICAL LEGENDS, DRAWING LIST, DEMOLITION WORK & SLD
E2 ELECTRICAL NEW WORK

MECHANICAL DRAWINGS:

M1 MECHANICAL DRAWING LIST, LEGENDS, SCHEDULES & DETAILS
M2 MECHANICAL GROUND FLOOR FIRE PROTECTION
M3 MECHANICAL GROUND FLOOR HVAC
M4 MECHANCIAL PENTHOUSE HVAC NEW WORK

END OF SECTION

Part 1 General

1.1 MINIMUM STANDARDS

.1 Materials shall be new and work shall conform to the minimum applicable standards of the Canadian General Standards Board, the Canadian Standards Association, the National Building Code of Canada 2015 (NBC) and all applicable Provincial and Municipal codes. In the case of conflict or discrepancy the most stringent requirement shall apply.

1.2 TAXES

.1 Pay all taxes properly levied by law (including Federal, Provincial and Municipal).

1.3 FEES, PERMITS AND CERTIFICATES

.1 Pay all fees and obtain all permits. Provide authorities with plans and information for acceptance certificates. Provide inspection certificates as evidence that work conforms to requirements of Authority having jurisdiction.

1.4 FIRE SAFETY REQUIREMENTS

.1 Comply with both the National Building Code of Canada 2015 and the National Fire Code of Canada 2015 for safety of persons in buildings in the event of a fire and the protection of buildings from the effects of fire, as follows;

- .1 The National Building Code (NBC): for fire safety and fire protection features that are required to be incorporated in a building during construction.
- .2 The National Fire Code (NFC):
  - .1 The on-going maintenance and use of the fire safety and fire protection features incorporated in buildings.
  - .2 The conduct of activities that might cause fire hazards in and around buildings.
  - .3 Limitations on hazardous contents in and around buildings.
  - .4 The establishment of fire safety plans.
  - .5 Fire safety at construction and demolition sites.

.2 Welding and cutting:

- .1 Before welding, soldering, grinding and/or cutting work, obtain a permit as directed by the Departmental Representative. Store flammable liquids in approved CSA containers.
- .2 At least one week prior to commencing cutting, welding or soldering procedure, provide to Departmental Representative:
  - .1 Notice of intent, indicating devices affected, time and duration of isolation or bypass.
  - .2 Completed welding permit as defined in NFC.
  - .3 Return welding permit to Departmental Representative immediately upon completion of procedures for which permit was issued.

.3 "Fire Watchers" as described in NFC shall be assigned when welding or cutting operations are carried out in areas where combustible materials within 15m may be ignited by conduction or radiation.

.3 Where work requires interruption or cause activation of fire alarms or fire suppression, extinguishing or protection systems:

.1 Provide "Watchman Service" as described in NFC; In general, watchman service is defined as an individual conversant with "Fire Emergency Procedures", performing fire picket duty within an unprotected and unoccupied (no workers) area once per hour.

.2 Retain services of manufacturer for fire protection systems on daily basis or as approved by Departmental Representative, to isolate and protect all devices relating to:

.1 modification of fire alarms, fire suppression, extinguishing or protection systems; and/or

.2 cutting, welding, soldering or other construction activities that might activate fire protection systems.

.3 Immediately upon completion of work, restore fire protection systems to normal operation and verify that all devices are fully operational.

.4 Inform fire alarm system monitoring agency and local Fire Department immediately prior to isolation and immediately upon restoration of normal operation.

1.5 FIELD QUALITY CONTROL

.1 Carry out Work using qualified licensed workers or apprentices in accordance with Provincial Act respecting manpower vocational training and qualification.

.2 Permit employees registered in Provincial apprenticeship program to perform specific tasks only if under direct supervision of qualified licenced workers.

.3 Determine permitted activities and tasks by apprentices, based on level of training attended and demonstration of ability to perform specific duties.

1.6 HAZARDOUS MATERIALS

.4 Hazardous Materials: product, substance, or organism that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.

.2 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and the provision of Material Safety Data Sheets (MSDS).

.3 For work in occupied buildings give the Departmental Representative 48 hours notice for work involving designated substances (Ontario Bill 208), hazardous substances (Canada Labour Code Part II Section 10), and before painting, caulking or using adhesives and other materials that cause off-gassing.

1.7 TEMPORARY UTILITIES

.1 Existing services required for work, may be used by the Contractor without charge. Ensure capacity is adequate prior to imposing additional loads. Connect and disconnect at own expense and responsibility and remove all such work after use.

.5 Maximum power supply of 110 V, 15 A is available and will be provided at no cost. Connect to existing power supply in accordance with Canadian Electrical Code and provide meters and switching.

.3 Notify the Departmental Representative and utility companies of intended interruption of services, obtain requisite permission.

1.8 REMOVED MATERIALS

.1 Unless otherwise specified, materials for removal become the Contractor's property and shall be taken from site.

1.9 PROTECTION

.1 Protect finished work against damage until take-over.

.2 Protect adjacent work against the spread of dust and dirt beyond the work areas.

.3 Protect operatives and other users of site from all hazards.

1.10 CUT, PATCH and MAKE GOOD

.1 Cut surfaces as required to accommodate work.

.2 Remove all items so shown or specified.

.3 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative’s approval. Match existing material, colour, finish and texture.

1.11 SLEEVES, HANGERS AND INSERTS

.1 Co-ordinate setting and packing of sleeves and supply and installation of hangers and inserts. Obtain Departmental Representative’s approval before cutting into structure.

1.12 EXAMINATION

.1 Examine site and conditions likely to affect work and be familiar and conversant with existing conditions.

1.13 SIGNS

.1 Provide common-use signs related to traffic control, information, instruction, use of equipment, public safety devices, etcetera, in both official languages or using commonly-understood graphic symbols to the Departmental Representative’s approval.

.2 No advertising will be permitted on this project.

1.14 ACCESS AND EGRESS

.1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

.2 Allow for egress from the building interior through the area of work at each of areas 117, 119 and 121 to the exterior, at all times.

1.15 SCAFFOLDS AND WORK PLATFORMS

.1 Design, install, and inspect scaffolds and work platforms required for work in accordance with relevant municipal, provincial and other regulations.

.2 Provide design drawings, signed and sealed by qualified Professional Engineer licensed in the province of Ontario, where prescribed.

.3 Additions or modifications to scaffolding must be approved by Professional Engineer in writing.

1.16 SITE STORAGE

.1 Storage will be allowed within the area of Work only; no other storage will be available.

.2 Do not unreasonably encumber site with materials or equipment.

1.17 OPERATIONS AND MAINTENANCE MANUALS

.1 Submit to Departmental Representative six (6) copies of approved Operations Data and Maintenance Manual in both official languages, compiled as follows:

.1 Bind data in vinyl hard cover 3 "D" ring type loose leaf binders for 212 x 275¦mm size paper. Binders must not exceed 75¦mm thick or be more than 2/3 full.

.2 Enclose title sheet labelled "Operation Data and Maintenance Manual," project name, date and list of contents. Project name must appear on binder face and spine.

.3 Organize contents into applicable sections of work to parallel project specifications breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.

.2 Include following information plus data specified.

.1 Maintenance instruction for finished surface and materials.

.2 Copy of hardware and paint schedules.

.3 Description: Operation of the equipment and systems defining start-up, shut-down and emergency procedures, and any fixed or adjustable set points that affect the efficiency of the operation. Include nameplate information such as make, size, capacity and serial number.

.4 Maintenance: Use clear drawings, diagrams or manufacturers' literature which specifically apply and detail the following:

.1 lubrication products and schedules.

.2 trouble shooting procedures.

.3 adjustment techniques.

.4 operational checks.

.5 Suppliers names, addresses and telephone numbers and components supplied by them must be included in this section. Components must be identified by a description and manufacturers part number.

.5 Guarantees showing:

.1 Name and address of projects.

.2 Guarantee commencement date (date of Substantial Performance).

.3 Duration of guarantee.

.4 Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.

.5 Signature and seal of Guarantor.

.6 Additional material used in project listed under various Sections showing name of manufacturer and source of supply.

.3 Spare parts: List all recommended spares to be maintained on site to ensure optimum efficiency. List all special tools appropriate to unique application. All parts/tools detailed must be identified as to manufacturer, manufacturer part number and supplier (including address).

.4 Include one complete set of final reviewed shop drawings (bound separately) indicating corrections and changes made during fabrication and installation.

1.18 RECORDS

.1 As work progresses, maintain accurate records to show deviations from contract drawings. Just prior to Departmental Representative's inspection for issuance of final certificate of completion, supply to the Departmental Representative one (1) set of white prints with all deviations neatly inked in. The Departmental Representative will provide two sets of clean white prints for this purpose.

1.19 GUARANTEES AND WARRANTIES

.1 Before completion of work collect all manufacturer's guarantees and warranties and deposit with Departmental Representative.

.2 Work of this contract shall not compromise any warranties in effect for the existing building.

1.20 CLEAN UP

.1 Clean up work area as work progresses. At the end of each work period, and more often if ordered by the Departmental Representative, remove debris from site, neatly stack material for use, and clean up generally.

.2 Upon completion remove scaffolding, temporary protection and surplus materials. Make good defects noted at this stage.

.3 Wash and polish glass, mirrors, ceramic tile, aluminum, chrome, stainless steel, baked or porcelain enamel, plastic laminate and other plastic surfaces, floors, hardware and washroom fixtures. Clean manufactured articles in accordance with manufacturer's directions. Clean all wall and ceiling surfaces, including existing building surfaces.

.4 Clean areas under contract to a condition at least equal to that previously existing and to approval of Departmental Representative.

1.21 BUILDING SMOKING ENVIRONMENT

.1 Smoking is not permitted on the site. Obey smoking restrictions on building property.

1.22 DUST CONTROL AND SECURING SITE

.1 Provide dust tight control on the construction site to localize dust generating activities, and for protection of workers, finished areas of work and public.

1.23 TESTING LABORATORY SERVICES

.1 Departmental Representative will appoint and pay for costs of inspection and testing services, unless indicated otherwise.

.2 Provide safe working areas and assist with testing procedures, including provisions for materials or services and co-ordination, as required by testing agency and as authorized by Departmental Representative.

.3 Where tests indicate non-compliance with specifications, contractor to pay for initial test and all subsequent testing of work to verify acceptability of corrected work.

1.24 SCHEDULING

.1 Within 5 days after award of contract submit bar chart construction schedule for work, indicating anticipated progress stages within time of completion. When schedule has been reviewed by the Departmental Representative, make any corrections required and resubmit. Take necessary measures to complete work within scheduled time. Do not change schedule without notifying Departmental Representative.

.2 Ensure Project Schedule includes as minimum milestone and activity types the following (not necessarily in this order):

.1 Award
.2 Shop Drawings, Samples
.3 Permits
.4 Site Mobilization
.5 Demolition
.6 Electrical

.7 HVAC
.8 Install New Baffles
.9 Install New Acoustic Material
.10 Fire Systems
.11 Lighting
.12 Testing and Commissioning
.13 Final Review/Substantial Performance
.14 Deficiencies/Completion

.3 Unless advised otherwise and approved, the work performed at the site by the Contractor shall be carried out during normal working hours (07:30 – 16:30) during the week and shall be carried out with the least possible interference or disturbance to other site activities or operations. Contractors wishing to work outside these hours will require approval from the Departmental Representative and provide minimum 48 hours prior notification. Any such scheduled work must be canceled with 8 hours prior notification or the cost of the escort will be back-charged to the Contractor. If the Contractor does not attend such scheduled work the escort costs will also be back-charged.

.4 Update project schedule on monthly basis reflecting activity changes and completions, as well as activities in progress.

1.25 COST BREAKDOWN

.1 Before submitting first progress claim submit breakdown of Contract Amount in detail as directed by Departmental Representative and aggregating the Contract Amount. After approval by Departmental Representative cost breakdown will be used as the basis of progress payments.

1.26 PRECEDENCE

.3 For Federal Government projects, Division 01 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

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 Regulatory Requirements

.1 The following Limited Designated Substances Report (DSR) was prepared in order to meet the owners or engineer's requirements under:

- .1 Section 30, of the Occupational Health and Safety Act, Revised Statutes of Ontario (R.S.O.) 1990, Chapter 0.1.
- .2 The Canada Labour Code, Part II, Sections 124 & 125.
- .3 Revised Regulations of Ontario (R.R.O.) 1990, Regulation 347 (O. Reg. 347/90) General Waste Management, as amended.
- .4 Public Services and Procurement Canada Management Standard, 2017.

.2 The designated substances identified in the Occupational Health and Safety Act and its corresponding regulations are:

- .1 **Acrylonitrile**: O.Reg. 490/09, as amended.
- .2 **Arsenic**: O.Reg.. 490/09, as amended.
- .3 **Asbestos**:
  - .1 O.Reg. 490/09, as amended.
  - .2 O. Reg. 278/05, as amended.
- .4 **Benzene**: O.Reg. 490/09, as amended.
- .5 **Coke Oven Emissions**: O.Reg. 490/09, as amended.
- .6 **Ethylene Oxide**: O.Reg. 490/09, as amended
- .7 **Isocyanates**: O.Reg. 490/09, as amended
- .8 **Lead:** O.Reg. 490/09, as amended.
- .9 **Mercury**: O.Reg. 490/09, as amended.
- .10 **Silica**: O.Reg. 490/09, as amended.
- .11 **Vinyl Chloride**: O.Reg. 490/09, as amended.

.3 The Guide to Green Government sets out the policy requirements for the federal government to comply with the most stringent environmental regulations, federal or provincial. Also, under the Code of Environmental Stewardship, the federal government has committed to meet or exceed the letter and spirit of federal environmental laws. Within the Guide to Green Government, pollution prevention efforts are required in federal projects. Pollution prevention is defined as the use of processes, practices, materials, products or energy that avoids or minimizes the creation of pollutants and waste, and reduces overall risk to human health and the environment. These policies must be adhered to throughout the duration of any projects performed at the subject site.

.4 Disposal of construction debris and waste are controlled by O. Reg. 347/90, as amended under the Environmental Protection Act.

.5 Notification:

.1 All contractors requesting tenders from subcontractors shall provide this report to subcontractors.

.2 Contractors are required, on the Ontario Ministry of Labour Notice of Project form, to list all Designated Substances that may be used, handled or disturbed by work on the project. This includes Designated Substances already present as part of the structure or finishes as well as Designated Substances brought to the project site by the contractor.

.3 Submit to the Engineer a copy of all notifications prior to the start of work.

1.2 Scope and Validity Date

.1 The following report was prepared to provide an overall view of designated substances that were potentially present throughout the site. More specifically, lead containing or contaminated materials and asbestos containing materials throughout the site. Sampling and identification of lead based paints was not included in the scope for these projects.

.2 An assessment must be made prior to commencing any project to ensure that the information presented herein reflects the scope of work and the requirements of the proposed project. It is important to note that more specific sampling may be required depending on the scope of work and the area affected by the proposed project(s).

.3 The following report was prepared by LRL Associates Ltd. (LRL) based on a survey conducted on September 9 and November 25, 2016. Since that time, designated substances may have been removed from or added to the project area.

.4 The scope of work for this project specific limited DSR involved a visual inspection of throughout the interior the building as well as the exterior finishes, which may present designated substances within the building materials and finishes. Lead based paints were not included in the scope of the project. Included in the scope of work was a visual survey for poly-chlorinated biphenyls (PCBs) and ozone depleting substances (ODS).

.1 An inspection was conducted for suspected asbestos containing materials (ACMs) and lead residue. Suspected ACMs and areas coated with lead residue from the site activities were identified. Representative samples of the suspected materials were submitted to an independent laboratory for testing.

.2 The surveys and visual inspections were limited to readily accessible areas by non-destructive means. Destructive testing was not included in the investigation, however, is recommended prior to any major demolition.

.5 Prior to beginning work, confirm with Engineer that additional designated substances have not been brought to the project area.

PART 2 DESIGNATED SUBSTANCES

2.1 Survey Results

.1 ACRYLONITRILE: Not Identified

.2 ARSENIC: Not Identified

.3 ASBESTOS: Not Identified

.1 A material is considered asbestos containing if it contains more than 0.5% asbestos fibres. Potential asbestos containing material was identified in the survey area; therefore between one (1) and seven (7) samples of each suspected asbestos containing material were collected as per O. Reg. 278/05, as amended. Test results of suspected asbestos containing materials collected are located at the end of this section. Copies of the laboratory analysis are included in **Annex A**.

.2 All friable material or suspected asbestos containing material encountered during the work that have not been identified during the initial surveys, must be considered as containing asbestos unless analysis shows otherwise.

.3 Below is a summary of potential asbestos containing materials:

.1 Piping: Piping identified in the area surveyed was either not insulated or was insulated with fibreglass.

.2 Air Handling Units: Air handling units identified in the area surveyed were either not insulated or was insulated with fibreglass.

.3 Hard Plasters: Hard plasters, including joint compound or textured finishes were not encountered.

.4 Tanks & Vessels: No tanks or vessels were identified.

.5 Acoustic Ceiling Tiles: No ceiling tiles were identified in the area surveyed. 0.6 m by 1.2 m suspended acoustic ceiling tiles were encountered across the majority of the building.

.6 Sprayed or Trowelled Fireproofing: Fireproofing materials were identified above select suspended ceiling tiles encountered.

.7 Transite Panels: No transite paneling was identified.

.8 Vinyl and Sheet Flooring: Vinyl sheet flooring as well as 0.3 m by 0.3 m dark blue and light blue vinyl tiles was identified.

.9 Other: Mortar and grout was encountered between masonry block walls located throughout the building and between the exterior brick veneer, and the grout between the 0.3 and 0.3 m ceramic floor tiles in the northern portion of the building. Sound-proofing was observed across the ceiling and walls of select locations of the site. Sealant/caulking was encountered around the exterior door frames and window throughout the building, along work benches and select walls throughout the interior of the site.

.4 Should material resembling spray or trowel applied asbestos or any other designated substance be encountered during the course of any project carried out at this building, the contractor shall stop work, take preventative measures, and notify the Engineer/Consultant in charge immediately. Do not proceed until written instructions have been received stating proper procedures to be followed.

Table 1 Summary of sample collected and analysed for asbestos.

Type of Material	Description	Sample Number	Asbestos Content (%)
Vinyl Flooring	Dark blue with yellow mastic	VF1 (A-C)	<0.5
Vinyl Tiles	Dark blue	VT1 (A-C)	<0.5
Vinyl Tiles	Light blue	VT2 (A-C)	<0.5
Acoustic Ceiling Tiles	Beige	AC1 (A-C)	<0.5
Mortar	Grey	MO1 (A-G)	<0.5
Mortar	Grey	MO2 (A-G)	<0.5
Mortar	Beige	MO3 (A-C)	<0.5
Mortar	Grey	MO4 (A-C)	<0.5
Fire-proofing	Beige-grey	FP1 (A-C)	<0.5
Sound-proofing	Black	SP1 (A-C)	<0.5
Caulking	Light-grey	CA1 (A-C)	<0.5
Mortar	White	CA2 (A-C)	<0.5
Mortar	Clear	CA4 (A-C)	<0.5

Notes

(A-C…) Replicate sample collected of homogenous material.
CH Chrysotile Asbestos

.4 BENZENE: Not Identified

.5 COKE OVEN EMISSIONS: Not Identified

.6 ETHYLENE OXIDE: Not Identified

.7 ISOCYANATES: Not Identified

.8 LEAD: Identified

In 1976, the Canadian federal government limited the concentration of lead in interior and exterior paints as well as additional liquid coating to a maximum of 5000 ppm. The Hazardous Products Act, 2005, limited the acceptable concentration of lead content to surface coating materials to 600 ppm. This concentration was updated in October 2010 to a maximum limit of 90 ppm and is located in the Surface Coating Materials Regulation (SOR/2005-109).

The occupational exposure limit for elemental, inorganic and organic compounds of lead, as specified under the occupational health and safety act (O. Reg. 490/09,

Designated Substances), equals 0.05 milligrams per cubic metre (mg/m^3) of air as an 8-hour daily or 40-hour weekly time-weighted average limit.

The Ministry of Labour (MOL) guideline, *Lead on Construction Projects*, 2011, provides measures and procedures that should be followed during construction projects when lead-containing materials are present. Construction activities that include handling lead-containing material are grouped into three (3) individual categories based on the presumed airborne concentrations that could be released during the work. The categories are as follows:

- Type 1 (low risk) when concentrations less than 0.05 mg/m^3;
- Type 2 (medium risk) when concentrations are between greater than 0.05 and less than 1.25 mg/m^3. This category is separated into two (2) sub-categories (Type 2a and Type 2b); and
- Type 3 (high risk) when concentrations are between 1.25 mg/m^3 and 2.5 mg/m^3. This category is separated into two (2) sub-categories (Type 3a and Type 3b).

.1 At the time of LRLs site visit on September 9, 2016, dust was observed within the ammunition collection and storage area, namely on the interior of the door from the debris loading area to the exterior storage area., as well as across the ceiling of the IFR. It is understood that the dust is likely composed primarily of lead residue from the IFR and associated disposal of waste produced.

.2 Samples were not collected to confirm the presence of lead residue on the building surface; rather it is assumed that it is present in high concentrations (i.e. would generate lead concentrations greater than 2.5 mg/m^3 when disturbed) across all surfaces of the IFR, including interior walls and interior faces of exterior doors and duct work in contact with the ceiling and adjoining walls.

.3 According to published information by Health Canada concerning lead-based paints, buildings constructed after 1980 should have no concern of lead levels in interior paints but lead could still be found in some exterior paints. However after 1992, all consumer paints produced in Canada and the U.S. were virtually lead free.

.9 MERCURY: Not Identified

.1 Mercury liquid may be present inside thermostats and mechanical switches. No thermostats were identified in the work area.

.2 Mercury vapours may be present inside fluorescent light tubes found in the work area.

.10 SILICA: Identified

Based on the history of the composition of building materials, it is possible that crystalline silica is present in the joint compound as part of the scope of this project as well as the main structural components of the building envelope and flooring (cement).

.11 VINYL CHLORIDE: Not Identified

.12 POLYCHLORINATED BIPHENYLS (PCBs): Not Identified

Although PCBs are not a designated substance under the Ontario Ministry of Labour's (MOL) regulations, they are subject to Ontario Ministry of Environment and to Environment Canada regulations and are therefore included in this report. The use of PCBs in electrical equipment such as transformers and capacitors, including capacitors found in fluorescent lamp ballasts, was common up to the 1980's. It is noted that the building post-dates the prohibition on PCBs.

.1 Fluorescent light fixtures were identified in select locations throughout the building.

.2 As mentioned above, the building post-dates the prohibition on PCB's, however for precautionary measures, when removing light ballasts, they should be inspected for labelling indicating that they do not contain PCBs or cross referenced with manufacture's information to confirm the presence or absence of PCBs. Lamp ballasts can be compared to Environment Canada's Environmental Protection Series Identification of Lamp Ballasts Containing PCBs, Report EPS 2/CC/2 (revised), August 1991. If the ballasts cannot be confirmed to be PCB free, they should be assumed to be PCBs containing and disposed as such in accordance to O/Reg. 347/09, as amended.

.13 OZONE DEPLETING SUBSTANCES (ODS): Not Identified

.1 Although not observed, it is assumed that fire extinguishers are present throughout the site. They may contain ozone-depleting substances.

2.2 RECOMMENDATIONS

.1 ASBESTOS

The Public Services and Procurement Canada's Asbestos Management Standard sets out requirements regarding operational and technical activities required to be carried out for the management of asbestos-containing material. All work must be done in accordance with this standard, as well as all other applicable legislation.

ACMs were not identified in the project area during this investigation. All friable material or suspected ACM encountered during the work that have not been identified during the initial survey, must be considered as containing asbestos unless analysis shows otherwise.

Disturbance of all asbestos (whether friable or non-friable) is regulated by O. Reg. 490/09 and Reg. 278/05, as amended, which outlines the construction practices involving asbestos containing materials. Therefore, appropriate respiratory protection and ventilation must be utilized during demolition or disturbance of any asbestos containing materials in accordance with this regulation.

.2 LEAD

The Ministry of Labour (MOL) guideline, *Lead on Construction Projects*, 2011, provides measures and procedures that should be followed during construction projects when lead-containing materials are present. Construction activities that include handling lead-containing material are grouped into three (3) individual categories based on the presumed airborne concentrations that could be released during the work.

It is anticipated that during the proposed construction activities, surfaces identified as being lead containing will be encountered (i.e. the acoustic ceiling tiles and baffles, as well as duct work, floors and walls). As it is assumed that these surfaces are covered in lead residues. Available options for the handling of the presumed lead containing material include Type 3 Operations outlined in MOL's "Guideline: Lead on Construction Projects" and ensure lead (fumes or dust) not exceed the Time Weighted Average Exposure Value (TWAEV) of 0.05 mg/m^3, or cleaning of surfaces to remove suspected lead residue. Specifications for the removal of the lead containing materials using Type 3 procedures are provided in **Annex B**.

Any disturbance of these structures should be treated with caution and the following procedures should be considered. Associated personal protection equipment (PPE) and precautions required by the Ministry of Labour Occupational Health and Safety Act requirements for construction projects including Regulation 843 as amended by Regulation 109/04, must be enforced when the activities are underway including respiratory requirements, containments and disposal of building materials assumed to be lead containing. It should be noted that if the building surfaces suspected of containing lead residue are cleaned accordingly, and subsequent testing confirms that

the materials are not lead containing, special precautions associated with lead containing materials would no longer be required.

If any paint or surface found to be in contact with the inferred lead residue found in the IFR and adjoin ammunition room and waste disposal area, are uncovered in the project area which was not previously tested and reported as part of this investigation, it should be considered as lead based, until analytical testing confirms otherwise. This includes duct work and adjoining walls.

.3 MERCURY

Mercury is governed by O. Reg. 490/90, as amended, under the Occupational Health and Safety Act. The regulation provides requirement for allowable exposure levels. In addition, mercury waste is considered a hazardous waste under O. Reg. 347, as amended of the Ontario Environmental Protection Act. During renovation projects, mercury equipment and all suspected mercury-containing materials should be collected and properly stored. If they are not to be reused, they should be disposed of according to O. Reg. 347/90, as amended.

.4 SILICA

Silica occurs naturally as crystalline material in cement. Crystalline silica is significantly more toxic than amorphous silica, therefore for health reasons; only crystalline varieties are regulated under O. Reg. 490/09, as amended of the Occupational Health and Safety Act.

Silica dust can be generated through such processes as blasting, grinding, crushing and sandblasting silica-containing material identified in Section 2.1.10. Therefore, appropriate respiratory protection, and ventilation must be utilized during the demolition and modification of these structures. The MOL's document "*Guideline – Silica on Construction Projects*" has become an industry standard for protecting workers from silica exposure. This document outlines method for controlling silica hazard and offers classification criteria and measures and procedures for different types of operations.

.5 POLYCHLORINATED BIPHENYLS (PCBs)

PCBs are not recognized as a Designated Substance; however, a survey of the rooms was completed. Ballasts from a typical 1.2 meter fluorescent light fixture contain approximately 23.6 grams of PCBs.

As mentioned herein, fluorescent light ballasts have been identified in the specified area however it was not confirmed if all fixtures were considered as containing PCBs. Two (2) light fixtures in this area was inspected, two ballasts were observed, both indicating that they do not contain PCBs.

When removing the light ballasts, they should be inspected for labelling indicating that they do not contain PCBs or cross referenced with manufacturer's information to confirm the presence or absence of PCBs. Lamp ballasts can be compared to Environment Canada's Environmental Protection Series Identification of Lamp Ballasts Containing PCBs, Report EPS 2/CC/2 (revised), August 1991. If the ballasts cannot be confirmed to be PCB free, they should be assumed to be PCBs containing and disposed as such in accordance to O. Reg. 347/90, as amended and disposed of in accordance with:

- Canadian Environmental Protection Act,
- Canadian Council of Ministers of the Environment, and

Guidelines for the Management of Wastes Containing Polychlorinated Biphenyls

.6 OZONE DEPLETING SUBSTANCES

Halocarbons are commonly used as cooling agents in refrigeration systems, air conditioning equipment and fire extinguishers. As noted herein, there are fire

extinguishers present that contain ODS.

The maintenance or decommissioning of these equipment should only be performed by licensed technicians. Regulations require that any equipment ODS (CFCs and HCFCs) must be certified emptied before they can be disposed. Disposing of these substances should conform to the Ontario Environmental Protection Act, Reg. 189/94 for refrigerants, Ozone Depleting Substances Regulations and the Code of Practice for the Elimination of Fluorocarbon Emission from refrigeration and air conditioning systems.

PART 3 – CONTRACTOR DUTIES

.1 The contractor must review the designated substance report and take the necessary precautions to protect the health and safety of the workers and the environment. As per s.30 (4) of the *Ontario Occupational Health and Safety Act*, the party hiring the contractor (i.e. the Engineer) shall ensure that the contractor and subcontractor (if any) for the project has received a copy of the designated substance report prior to entering a binding contract for the supply of work on the project. As per s. 27 (2) (a,b,c) of the Ontario Occupational Health and Safety Act and s. 124 of *Canada Labour Code, Part II*, while on site, the contractor supervisor shall take every reasonable precaution in the protection of a worker. If you have any questions about the designated substance report, please contact the Engineer.

.2 If potentially hazardous materials are identified that are not identified in the survey, work should stop immediately until the materials are sampled to properly identify them and determine their means of disposal.

PART 4 - EXECUTION

Not Applicable

*****************END OF SECTION****************

Annex A

Laboratory Certificates of Analysis

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

LRL Associates Ltd.

5430 Canotek Road
Ottawa, ON K1J 9G2
Attn: Jessica Arthurs

Client PO:
Project: 160757
Custody: 18420

Report Date: 7-Dec-2016
Order Date: 1-Dec-2016

Order #: 1649368

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1649368-01	VF1-A
1649368-02	VF1-B
1649368-03	VF1-C
1649368-04	VT2-A
1649368-05	VT2-B
1649368-06	VT2-C
1649368-07	AC1-A
1649368-08	AC1-B
1649368-09	AC1-C
1649368-10	MO2-A
1649368-11	MO2-B
1649368-12	MO2-C
1649368-13	MO2-D
1649368-14	MO2-E
1649368-15	MO2-F
1649368-16	MO2-G
1649368-17	MO4-A
1649368-18	MO4-B
1649368-19	MO4-C
1649368-20	MO3-A
1649368-21	MO3-B
1649368-22	MO3-C
1649368-23	VT1-A
1649368-24	VT1-B
1649368-25	VT1-C
1649368-26	FP1-A

Approved By:

Emma Diaz

Senior Analyst

1649368-27	FP1-B
1649368-28	FP1-C
1649368-29	SP1-A
1649368-30	SP1-B
1649368-31	SP1-C
1649368-32	CA4-A
1649368-33	CA4-B
1649368-34	CA4-C
1649368-35	MO1-A
1649368-36	MO1-B
1649368-37	MO1-C
1649368-38	MO1-D
1649368-39	MO1-E
1649368-40	MO1-F
1649368-41	MO1-G
1649368-42	CA1-A
1649368-43	CA1-B
1649368-44	CA1-C
1649368-45	CA2-A
1649368-46	CA2-B
1649368-47	CA2-C
1649368-48	AC2-A
1649368-49	AC2-B
1649368-50	AC2-C
1649368-51	VF2-A (Tile)
1649368-52	VF2-B (Tile)
1649368-53	VF2-C (Tile)
1649368-54	VF2-A (Rope)
1649368-55	VF2-B (Rope)
1649368-56	VF2-C (Rope)
1649368-57	JC1-A
1649368-58	JC1-B
1649368-59	JC1-C
1649368-60	MO6-A
1649368-61	MO6-B
1649368-62	MO6-C
1649368-63	MO6-D
1649368-64	MO6-E
1649368-65	MO6-F
1649368-66	MO6-G
1649368-67	CA9-A
1649368-68	CA9-B
1649368-69	CA9-C
1649368-70	MO4-A

1649368-71	MO4-B
1649368-72	MO4-C
1649368-73	VF4-A
1649368-74	VF4-B
1649368-75	VF4-C
1649368-76	CA7-A
1649368-77	CA7-B
1649368-78	CA7-C
1649368-79	VF3-A (Floor)
1649368-80	VF3-B (Floor)
1649368-81	VF3-C (Floor)
1649368-82	VF3-A (Rope)
1649368-83	VF3-B (Rope)
1649368-84	VF3-C (Rope)
1649368-85	MO5-A
1649368-86	MO5-B
1649368-87	MO5-C
1649368-88	CA10-A
1649368-89	CA10-B
1649368-90	CA10-C
1649368-91	CA6-A
1649368-92	CA6-B
1649368-93	CA6-C
1649368-94	CA5-A
1649368-95	CA5-B
1649368-96	CA5-C
1649368-97	AC3-A
1649368-98	AC3-B
1649368-99	AC3-C
1649368-AA	CA11-A
1649368-AB	CA11-B
1649368-AC	CA11-C
1649368-AD	MO7-A
1649368-AE	MO7-B
1649368-AF	MO7-C
1649368-AG	MO8-A
1649368-AH	MO8-B
1649368-AI	MO8-C
1649368-AJ	MO8-D
1649368-AK	MO8-E
1649368-AL	MO8-F
1649368-AM	MO8-G
1649368-AN	JC2-A
1649368-AO	JC2-B

1649368-AP	JC2-C
1649368-AQ	JC2-D
1649368-AR	JC2-E
1649368-AS	JC2-F
1649368-AT	JC2-G
1649368-AU	MO9-A
1649368-AV	MO9-B
1649368-AW	MO9-C
1649368-AX	AS2-A
1649368-AY	AS2-B
1649368-AZ	AS2-C
1649368-BA	AS1-A
1649368-BB	AS1-B
1649368-BC	AS1-C
1649368-BD	AS3-A
1649368-BE	AS3-B
1649368-BF	AS3-C
1649368-BG	JC1-D
1649368-BH	JC1-E
1649368-BI	JC1-F
1649368-BJ	JC1-G

Certificate of Analysis
Client: LRL Associates Ltd.
Client PO:

Report Date: 07-Dec-2016
Order Date: 1-Dec-2016
Project Description: 160757

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1649368-01	25-Nov-16	sample homogenized	Blue/Yellow	Floor Tile/Mastic	No	**Client ID: VF1-A** [ASLYR, AS-PRE]	
						MMVF	5
						Non-Fibers	95
1649368-02	25-Nov-16	sample homogenized	Blue/Yellow	Floor Tile/Mastic	No	**Client ID: VF1-B** [ASLYR, AS-PRE]	
						MMVF	5
						Non-Fibers	95
1649368-03	25-Nov-16	sample homogenized	Blue/Yellow	Floor Tile/Mastic	No	**Client ID: VF1-C** [ASLYR, AS-PRE]	
						MMVF	5
						Non-Fibers	95
1649368-04	25-Nov-16	sample homogenized	Blue	Floor Tile	No	**Client ID: VT2-A** [AS-PRE]	
						Non-Fibers	100
1649368-05	25-Nov-16	sample homogenized	Blue	Floor Tile	No	**Client ID: VT2-B** [AS-PRE]	
						Non-Fibers	100
1649368-06	25-Nov-16	sample homogenized	Blue/Black	Floor Tile/Mastic	No	**Client ID: VT2-C** [ASLYR, AS-PRE]	
						Non-Fibers	100
1649368-07	25-Nov-16	sample homogenized	Beige	Ceiling Tile	No	**Client ID: AC1-A** [AS-PRE]	
						Cellulose	73.08
						MMVF	6.92
						Non-Fibers	20
1649368-08	25-Nov-16	sample homogenized	Beige	Ceiling Tile	No	**Client ID: AC1-B** [AS-PRE]	
						Cellulose	72.82
						MMVF	7.18
						Non-Fibers	20
1649368-09	25-Nov-16	sample homogenized	Beige	Ceiling Tile	No	**Client ID: AC1-C** [AS-PRE]	
						Cellulose	72.88
						MMVF	7.12
						Non-Fibers	20
1649368-10	25-Nov-16	sample homogenized	Grey	Mortar	No	**Client ID: MO2-A**	
						Non-Fibers	100
1649368-11	25-Nov-16	sample homogenized	Grey	Mortar	No	**Client ID: MO2-B**	
						Non-Fibers	100
1649368-12	25-Nov-16	sample homogenized	Grey	Mortar	No	**Client ID: MO2-C**	
						Non-Fibers	100
1649368-13	25-Nov-16	sample homogenized	Grey	Mortar	No	**Client ID: MO2-D**	
						Non-Fibers	100

Certificate of Analysis
Client: LRL Associates Ltd.
Client PO:

Report Date: 07-Dec-2016
Order Date: 1-Dec-2016
Project Description: 160757

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1649368-14	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO2-E	
						Non-Fibers	100
1649368-15	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO2-F	
						Non-Fibers	100
1649368-16	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO2-G	
						Non-Fibers	100
1649368-17	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO4-A	
						Non-Fibers	100
1649368-18	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO4-B	
						Non-Fibers	100
1649368-19	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO4-C	
						Non-Fibers	100
1649368-20	25-Nov-16	sample homogenized	Beige	Mortar	No	Client ID: MO3-A	
						Non-Fibers	100
1649368-21	25-Nov-16	sample homogenized	Beige	Mortar	No	Client ID: MO3-B	
						Non-Fibers	100
1649368-22	25-Nov-16	sample homogenized	Beige	Mortar	No	Client ID: MO3-C	
						Non-Fibers	100
1649368-23	25-Nov-16	sample homogenized	Blue	Floor Tile	No	Client ID: VT1-A [AS-PRE]	
						Non-Fibers	100
1649368-24	25-Nov-16	sample homogenized	Blue	Floor Tile	No	Client ID: VT1-B [AS-PRE]	
						Non-Fibers	100
1649368-25	25-Nov-16	sample homogenized	Blue	Floor Tile	No	Client ID: VT1-C [AS-PRE]	
						Non-Fibers	100
1649368-26	25-Nov-16	sample homogenized	Grey	Fireproofing	No	Client ID: FP1-A	
						MMVF	60
						Non-Fibers	40
1649368-27	25-Nov-16	sample homogenized	Grey	Fireproofing	No	Client ID: FP1-B	
						MMVF	60
						Non-Fibers	40
1649368-28	25-Nov-16	sample homogenized	Grey	Fireproofing	No	Client ID: FP1-C	
						MMVF	60
						Non-Fibers	40
1649368-29	25-Nov-16	sample homogenized	Black	Tar	No	Client ID: SP1-A [AS-PRE]	
						Non-Fibers	100

PARACEL LABORATORIES LTD.

Order #: 1649368

Certificate of Analysis
Client: LRL Associates Ltd.
Client PO:

Report Date: 07-Dec-2016
Order Date: 1-Dec-2016
Project Description: 160757

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1649368-30	25-Nov-16	sample homogenized	Black	Tar	No	Client ID: SP1-B [AS-PRE]	
						Non-Fibers	100
1649368-31	25-Nov-16	sample homogenized	Black	Tar	No	Client ID: SP1-C [AS-PRE]	
						Non-Fibers	100
1649368-32	25-Nov-16	sample homogenized	Colorless	Caulking	No	Client ID: CA4-A [AS-PRE]	
						Non-Fibers	100
1649368-33	25-Nov-16	sample homogenized	Colorless	Caulking	No	Client ID: CA4-B [AS-PRE]	
						Non-Fibers	100
1649368-34	25-Nov-16	sample homogenized	Colorless	Caulking	No	Client ID: CA4-C [AS-PRE]	
						Non-Fibers	100
1649368-35	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO1-A	
						Non-Fibers	100
1649368-36	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO1-B	
						Non-Fibers	100
1649368-37	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO1-C	
						Non-Fibers	100
1649368-38	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO1-D	
						Non-Fibers	100
1649368-39	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO1-E	
						Non-Fibers	100
1649368-40	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO1-F	
						Non-Fibers	100
1649368-41	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO1-G	
						Non-Fibers	100
1649368-42	25-Nov-16	sample homogenized	Grey	Caulking	No	Client ID: CA1-A [AS-PRE]	
						Non-Fibers	100
1649368-43	25-Nov-16	sample homogenized	Grey	Caulking	No	Client ID: CA1-B [AS-PRE]	
						Non-Fibers	100
1649368-44	25-Nov-16	sample homogenized	Grey	Caulking	No	Client ID: CA1-C [AS-PRE]	
						Non-Fibers	100
1649368-45	25-Nov-16	sample homogenized	White	Caulking	No	Client ID: CA2-A [AS-PRE]	
						Non-Fibers	100
1649368-46	25-Nov-16	sample homogenized	White	Caulking	No	Client ID: CA2-B [AS-PRE]	
						Non-Fibers	100

Certificate of Analysis
Client: LRL Associates Ltd.
Client PO:

Report Date: 07-Dec-2016
Order Date: 1-Dec-2016
Project Description: 160757

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1649368-47	25-Nov-16	sample homogenized	White	Caulking	No	**Client ID: CA2-C** [AS-PRE]	
						Non-Fibers	100
1649368-48	25-Nov-16	sample homogenized	Grey	Ceiling Tile	No	**Client ID: AC2-A**	
						MMVF	50
						Non-Fibers	50
1649368-49	25-Nov-16	sample homogenized	Grey	Ceiling Tile	No	**Client ID: AC2-B**	
						MMVF	50
						Non-Fibers	50
1649368-50	25-Nov-16	sample homogenized	Grey	Ceiling Tile	No	**Client ID: AC2-C**	
						MMVF	50
						Non-Fibers	50
1649368-51	25-Nov-16	sample homogenized	Blue	Floor Tile	No	**Client ID: VF2-A (Tile)** [AS-PRE]	
						Non-Fibers	100
1649368-52	25-Nov-16	sample homogenized	Blue	Floor Tile	No	**Client ID: VF2-B (Tile)** [AS-PRE]	
						Non-Fibers	100
1649368-53	25-Nov-16	sample homogenized	Blue	Floor Tile	No	**Client ID: VF2-C (Tile)** [AS-PRE]	
						Non-Fibers	100
1649368-54	25-Nov-16	sample homogenized	Brown	Burlap Backing	No	**Client ID: VF2-A (Rope)** [AS-PRE]	
						Cellulose	95
						Non-Fibers	5
1649368-55	25-Nov-16	sample homogenized	Brown	Burlap Backing	No	**Client ID: VF2-B (Rope)** [AS-PRE]	
						Cellulose	95
						Non-Fibers	5
1649368-56	25-Nov-16	sample homogenized	Brown	Burlap Backing	No	**Client ID: VF2-C (Rope)** [AS-PRE]	
						Cellulose	95
						Non-Fibers	5
1649368-57	25-Nov-16	sample homogenized	White	Drywall Joint Compound	No	**Client ID: JC1-A**	
						Non-Fibers	100
1649368-58	25-Nov-16	sample homogenized	White	Drywall Joint Compound	No	**Client ID: JC1-B**	
						Non-Fibers	100
1649368-59	25-Nov-16	sample homogenized	White	Drywall Joint Compound	No	**Client ID: JC1-C**	
						Non-Fibers	100
1649368-60	25-Nov-16	sample homogenized	Grey	Mortar	No	**Client ID: MO6-A**	
						Non-Fibers	100

Certificate of Analysis
Client: LRL Associates Ltd.
Client PO:

Report Date: 07-Dec-2016
Order Date: 1-Dec-2016
Project Description: 160757

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1649368-61	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO6-B	
						Non-Fibers	100
1649368-62	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO6-C	
						Non-Fibers	100
1649368-63	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO6-D	
						Non-Fibers	100
1649368-64	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO6-E	
						Non-Fibers	100
1649368-65	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO6-F	
						Non-Fibers	100
1649368-66	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO6-G	
						Non-Fibers	100
1649368-67	25-Nov-16	sample homogenized	Black	Caulking	No	Client ID: CA9-A [AS-PRE]	
						Non-Fibers	100
1649368-68	25-Nov-16	sample homogenized	Black	Caulking	No	Client ID: CA9-B [AS-PRE]	
						Non-Fibers	100
1649368-69	25-Nov-16	sample homogenized	Black	Caulking	No	Client ID: CA9-C [AS-PRE]	
						Non-Fibers	100
1649368-70	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO4-A	
						Non-Fibers	100
1649368-71	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO4-B	
						Non-Fibers	100
1649368-72	25-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO4-C	
						Non-Fibers	100
1649368-73	25-Nov-16	sample homogenized	Beige	Floor Tile	No	Client ID: VF4-A [AS-PRE]	
						Non-Fibers	100
1649368-74	25-Nov-16	sample homogenized	Beige	Floor Tile	No	Client ID: VF4-B [AS-PRE]	
						Non-Fibers	100
1649368-75	25-Nov-16	sample homogenized	Beige	Floor Tile	No	Client ID: VF4-C [AS-PRE]	
						Non-Fibers	100
1649368-76	25-Nov-16	sample homogenized	Grey	Caulking	No	Client ID: CA7-A [AS-PRE]	
						Non-Fibers	100
1649368-77	25-Nov-16	sample homogenized	Grey	Caulking	No	Client ID: CA7-B [AS-PRE]	
						Non-Fibers	100

Certificate of Analysis
Client: LRL Associates Ltd.
Client PO:

Report Date: 07-Dec-2016
Order Date: 1-Dec-2016
Project Description: 160757

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1649368-78	25-Nov-16	sample homogenized	Grey	Caulking	No	Client ID: CA7-C [AS-PRE]	
						Non-Fibers	100
1649368-79	25-Nov-16	sample homogenized	Grey	Floor Tile	No	Client ID: VF3-A (Floor) [AS-PRE]	
						Non-Fibers	100
1649368-80	25-Nov-16	sample homogenized	Grey	Floor Tile	No	Client ID: VF3-B (Floor) [AS-PRE]	
						Non-Fibers	100
1649368-81	25-Nov-16	sample homogenized	Grey	Floor Tile	No	Client ID: VF3-C (Floor) [AS-PRE]	
						Non-Fibers	100
1649368-82	25-Nov-16	sample homogenized	Brown	Burlap Backing	No	Client ID: VF3-A (Rope) [AS-PRE]	
						Cellulose	95
						Non-Fibers	5
1649368-83	25-Nov-16	sample homogenized	Brown	Burlap Backing	No	Client ID: VF3-B (Rope) [AS-PRE]	
						Cellulose	95
						Non-Fibers	5
1649368-84	25-Nov-16	sample homogenized	Brown	Burlap Backing	No	Client ID: VF3-C (Rope) [AS-PRE]	
						Cellulose	95
						Non-Fibers	5
1649368-85	25-Nov-16	sample homogenized	White	Mortar	No	Client ID: MO5-A	
						Non-Fibers	100
1649368-86	25-Nov-16	sample homogenized	White	Mortar	No	Client ID: MO5-B	
						Non-Fibers	100
1649368-87	25-Nov-16	sample homogenized	White	Mortar	No	Client ID: MO5-C	
						Non-Fibers	100
1649368-88	25-Nov-16	sample homogenized	White	Caulking	No	Client ID: CA10-A [AS-PRE]	
						MMVF	<MDL
						Non-Fibers	100
1649368-89	25-Nov-16	sample homogenized	White	Caulking	No	Client ID: CA10-B [AS-PRE]	
						MMVF	0.64
						Non-Fibers	99.36
1649368-90	25-Nov-16	sample homogenized	White	Caulking	No	Client ID: CA10-C [AS-PRE]	
						MMVF	0.65
						Non-Fibers	99.35
1649368-91	25-Nov-16	sample homogenized	Grey	Caulking	No	Client ID: CA6-A [AS-PRE]	
						Non-Fibers	100

Certificate of Analysis
Client: LRL Associates Ltd.
Client PO:

Report Date: 07-Dec-2016
Order Date: 1-Dec-2016
Project Description: 160757

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1649368-92	25-Nov-16	sample homogenized	Grey	Caulking	No	Client ID: CA6-B [AS-PRE]	
						Non-Fibers	100
1649368-93	25-Nov-16	sample homogenized	Grey	Caulking	No	Client ID: CA6-C [AS-PRE]	
						Non-Fibers	100
1649368-94	25-Nov-16	sample homogenized	Black	Caulking	No	Client ID: CA5-A [AS-PRE]	
						Non-Fibers	100
1649368-95	25-Nov-16	sample homogenized	Black	Caulking	No	Client ID: CA5-B [AS-PRE]	
						Non-Fibers	100
1649368-96	25-Nov-16	sample homogenized	Black	Caulking	No	Client ID: CA5-C [AS-PRE]	
						Non-Fibers	100
1649368-97	25-Nov-16	sample homogenized	Grey	Ceiling Tile	No	Client ID: AC3-A [AS-PRE]	
						Cellulose	50
						MMVF	10
						Non-Fibers	40
1649368-98	25-Nov-16	sample homogenized	Grey	Ceiling Tile	No	Client ID: AC3-B [AS-PRE]	
						Cellulose	50
						MMVF	10
						Non-Fibers	40
1649368-99	25-Nov-16	sample homogenized	Grey	Ceiling Tile	No	Client ID: AC3-C [AS-PRE]	
						Cellulose	50
						MMVF	10
						Non-Fibers	40
1649368-AA	25-Nov-16	sample homogenized	White	Caulking	No	Client ID: CA11-A [AS-PRE]	
						Non-Fibers	100
1649368-AB	25-Nov-16	sample homogenized	White	Caulking	No	Client ID: CA11-B [AS-PRE]	
						Non-Fibers	100
1649368-AC	25-Nov-16	sample homogenized	White	Caulking	No	Client ID: CA11-C [AS-PRE]	
						Non-Fibers	100
1649368-AD	28-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO7-A	
						Non-Fibers	100
1649368-AE	28-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO7-B	
						Non-Fibers	100
1649368-AF	28-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO7-C	
						Non-Fibers	100

Certificate of Analysis
Client: LRL Associates Ltd.
Client PO:

Report Date: 07-Dec-2016
Order Date: 1-Dec-2016
Project Description: 160757

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1649368-AG	28-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO8-A	
						Non-Fibers	100
1649368-AH	28-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO8-B	
						Non-Fibers	100
1649368-AI	28-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO8-C	
						Non-Fibers	100
1649368-AJ	28-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO8-D	
						Non-Fibers	100
1649368-AK	28-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO8-E	
						Non-Fibers	100
1649368-AL	28-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO8-F	
						Non-Fibers	100
1649368-AM	28-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO8-G	
						Non-Fibers	100
1649368-AN	28-Nov-16	sample homogenized	White	Drywall Joint Compound	No	Client ID: JC2-A	
						Non-Fibers	100
1649368-AO	28-Nov-16	sample homogenized	White	Drywall Joint Compound	No	Client ID: JC2-B	
						Non-Fibers	100
1649368-AP	28-Nov-16	sample homogenized	White	Drywall Joint Compound	No	Client ID: JC2-C	
						Non-Fibers	100
1649368-AQ	28-Nov-16	sample homogenized	White	Drywall Joint Compound	No	Client ID: JC2-D	
						Non-Fibers	100
1649368-AR	28-Nov-16	sample homogenized	White	Drywall Joint Compound	No	Client ID: JC2-E	
						Non-Fibers	100
1649368-AS	28-Nov-16	sample homogenized	White	Drywall Joint Compound	No	Client ID: JC2-F	
						Non-Fibers	100
1649368-AT	28-Nov-16	sample homogenized	White	Drywall Joint Compound	No	Client ID: JC2-G	
						Non-Fibers	100
1649368-AU	28-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO9-A	
						Non-Fibers	100
1649368-AV	28-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO9-B	
						Non-Fibers	100
1649368-AW	28-Nov-16	sample homogenized	Grey	Mortar	No	Client ID: MO9-C	
						Non-Fibers	100

Certificate of Analysis

Client: LRL Associates Ltd.

Client PO:

Report Date: 07-Dec-2016

Order Date: 1-Dec-2016

Project Description: 160757

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1649368-AX	28-Nov-16	sample homogenized	Black	Roofing Material	No	**Client ID: AS2-A** [AS-PRE]	
						Non-Fibers	90
						Other fibers	10
1649368-AY	28-Nov-16	sample homogenized	Black	Roofing Material	No	**Client ID: AS2-B** [AS-PRE]	
						Non-Fibers	90
						Other fibers	10
1649368-AZ	28-Nov-16	sample homogenized	Black	Roofing Material	No	**Client ID: AS2-C** [AS-PRE]	
						Non-Fibers	90
						Other fibers	10
1649368-BA	28-Nov-16	sample homogenized	Black	Roofing Material	No	**Client ID: AS1-A** [AS-PRE]	
						MMVF	5
						Non-Fibers	90
						Other fibers	5
1649368-BB	28-Nov-16	sample homogenized	Black	Roofing Material	No	**Client ID: AS1-B** [AS-PRE]	
						MMVF	5
						Non-Fibers	90
						Other fibers	5
1649368-BC	28-Nov-16	sample homogenized	Black	Roofing Material	No	**Client ID: AS1-C** [AS-PRE]	
						MMVF	5
						Non-Fibers	90
						Other fibers	5
1649368-BD	28-Nov-16	sample homogenized	Black	Roofing Material	No	**Client ID: AS3-A** [AS-PRE]	
						Non-Fibers	90
						Other fibers	10
1649368-BE	28-Nov-16	sample homogenized	Black	Roofing Material	No	**Client ID: AS3-B** [AS-PRE]	
						Non-Fibers	90
						Other fibers	10
1649368-BF	28-Nov-16	sample homogenized	Black	Roofing Material	No	**Client ID: AS3-C** [AS-PRE]	
						Non-Fibers	90
						Other fibers	10
1649368-BG	25-Nov-16	sample homogenized	White	Drywall Joint Compound	No	**Client ID: JC1-D**	
						Non-Fibers	100
1649368-BH	25-Nov-16	sample homogenized	White	Drywall Joint Compound	No	**Client ID: JC1-E**	
						Non-Fibers	100

PARACEL LABORATORIES LTD.

Order #: 1649368

Certificate of Analysis
Client: LRL Associates Ltd.
Client PO:

Report Date: 07-Dec-2016
Order Date: 1-Dec-2016
Project Description: 160757

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1649368-BI	25-Nov-16	sample homogenized	White	Drywall Joint Compound	No	Client ID: JC1-F	
						Non-Fibers	100
1649368-BJ	25-Nov-16	sample homogenized	White	Drywall Joint Compound	No	Client ID: JC1-G	
						Non-Fibers	100

** MMVF: Man Made Vitreous Fibers: Fiberglass, Mineral Wool, Rockwool, Glasswool*

Analysis Summary Table

Analysis	Method Reference/Description	Lab Location	NVLAP Lab Code *	Analysis Date
Asbestos, PLM Visual Estimation	by EPA 600/R-93/116	2 - Ottawa West Lab	200812-0	6-Dec-16

** Reference to the NVLAP term does not permit the user of this report to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.*

Qualifier Notes

Sample Qualifiers :

ASLYR: Layers were noted for this sample, however, the entire sample was homogenized per client request.

AS-PRE: Due to the difficult nature of the bulk sample (interfering fibers/binders), additional NOB preparation was required prior to analysis

Work Order Revisions / Comments

None

Annex B

Type 3 Lead Removal Specifications

REFER TO SPECIFICATION SECTION 02 83 12 - LEAD CONTAINING MATERIAL ABATEMENT - MAXIMUM PRECAUTIONS

Part 1 General

1.1 ADMINISTRATIVE

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

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

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

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

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

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

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

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

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

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario.

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

.4 Allow 5 days for Departmental Representative's review of each submission.

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

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

.7 Accompany submissions with transmittal letter, containing:

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

.8 Submissions include:

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

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

.10 Submit PDF electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request. PDF files shall be scaled so that a 1:1 print produces properly scaled drawings. Provide paper copies as requested, up to 6 copies as requested.

.11 Submit PDF electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative

where shop drawings will not be prepared due to standardized manufacture of product. Provide paper copies as requested, up to 6 copies as requested.

.12 Submit PDF electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative. Provide paper copies as requested, up to 6 copies as requested.

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

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

.13 Submit PDF electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative. Provide paper copies as requested, up to 6 copies as requested.

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

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

.14 Submit PDF electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative. Provide paper copies as requested, up to 6 copies as requested.

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

.15 Submit PDF electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative. Provide paper copies as requested, up to 6 copies as requested.

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

.17 Submit PDF electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative. Provide paper copies as requested, up to 6 copies as requested.

.18 Delete information not applicable to project.

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

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

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

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

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

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

.2 Deliver samples prepaid to address(s) provided by Departmental Representative.

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

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

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

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

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

1.4 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic copy of colour digital photography in jpg format, fine resolution weekly and as directed by Departmental Representative

.2 Project identification: name and number of project and date of exposure indicated.

.3 Number of viewpoints: minimum 4 locations.

.1 Viewpoints and their location as determined by Departmental Representative.

.4 Frequency of photographic documentation: weekly and as directed by Departmental Representative, but to include completion of services prior to concealment, substrate behind acoustic materials and substantial completion.

1.5 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit WSIB status.

.2 Submit transcription of insurance immediately after award of Contract.

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 Occupational Health and Safety Act R.S.O. 1990, c. 0.1, and Regulations for Construction Projects O. Reg. 213/91, current edition.

.2 CAN/CSA, Z462-15 (Workplace Electrical Safety Standard)

.3 CAN/CSA-Z460-05 (R2010) - Control of Hazardous Energy.

1.2 SUBMITTALS

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

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

.1 Results of site specific safety hazard assessment.

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

.3 Written safe work procedures to address the known hazards.

.3 Submit three (3) copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.

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

.5 Submit copies of incident and accident reports within 24 hours after the event.

.6 Submit WHMIS MSDS - Material Safety Data Sheets to Departmental Representative.

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

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

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

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

1.3 FILING OF NOTICE

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

.2 Install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.4 SAFETY ASSESSMENT

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

1.5 MEETINGS

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

1.6 GENERAL REQUIREMENTS

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

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

1.7 RESPONSIBILITY

.1 Be responsible and assume the role of "Constructor" as described in the Ontario Occupational Health & Safety Act and Regulations for Construction Projects for only their scope and areas of work as defined in this Project Specification.

.2 Assume responsibility for health and safety of all other contractors present on site under the prescriptions of the present section.

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

1.8 COMPLIANCE REQUIREMENTS

.1 Comply with the Ontario Occupational Health and Safety Act, R.S.O. 1990, c. 0.1.

.2 Comply with the Ontario Regulations for Construction Projects, O. Reg. 213/91.

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

.4 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C.

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

1.9 UNFORSEEN HAZARDS

.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise Health and Safety co-ordinator and follow procedures in place for Employee's Right to Refuse Work and in accordance with Acts and Regulations

of Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.10 HEALTH AND SAFETY CO-ORDINATOR

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

.1 Have site-related working experience specific to activities associated with specified Work. Submit relevant experience to Departmental Representative.

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

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

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

.5 Be on site during execution of Work.

1.11 POSTING OF DOCUMENTS

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

1.12 CORRECTION OF NON-COMPLIANCE

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

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

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

1.13 BLASTING

.1 Blasting or other use of explosives is not permitted.

1.14 POWDER ACTUATED DEVICES

.1 Use powder actuated devices only after receipt of written permission from Departmental Representative.

1.15 WORK STOPPAGE

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

END OF SECTION

Part 1 General

1.1 INSPECTION

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

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

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

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

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative or Contractor subject to item 1.1.4 above.

.2 Provide equipment required for executing inspection and testing by appointed agencies.

.3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.

1.3 ACCESS TO WORK

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

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

1.4 PROCEDURES

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

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

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

1.5 REJECTED WORK

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

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

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

1.6 REPORTS

.1 Submit PDF electronic copies of inspection and test reports to Departmental Representative.

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

1.7 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

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

1.8 MOCK-UPS

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

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

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

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

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

.6 Remove mock-up at conclusion of Work or when acceptable to Departmental Representative.

.7 Mock-ups may remain as part of Work at the discretion of Departmental Representative.

1.9 MILL TESTS

.1 Submit mill test certificates as requested and required of specification Sections.

1.10 EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

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 Standards Association (CSA International)

.1 CAN/CSA-S269.2-16, Access Scaffolding for Construction Purposes.

.2 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', latest version.

1.2 SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

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

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

.3 Indicate use of supplemental or other staging area.

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

.5 Remove from site all such work after use.

1.4 SCAFFOLDING

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

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

1.5 HOISTING

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

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

1.6 SITE STORAGE/LOADING

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

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

1.7 CONSTRUCTION PARKING

.1 Parking will be permitted on site subject to approval of location and quantity by Departmental Representative, and provided it does not disrupt performance of Work and other Departmental Representative activities.

.2 Provide and maintain adequate access to project site.

1.8 SECURITY

.1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.9 OFFICES

.1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.

.2 Maintain a complete and updated set of all contract documents and approved submittals, including, but no limited to, drawings, specifications, addenda, shop drawings, site instructions, change orders

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

.4 Subcontractors to provide their own offices as necessary. Direct location of these offices.

1.10 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

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

1.11 SANITARY FACILITIES

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

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

1.12 CONSTRUCTION SIGNAGE

.1 No advertising will be permitted on site.

.2 Signs and notices for safety and instruction in both official languages. Graphic symbols to CAN/CSA-Z321.

.3 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Departmental Representative.

1.13 CLEAN-UP

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

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Refer to Civil.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Conform to reference standards in whole or in part as specifically requested in specifications.

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

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

1.2 QUALITY

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

.2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.

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

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

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

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

1.3 STORAGE, HANDLING AND PROTECTION

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

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

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

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

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

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

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

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

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

1.4 TRANSPORTATION

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

.2 Transportation cost of products supplied by Departmental Representative will be paid for by Departmental Representative. Unload, handle and store such products.

1.5 MANUFACTURER'S INSTRUCTIONS

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

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

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

1.6 QUALITY OF WORK

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

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

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

1.7 CO-ORDINATION

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

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

1.8 CONCEALMENT

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

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

1.9 REMEDIAL WORK

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

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

1.10 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate and subject to relocation prior to installation within a radius of up to 3000mm from the location shown to suit site conditions, interferences or other conditions determined by the Departmental Representative.

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

1.11 FASTENINGS

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

.2 Prevent electrolytic action between dissimilar metals and materials.

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

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

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

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

1.12 FASTENINGS - EQUIPMENT

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

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

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

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

1.13 PROTECTION OF WORK IN PROGRESS

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

1.14 EXISTING UTILITIES

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

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

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 SUBMITTALS

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

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

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

.3 Include in request:

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

1.2 MATERIALS

.1 Required for original installation.

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

1.3 PREPARATION

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

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

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

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

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

1.4 EXECUTION

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

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

.3 Uncover Work to install ill-timed Work.

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

.5 Remove samples of installed Work for testing as requested.

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

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

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

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

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

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

.12 Seal all penetrations through exterior wall and roof liner panels.

.13 Seal penetrations in wall, ceiling, or floor fire separations in accordance with applicable ULC listed firestop assemblies to maintain the integrity and indicated rating of the fire separation. Provide submittals for proposed firestop assemblies prior to installation for approval by Departmental Representative. Where ULC listed firestop assemblies are not available to suit site conditions, provide Engineering Judgment.

.14 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material full thickness of the construction element.

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

.16 Conceal pipes, ducts and wiring in floor, wall and ceiling construction.

1.5 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 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Waste Management Goals

.1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss Waste Management Plan and Goals.

.2 Waste Management Goal 75 percent of total Project Waste to be diverted from landfill sites. Provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.

.3 Accomplish maximum control of solid construction waste.

.4 Preserve environment and prevent pollution and environment damage.

.5 Waste materials (i.e. materials that cannot be reused, refurbished or recycled) will be properly labelled, stored, transported and disposed in compliance with the requirements of all applicable rules and regulations of Federal, Provincial and Municipal authorities having jurisdiction and the requirements of the protocols designated in the Specifications.

.6 The Ontario regulations mandate waste audits, waste reduction work plans and source separation (recycling) programs.

.7 The Ontario 3Rs Regulations consist of four regulations, made under the Ontario *Environmental Protection Act* (EPA). Two of the regulations apply to federal facilities (O. Reg 102 and 103).

1.2 Definitions

.1 Class III: non-hazardous waste - construction renovation and demolition waste.

.2 Cost/Revenue Analysis Workplan (CRAW): based on information from WRW, and intended as financial tracking tool for determining economic status of waste management practices.

.3 Demolition Waste Audit (DWA): relates to actual waste generated from project.

.4 Inert Fill: inert waste - exclusively asphalt and concrete.

.5 Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

.6 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.

.7 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.8 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

.9 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.

.2 Returning reusable items including pallets or unused products to vendors.

.10 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.11 Separate Condition: refers to waste sorted into individual types.

.12 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.

.13 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.

.14 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.

.15 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (Schedule A).

.16 Waste Management Summary Report (MWSR): a one page report summarizing the total reuse, recycling and landfill percentages of all materials removed from site accompanied by copies of all material tracking forms (Schedule D).

1.3 Documents

.1 Maintain at job site, one copy of following documents:

.1 Waste Audit.

.2 Waste Reduction Workplan.

.3 Material Source Separation Plan.

.4 Waste Management Summary Report

.5 Schedules A, B, C and D completed for project.

1.4 Submittals

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

.2 Prepare and submit following prior to project start-up:

.1 Submit 2 copies of completed Waste Audit (WA): Schedule A.

.2 Submit 2 copies of completed Waste Reduction Workplan (WRW): Schedule B.

.3 Submit 2 copies of Cost/Revenue Analysis Workplan (CRAW): Schedule C.

.4 Submit 2 copies of Materials Source Separation Program (MSSP) description.

.3 Submit before final payment 2 copies of Waste Management Summary Report (WMSR) Schedule D.

.1 Failure to submit could result in hold back of final payment.

.2 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled, co-mingled and separated off-site or disposed of.

.3 For each material reused, sold or recycled from project, include amount in tonnes or quantities by number, type and size of items and the destination.

.4 For each material land filled or incinerated from project, include amount in tonnes of material and identity of landfill, incinerator or transfer station.

1.5 Quality Assurance – Compliance Requirements

.1 Comply with the Environmental Protection Act

.2 Comply with (Ontario Regulation 101/94 - Recycling and Composting of Municipal Wastes

.3 Comply with Ontario Regulation 102/94) - Waste Audits and Waste Reduction Work Plans

.4 Comply with Ontario Regulation 103/94- Industrial, Commercial and Institutional (IC&I) Source Separation Programs

.5 Comply with Ontario Regulation 105/94 - General Waste Management Amendment

1.6 Waste Audit (WA)

.1 Conduct WA prior to project start-up.

.2 Prepare WA: Schedule A.

.3 Record, on WA - Schedule A, extent to which materials or products used consist of recycled or reused materials or products.

1.7 Waste Reduction Workplan (WRW)

.1 Prepare WRW (Schedule B) prior to project start-up.

.2 WRW should include but not limited to:

.1 Destination of materials listed.
.2 Deconstruction/disassembly techniques and sequencing.
.3 Schedule for deconstruction/disassembly.
.4 Location.
.5 Security.
.6 Protection.
.7 Clear labelling of storage areas.
.8 Details on materials handling and removal procedures.
.9 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.

.3 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.

.4 Describe management of waste.

.5 Identify opportunities for reduction, reuse, and recycling of materials. Based on information acquired from WA.

.6 Post WRW or summary where workers at site are able to review content.

.7 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.

.8 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.

1.8 Cost /Revenue Analysis Workplan (CRAW)

.1 Prepare CRAW: Schedule C.

1.9 Waste Management Summary Report (WMSR)

.1 Prepare WMSR after project completion.

.2 Prepare WMSR: Schedule D

.3 Provide details of quantities of materials salvaged for reuse, recycling or disposal. Reports must be accompanied by copies of weigh bills/receipts/manifests/invoices from authorized facilities validating the figures stated in the reports.

1.10 Materials Source Separation Program (MSSP)

.1 Prepare MSSP and have ready for use prior to project start-up.

.2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.

.3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.

.4 Provide containers to deposit reusable and recyclable materials.

.5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.

.6 Locate separated materials in areas which minimize material damage.

.7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.

.1 Transport to approved and authorized recycling facility.

.8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition.

.1 Ship materials to site operating under Certificate of Approval.

.2 Materials must be immediately separated into required categories for reuse or recycling.

1.11 Storage, Handling and Protection

.1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.

.2 Unless specified otherwise, materials for removal become Contractor's property.

.3 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.4 Protect structural components not removed for demolition from movement or damage.

.5 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.

.6 Protect surface drainage, mechanical and electrical from damage and blockage.

.7 Separate and store materials produced during dismantling of structures in designated areas.

.8 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.

.1 On-site source separation is recommended.
.2 Remove co-mingled materials to off-site processing facility for separation.
.3 Provide waybills for separated materials.

1.12 Disposal of Wastes

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner into waterways, storm, or sanitary sewers.

.3 Keep records of construction waste including:

.1 Number and size of bins.
.2 Waste type of each bin.
.3 Total tonnage generated.
.4 Tonnage reused or recycled.
.5 Reused or recycled waste destination.

.4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

.5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

.6 The Contractor shall not undertake any off-site transportation of demolition materials, rubble or debris unless all required permits have been obtained. The contractor shall be responsible for obtaining the necessary permits.

.7 All workers, haulers and subcontractors must possess current, applicable Certificates of Approval and Licenses in accordance with all applicable Ontario regulations to remove, handle and dispose of non-hazardous wastes. Provide proof of compliance within 24 hours upon written request of Departmental Representative.

.8 The Contractor is required to protect all recoverable materials from but not limited to: weather, theft, vandalism, animals, etc.

1.13 Use of Site and Facilities

.1 Execute work with least possible interference or disturbance to normal use of premises.

.2 Maintain security measures established by existing facility.

1.14 Scheduling

.1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

1.15 Sequencing

.1 Coordinate Work with other activities at site to ensure timely and orderly progress of work.

.2 Organize the site and workers in a manner that promotes waste reduction and the salvage and separation of materials for reuse and recycling.

.3 As a minimum, and in accordance with Ontario Regulation 103/94, separate and divert the following materials from landfill or incineration. (*Italics indicate those items required to be separated under 3Rs regulations*). Diverted materials shall be transported to approved facilities.

.1 Construction and Demolition Wastes
.2 Wood (not including painted or treated or laminated wood)
.3 Brick, Portland Cement Concrete (not including lead painted, adhesives or otherwise contaminated)
.4 Steel
.5 Metals (Metal work, electrical wire, metal plumbing, metal roofing, etc.*)*

PART 2 PRODUCTS

2.1 Not Used

.4 Not Used.

PART 3 EXECUTION

3.1 Application

.1 Do Work in compliance with WRW.

.2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 Cleaning

.1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.2 Clean-up work area as work progresses.

.3 Source separate materials to be reused/recycled into specified sort areas.

3.3 Waste Management Plan Implementation

.1 Manager: Contractor to designate an on-site party (or parties) responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the Project.

.2 Distribution: Contractor to distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, and the Departmental Representative.

.3 Instruction: Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.

.4 Separation facilities: Contractor shall lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.

.5 Hazardous wastes: Hazardous wastes shall be separated, stored, and disposed of according to local regulations.

.6 Application for Progress Payments: Contractor shall submit with each Application for Progress Payment a Summary of Waste Generated by the Project:

.1 Failure to submit this information shall render the Application for Payment incomplete and shall delay Progress Payment.

.2 The Summary shall be submitted on a form acceptable to the Departmental Representative and shall contain the following information:

.1 The amount in tonnes or cubic metres (tons or cubic yards) of material land filled from the Project,

.2 The identity of the landfill, the total amount of tipping fees paid at the landfill, and

.3 The total disposal cost. Include manifests, weight tickets, receipt, and invoices.

.3 For each material recycled, reused, or salvaged from the Project, the amount tonnes of cubic metres (tons or cubic yards), the date removed from the job site, the receiving party, the transportation cost, the amount of any money paid or received for the recycled or salvaged material, and the net total cost or savings of salvage or recycling each material.

.4 Attach manifests, weight tickets, receipts, and invoices.

3.4 Canadian Governmental Departments Chief Responsibility for the Environment

.1 Schedule E – Government Chief Responsibility for the Environment

.2 Ontario Ministry of Environment 135 St. Clair Avenue West, Toronto, ON M4V 1P5. Tel: 416 323-4321, 800- 565-4923. Fax: 416- 323-4682.

.3 Environment Canada, Toronto, ON. Tel: 416-734-4494.

3.5 Waste Audit (WA)

.1 Schedule A - Waste Audit (WA):

(1) Material Category	(2) Material Quantity Unit	(3) Estimated Waste %	(4) Total Quantity of Waste (unit)	(5) Generation Point	(6) % Recycled	(7) % Reused

(1) Material Category	(2) Material Quantity Unit	(3) Estimated Waste %	(4) Total Quantity of Waste (unit)	(5) Generation Point	(6) % Recycled	(7) % Reused
Wood and Plastics Material Description						
Off-cuts						
Warped Pallet Forms						
Plastic Packaging						
Cardboard Packaging						
Other						
Doors and Windows Material Description						
Painted Frames						
Glass						
Wood						
Metal						
Gypsum Board						
Other (Specify)						

3.6 Waste Reduction Workplan (WRW)

.1 Schedule B – Waste

(1) Material Category	(2) Person(s) Respon-sible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material(s) Destina-tion
Wood and Plastics Material Description							
Chutes							
Warped Pallet Forms							
Plastic Packag ing							
Card-board Packag ing							
Other							
Doors and Windows Material Description							
Painted Frames							
Glass							
Wood							
Metal							
Gypsum Board							
Other (Specify)							

3.7 Cost/Revenue Analysis Workplan (CRAW)

.1 Schedule C - Cost/Revenue Analysis Workplan (CRAW):

(1) Material Description	(2) Total Quantity (unit)	(3) Volume (cum)	(4) Weight (cum)	(5) Disposal Cost/Credit $(+/-)	(6) Category Sub-Total $(+/-)
Wood					
Wood Stud					
Plywood					
Baseboard - Wood					
Door Trim - Wood					
Cabinet					
Doors and Windows					
Panel Regular					
Slab Regular					
Wood Laminate					
Gypsum Board					
Glazing					
Metal					
		(7) Cost (-) / Revenue (+)			

3.8 Waste Management Summary Report (WMSR)

.1 Schedule D – Waste Management Summary Report (WMSR):

(1) Material Description	(2) Quantity	(3) Unit	(4) Total	(5) Volume (cum)	(6) Weight (cum)	(7) Remarks and Assumptions
Wood						
Wood Stud						
Plywood						
Baseboard-Wood						
Door Trim - Wood						
Cabinet						
Doors and Windows						
Panel Regular						
Slab Regular						
Wood Laminate						
Gypsum Board						
Glazing						
Metal						

END OF SECTION

Part 1 GENERAL

1.1 Summary

.1 It is understood that the a portion of the subject site will undergo renovation activities in order to upgrade the acoustics and ballistics.This will include the removal of the majority of the surficial materials, including the ceiling baffles, acoustic wall panels and select sections of supply/exhaust ducts, throughout the area of concern. These building materials and components are suspected of being coated with a lead containing dust as a result of the site activities. The work should be completed in accordance with the requirements of this Section:

.1 Removal of lead contaminated dust from ceiling baffles, acoustic wall panels and supply/exhaust ducts, or any other surface encountered that is suspected of being exposed to lead containing dust, using power tools with an effective dust collection system equipped with HEPA filter.

.2 Abrasive blasting of lead containing material including the ceiling baffles, acoustic wall panels and supply/exhaust ducts, or any other surface encountered that is suspected of being exposed to lead containing dust.

.3 Removal of lead-containing dust using air mist extraction system.

1.2 Related Work

.1 Section 01060 Designated Substance Survey

.2 Section 01 35 29.06 Health and Safety Requirements

.3 Section 01 74 21 Construction/Demolition Waste Management and Disposal

1.3 Reference Standards

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-Z180.1-00(R2005), Compressed Breathing Air and Systems.

.2 Department of Justice Canada

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.3 Health Canada

.1 Workplace Hazardous Materials Information System (WHMIS), Material Safety Data Sheets (MSDS).

.4 Human Resources and Social Development Canada (HRSDC)

.1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.

.5 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.6 U.S. Environmental Protection Agency (EPA)

.1 EPA 747-R-95-007, Sampling House Dust for Lead.

.7 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (NIOSH).

.1 NIOSH 94-113 - NIOSH Manual of Analytical Methods (NMAM), 4th Edition (1994).

.8 U.S. Department of Labour - Occupational Safety and Health Administration (OSHA) - Toxic and Hazardous Substances.

.1 Lead in Construction Regulation - 29 CFR 1926.62.

.9 Underwriters' Laboratories of Canada (ULC).

1.4 Definitions

.1 **HEPA vacuum**: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 **Authorized Visitors**: Departmental Representative, Project or Site Representative or designated representative(s) of regulatory agencies.

.3 **Poly Alpha Olefins (PAO) Test:** Testing method used to evaluate particle penetration and air flow resistance properties of filtration materials - HEPA filter leak test.

.4 **Airlock:** Ingress or egress system without permitting air movement between contaminated area and uncontaminated area.

.5 **Curtained doorway**: Arrangement of closures to allow ingress and egress from one (1) room to another while permitting minimal air movement between rooms, typically constructed as follows:

.1 Place two (2) overlapping sheets of polyethylene over existing or temporarily framed doorway, secure each along top of doorway, secure vertical edge of one (1) sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.

.2 Reinforce free edges of polyethylene with duct tape and add weight to bottom edge to ensure proper closing.

.3 Overlap each polyethylene sheet at openings 1.5 m on each side.

.6 **Action level**: employee exposure, without regard to usage of respirators, to an airborne concentration of lead of 50 micrograms per cubic metre of air calculated as an 8-hour time-weighted average (TWA). Maximum precautions for lead abatement are based on airborne lead concentrations greater than 1.25 milligrams per cubic metre of air within Work Area.

.7 **Work Area**: Area where work takes place, which will, or may disturb lead-based coatings or lead containing material.

.8 **Sprayer**: Garden reservoir type sprayer or airless spray equipment capable of producing a mist or fine spray. Must have appropriate capacity for scope of work.

.9 **Competent person**: Individuals, Project or Site Representative, or Departmental Representative capable of identifying existing lead hazards in workplace and taking corrective measures to eliminate them.

.10 **Lead in Dust**: Wipe sampling on the vertical and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.

.11 **Negative Air Pressure Machine**: Extracts air directly from work area and filters extracted air through a HEPA filter, discharge air to exterior of building.

.1 Maintain pressure differential of 5 to 7 Pa relative to adjacent areas outside of work areas. Machine to be equipped with alarm to warn of system breakdown, and equipped with instrument to continuously monitor and automatically record pressure differences.

1.5 Action and Informational Submittals

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

.2 Provide proof satisfactory to the Project of Site Representative or Departmental Representative that suitable arrangements have been made to dispose of lead containing materials waste in accordance with requirements of authority having jurisdiction.

.3 Provide Provincial requirement for Notice of Project Form.

.4 Provide proof of Contractor's General and Environmental Liability Insurance.

.5 Quality Control:

.1 Provide Project or Site Representative, or Departmental Representative necessary permits for transportation and disposal of lead containing waste and proof it has been received and properly disposed.

.2 Provide proof satisfactory to Project or Site Representative or Departmental Representative that employees had instruction on hazards of lead exposure, respirator use, dress, entry and exit from Work Area, and aspects of work procedures and protective measures.

.3 Provide proof that supervisory personnel have attended lead abatement course, of not less than 2 days duration, approved by Project or Site Representative, or Departmental Representative. Minimum of one (1) supervisor for every ten workers.

.6 Product Data:

.1 Provide documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:

.1 Encapsulants.

.2 Amended water.

.3 Slow drying sealer.

1.6 Quality Assurance

.1 Regulatory Requirements: comply with Federal, Provincial and local requirements pertaining to lead, in case of conflict among those requirements or with these specifications the more stringent requirement applies. Comply with regulations in effect at time work is performed.

.2 Health and Safety:

.1 Require construction work to be in compliance with the occupational health and safety regulations in Section 01 35 29.06 Health and Safety Requirements.

.2 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers while in Lead Work Area includes:

.1 Leads removal using power tool: respirator NIOSH approved and equipped with filter cartridges with assigned protection factor of 50, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure in Lead Work Area. Provide sufficient filters so workers can install new filters following disposal of used filters and before re-entering contaminated areas.

.2 Abrasive blasting of lead containing material: NIOSH approved and equipped with filter cartridges with assigned protection factor of 1000, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure in Lead Work Area. Respirator to be equivalent Type CE abrasive blast supplied air respirator operated in a pressure demand or positive pressure mode with a tight-fitting full-face-piece. Compressed air used to supply supplied air respirators to meet breathing air purity requirements of CAN/CSA-Z180.1. Where an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor/alarm to be provided.

.3 Disposable protective clothing that does not readily retain or permit skin contamination, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.

.3 Requirements for workers:

.1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters, clean coveralls and head covers before entering Equipment and Access Rooms or Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.

.2 Remove gross contamination from clothing before leaving work area. Place contaminated work suits in receptacles for disposal with other lead contaminated materials. Leave reusable items except respirator in Equipment and Access Room. When not in use in work area, store work footwear in Equipment and Access Room. Upon completion of lead abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or from Equipment and Access Room.

.3 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers not use this system as means to leave or enter Work Area.

.4 Eating, drinking, chewing, and smoking are not permitted in Work Area.

.5 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosure prior to commencing actual lead abatement.

.6 Ensure workers wash hands and face when leaving Lead Work Area.

.7 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.

.8 Ensure no person required to enter Work Area has facial hair that affects seal between respirator and face.

.9 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.

.2 Instruct Authorized Visitors in use of protective clothing, respirators and procedures

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Work Area.

1.7 Waste Management and Disposal

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

.2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.3 Disposal of lead waste generated by removal activities must comply with Provincial and Federal regulations. Dispose of lead waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.

.4 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.8 Existing Conditions

.1 Reports and information pertaining to lead containing materials to be handled, removed, or otherwise disturbed and disposed of during this Project are included in the tender document package (Project Specific Designated Substance Survey).

.2 Notify the Project or Site Representative, or Departmental Representative of any additional or questionable lead containing materials discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Project or Site Representative, or Departmental Representative.

1.9 Scheduling

.1 Not later than 2 days before beginning Work on this Project notify the following in writing; where appropriate.

.1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.

.2 Provincial Ministry of Labour.

.3 Disposal Authority.

.2 Inform sub trades of presence of lead-containing materials identified in Existing Conditions.

.3 Provide Project or Site Representative, or Departmental Representative a copy of notifications prior to start of Work.

.4 Hours of Work: perform work involving the removal of the building materials (i.e. ceiling baffles, acoustic wall panels and supply/exhaust ducts) covered by lead containing dust during regular site operation hours (8:00 am through 5:00 pm).

Part 2 PRODUCTS

2.1 Materials

.1 **Polyethylene**: 0.15 mm unless otherwise specified; in sheet size to minimize joints.

.2 **FR polyethylene**: 0.15 mm woven fibre reinforced fabric bonded both sides with polyethylene.

.3 **Tape**: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.

.4 **Slow - drying sealer**: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for trapping

residual lead containing residue.

.5 **Lead waste containers**: Metal type acceptable to dump operator with tightly fitting covers and 0.15 mm sealable polyethylene liners.

.1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

Part 3 EXECUTION

3.1 Supervision

.1 Approved Supervisor must remain within Work Area during disturbance, removal, or handling of the lead coated or containing material, including but not limited to the ceiling baffles, acoustic wall panels and supply/exhaust ducts.

3.2 Preparation

.1 Remove and wrap items to be salvaged or reused, and transport and store in area specified by Project or Site Representative, or Departmental Representative.

.2 Work Area:

.1 Shut off and isolate HVAC system to prevent lead dust and particulate dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.

.2 Pre-clean fixed casework, and equipment within work areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.

.3 Clean work areas using HEPA vacuum. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum.

.4 Install negative pressure machine system and operate continuously from installation of polyethylene sheeting until completion of final cleanup. Provide automatic continuous monitoring and recording instrument of pressure difference.

.5 Seal off openings, corridors, doorways, windows, skylights, ducts (supply and exhaust), grilles, and diffusers, with polyethylene sheeting sealed with tape.

.6 Cover floor surfaces in work area from wall to wall with FR polyethylene drop sheets to protect existing floor during removal.

.7 Build airlocks at entrances and exits from work areas to ensure work areas are always closed off by one curtained doorway when workers enter or exit.

.8 At point of access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used:

.1 CAUTION LEAD HAZARD AREA (25 mm).

.2 NO UNAUTHORIZED ENTRY (19 mm)

.3 WEAR ASSIGNED PROTECTIVE EQUIPMENT AND RESPIRATOR (19 mm).

.4 BREATHING LEAD CONTAMINATED DUST CAUSES SERIOUS BODILY HARM (7 mm).

.9 Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Authority having jurisdiction.

.10 Where water application is required for wetting lead containing materials, provide temporary water supply by use of appropriately sized hoses for application of water as required.

.11 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.

.3 Worker Decontamination Enclosure System:

.1 Worker Decontamination Enclosure System includes Equipment and Access Room and Clean Room, as follows:

.1 Equipment and Access Room: construct between exit and work areas, with two (2) curtained doorways, one to the rest of the suite, and one (1) to work area. Install waste receptor and storage facilities for workers' shoes and protective clothing to be re-worn in work areas. Build large enough to accommodate specified facilities, equipment needed, and at least one worker allowing sufficient space to change comfortably.

.2 Clean Room: construct with curtained doorway to outside of enclosure. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly

.4 Construction of Decontamination Enclosures:

.1 Construct framing for enclosures or use existing rooms. Line enclosure with polyethylene sheeting and seal with tape, apply two (2) layers of FR polyethylene on floor.

.2 Construct curtain doorways between enclosures so when people move through or waste containers and equipment are moved through doorway, one of two closure comprising doorway always remains closed.

.3 Shower room in decontamination facility to be provided with the following:

.1 Hot and cold water or water of constant temperature not less than 40 degrees Celsius or more than 50 degrees Celsius.

.2 Individual controls inside to regulate water flow and temperature.

.4 Prior to each shift in which a decontamination facility is being used, a competent person should inspect the facility to ensure that there are no defects that would allow lead-containing dust to escape. Defects should be repaired before the facility is used. The decontamination facility should be maintained in a clean and sanitary condition.

.5 Separation of Work Areas from Occupied Areas:

.1 Barriers between Work Area and occupied area to be constructed as follows:

.1 Construct floor to ceiling lumber or metal stud framing, cover with polyethylene sheeting and seal with duct tape. Apply plywood over polyethylene sheeting. Seal plywood joints and between adjacent materials with surface film forming sealer, to create airtight barrier.

.2 Cover plywood with polyethylene sheeting and sealed with duct tape.

.6 Maintenance of Enclosures:

.1 Maintain enclosures in tidy condition.

.2 Ensure barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately.

.3 Visually inspect enclosures at beginning of each working day.

.4 Use smoke test method to test effectiveness of barriers as directed by the Departmental Representative.

3.3 Lead Abatement

.1 Removal of lead containing material or lead coated materials to be performed using power tools that are attached to dust-collecting vacuums with HEPA filters.

.2 Remove lead containing material or lead coated materials in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.

.3 Wet method to be used to reduce dust generation. Examples of wet methods include wetting surfaces, wet scraping, and wet shovelling (where applicable). Wet method not to be used if it creates a hazard or cause damage to equipment or to project. Power tools to be equipped with a shroud, and to be kept flush with surface.

.4 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove immediate from working area to staging area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.

.5 After completion of stripping work, wire brush and wet sponge surface to remove visible material. During this work keep surfaces wet. After wire brushing and wet sponging, wet clean and HEPA vacuum entire work area including Equipment and Access Room. Compressed air or dry sweeping not be used to clean up lead-containing dust or waste. After inspection and approval by the Departmental Representative apply continuous coat of slow drying sealer to surfaces. Do not disturb work area for 8 hours, no entry, activity, or ventilation other than operation negative air machine during this period.

.6 After the removal of the lead containing or coated materials, wet clean work area and equipment and access room. During settling period no entry, activity, or ventilation will be permitted.

3.4 Inspection

.1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from requirements not been approved in writing by the Project or Site Representative, or Departmental Representative will result in Work shutdown, at no cost to Owner.

.2 Departmental Representative will inspect work for:

.1 Adherence to specific procedures and materials.

.2 Final cleanliness and completion.

.3 No additional costs will be allowed for additional labour or materials required to provide specified performance level.

.3 When lead dust leakage from Work Area occurs the Departmental Representative will order Work shutdown.

.1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.5 Lead Surface Sampling Work Areas

.1 Final lead surface sampling conducted as follows.

.1 After Work Area has passed a visual inspection for cleanliness approved by the Departmental Representative, and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period of 8 hours has passed, the Departmental Representative will perform lead wipe sampling in Work Area.

.2 If wipe sampling results show levels of lead dust in excess of 40 micrograms per square foot, re-clean work area at contractor's expense and apply another acceptable coat of lock-down agent to surfaces.

.3 Repeat as necessary until lead dust levels are less than 40 micrograms per square foot.

3.6 Final Cleanup

.1 Following specified cleaning procedures, and when lead wipe sampling is below acceptable concentrations proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum.

.3 Place polyethylene sheets, tape, cleaning material, clothing, and contaminated waste in plastic bags and sealed labelled waste containers for transport.

.4 Clean up Work areas, Equipment and Access Room, and other contaminated enclosures.

.5 Remove sealed waste containers and equipment used in Work and remove from work areas at appropriate time in cleaning sequence.

.6 Conduct final check to ensure no dust or debris remain on surfaces as result of dismantling operations.

3.7 Re-Establishment of Objects and Systems

.1 Repair or replace objects damaged in course of work to their original state or better, as directed by the Project or Site Representative.

*****************END OF SECTION*****************

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 13 54 00 – Firing Range Baffles

.3 Section 13 54 10 – Acoustic Ballistic Rubber Panels

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A123-15 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A153/A153M-2016 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.3 ASTM A480/A480M-16b Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.4 ASTM A653/A653M-15e1 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.5 ASTM F2329/F2329M-15 Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

.2 American Wood-Preservers' Association (AWPA)

.1 AWPA M2-16, Standard for Inspection of Treated Wood Products.

.2 AWPA M4-16, Standard for the Care of Preservative-Treated Wood Products.

.3 CSA Group

.1 CSA O80 Series-2015, Wood Preservation.

.4 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)

.1 SCAQMD Rule 1113-2016, Architectural Coatings.

.5 Underwriters Laboratory of Canada (ULC)

.1 CAN/ULC-S102 Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Sustainable Submittals:

.1 Submit certificate issued by Canadian Wood Preservation Authority (CWPCA) certifying conformity with Environment Canada Technical Recommendation Document for the Design and Operation of Wood Preservation Facilities.

.3 Quality assurance submittals:

.1 Submit certificates in accordance with Section 01 33 00 - Submittal Procedures.

.2 For products treated with fire-retardant by pressure impregnation submit following information certified by authorized signing officer of treatment plant:

.1 Information listed in AWPA M2 and revisions specified in CSA O80 Series, Supplementary Requirement to AWPA M2 applicable to specified treatment.

.2 Moisture content after drying following treatment with fire-retardant.

.3 Acceptable types of paint, stain, and clear finishes that may be used over treated materials to be finished after treatment.

.3 Recommended metal connector and fastener materials and corrosion protection.

.4 Product recommendation for field treatment.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Each sheet of fire-retardant panel to bear ULC label indicating Flame Spread Classification (FSC), and smoke developed.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 06 10 00 - Rough Carpentry, Section 01 61 00 - Common Product Requirements, with AWPA M4 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with product category, manufacturer's name and address.

.3 Waste Management and Disposal:

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

.2 Store separated reusable treated wood waste convenient to cutting station and work areas.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Preservatives: maximum VOC limit 350 g/L in accordance with SCAQMD Rule #1113, Architectural Coatings.

.2 Wood preservation plants: certified by Canadian Wood Preservation Authority (CWPCA) to Environment Canada Technical Recommendation Document for the Design and Operation of Wood Preservation Facilities.

2.2 FIRE-RETARDANT TREATED MATERIALS AND APPLICATION

.1 Provide fire retardant treated lumber for interior use conforming to CSA O80 Series standards use category F1 and clause 9.9, to provide the following characteristics when tested in accordance with CAN/ULC-S102:

.1 Flame Spread Classification: FSC 150

.2 Smoke developed of not more than: 300

.2 Provide fire retardant treated interior plywood conforming to CSA O80 Series standards use category F1 and clause 9.9, to provide the following characteristics when tested in accordance with CAN/ULC-S102:

.1 Flame Spread Classification: FSC 150.

.2 Smoke developed of not more than: 300.

.3 Kiln dry fire retardant treated products after treatment to the following moisture contents:

.1 Plywood: 15%.

.2 Lumber: 19%

2.3 CORROSION PROTECTION FOR CONNECTORS AND FASTENERS FOR USE WITH TREATED WOOD

.1 Connectors: Fabricated from steel sheet galvanized in accordance with ASTM A653 to minimum G185 coating or galvanized post fabrication to ASTM A123, or Type 304/316 stainless steel sheet to ASTM A480, as recommended by wood treatment supplier and connector manufacturer.

.2 Fasteners: Hot dip galvanized to ASTM A153/A153M Class C and D, ASTM F2329/F2329M, proprietary polymer coated steel fasteners, or Type 304/316 stainless steel to ASTM A480 as recommended by wood treatment supplier and fastener manufacturer.

Part 3 Execution

3.1 CONSTRUCTION

.1 Incorporate treated wood products into construction in accordance with Drawings and Specifications.

.2 Use connectors and fasteners with specified corrosion protection in all construction with treated wood products.

3.2 FIELD TREATMENT

.1 Comply with AWPA M4 and revisions specified in CSA O80 Series, Supplementary Requirements to AWPA M2.

.2 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of recommended preservative before installation.

.3 Remove chemical deposits from surfaces of treated wood to receive applied finish.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 05 73 – Wood Treatment

.2 Section 13 54 00 – Firing Range Baffles

.3 Section 13 54 10 – Acoustic Ballistic Rubber Panels

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM D1761-06, Standard Test Methods for Mechanical Fasteners in Wood.

.2 CSA International

.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.2 CSA O121-08, Douglas Fir Plywood.

.3 CSA O141-05(R2009), Softwood Lumber.

.4 CSA O151-09, Canadian Softwood Plywood.

.3 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

.4 National Research Council Canada (NRC)

.1 National Building Code of Canada 2015(NBC).

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 wood products and accessoriesand include product characteristics, performance criteria, physical size, finish and limitations.

1.4 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood in accordance with CSA and ANSI standards.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and 01 61 00- Common Product Requirements.

.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 off groundand in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wood from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Waste Reduction Workplan Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse and return of crates, packaging materials pallets, padding,as specified in Waste Reduction Workplan, Construction Waste Management Plan and in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 FRAMING STRUCTURAL AND PANEL MATERIALS

.1 Lumber: softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Framing and board lumber: in accordance with National Building Code of Canada (NBC).

.3 Furring, blocking, nailing strips, grounds, rough bucks, cants,curbs, fascia backing and sleepers:

.1 Board sizes: "Standard" or better grade.

.2 Dimension sizes: "Standard" light framing or better grade.

.3 Post and timbers sizes: "Standard" or better grade.

.4 Plywood: to CSA O325.

.5 Canadian softwood plywood (CSP): to CSA O151, standard construction.

2.2 ACCESSORIES

.1 General purpose adhesive: to CSA O112.9.

.1 VOC limit 70 200g/L maximum to SCAQMD Rule 1168.

.2 Nails, spikes and staples: to CSA B111.

.3 Bolts: 12.5mm diameter unless indicated otherwise, complete with nuts and washers.

.4 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product 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 PREPARATION

.1 All wood products must be fire retardant treated. Refer to Section 06 05 73 – Wood Treatment.

.2 Field treat all surfaces of wood materials requiring field treatment before installation.

3.3 MATERIAL USAGE

.1 Baffle Backing:

.1 Plywood, DFP or CSP, B or C grade, square edge, thickness as noted.

.2 Fasteners: Flathead, countersunk screws.

3.4 INSTALLATION

.1 Comply with requirements of NBC 2015 Part 9 supplemented by the following paragraphs.

.2 Install members true to line, levels and elevations, square and plumb.

.3 Construct continuous members from pieces of longest practical length.

.4 Install spanning members with "crown-edge" up.

.5 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.

.6 Install furring and blocking as required to space-out and support wall and ceiling finishes, and other work as required.

.7 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.8 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

.9 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.10 Countersink bolts where necessary to provide clearance for other work.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.

.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 10 00 – General Instructions.

.3 Waste Management: separate waste materials for recycling reusein 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.

3.6 PROTECTION

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

.2 Repair damage to adjacent materials caused by rough carpentry installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 13 54 00 – Firing Range Baffles

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C423-07, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.2 ATM E84-16, Standard Test Method for Surface Burning Characteristics of Building Materials.

.3 ASTM E1050-12, Standard Test Method for Impedance and Absorption of Acoustical Materials Using a Tube, Two Microphones and a Digital Frequency Analysis System.

.2 Canadian Standards Association (CSA International)

.1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

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

.1 Material Safety Data Sheets (MSDS).

.4 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1113-04, Architectural Coatings.

.2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

.5 Underwriter Laboratories of Canada (ULC)

.1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.2 CAN/ULC-S114-05, Standard Method of Test for Determination of Non-Combustibility In Building Materials.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.

.3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit duplicate 300 mm x 300mm sample of each type acoustical unit.

.4 Certificates:

.1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.5 Test Reports:

.1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Submit certified test report showing acoustical treatment on baffles has been tested to ASTM C423 with A mounting.

.6 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.

.2 Construct one representative mock-up of acoustic treatment.

.3 Construct mock-up where directed.

.4 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with work.

.5 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of the finished work.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Commence installation after building enclosed and dust generating activities are completed.

.2 Permit wet work to dry prior to commencement of installation.

.3 Maintain uniform minimum temperature of 15 degrees C and relative humidity of 20-40% prior to, during and after installation.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Waste Management and Disposal:

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

1.7 MAINTENANCE

.1 Extra Materials:

.1 Provide extra materials of acoustic units and adhesive in accordance with Section 01 00 10 – General Instructions.

.2 Provide acoustical units for maintenance use amounting to 2% of gross ceiling area for each pattern and type required for project.

.3 Provide sufficient adhesive to install extra material provided.

.4 Extra materials from same production run as installed materials.

.5 Identify each package of acoustical units including colour and type, and each container of adhesive.

.6 Deliver to Departmental Representative, upon completion of the work of this section.

.7 Store where directed by Departmental Representative.

Part 2 Products

2.1 MATERIALS

.1 Acoustical construction products must:

.1 Not require being labelled as poisonous, corrosive, flammable or explosive under Consumer Chemical and Container Regulations of the Hazardous Products Act.

.2 Be accompanied by detailed instructions for proper handling and installation so as to minimize health concerns.

.2 Acoustical treatment on underside of Firing Range Baffles: to ASTM C423 and ASTM E84.

.1 Product: SONEXone, manufactured by SONEX Acoustical Products

.1 Type: fireproof open cell melamine foam

.2 Pattern: wedge

.3 Flame spread rating of 25 or less.

.4 Smoke developed 50 or less.

.5 Fire and smoke rating in accordance with CAN/ULC-S102

.6 Noise reduction coefficient (NRC) designation: minimum 0.95 to ASTM C423

.7 Edge type: bevelled

.8 Colour: Grey.

.9 Size 610 x 1220 x 50 mm thick.

.10 Shape: flat

.11 Surface Coating: Black Hypalon high performance coating

.3 Adhesive: type recommended by acoustic unit manufacturer.

.4 Staples, nails and screws: to CSA B111, non-corrosive finish, type recommended by acoustic unit manufacturer.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install acoustic units square and aligned.

.2 Scribe acoustic units to fit adjacent work. Butt joints tight.

3.3 CLEANING

.1 Proceed in accordance with Section 01 00 10 – General Instructions.

.2 Keep acoustic installation and all components clean. Remove blemishes immediately.

3.4 PROTECTION

.1 Protect acoustic treatment from damage after installation and prior to completion of Work.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Provide a complete ballistic rubber block bullet trap along both flanking walls of range, including but not limited to, protective abrasion resistant minimum 500 Brinell hardness AR500 steel plate, ballistic rubber blocks, and compression system.

.2 Ballistic rubber block bullet trap to be designed to virtually eliminate the hazards of ricochet and splatter, minimize airborne lead contaminants, and protect onsite personnel. The blocks are designed to encapsulate bullets as part of the complete system.

1.2 REFERENCES

.1 ASTM International

.1 ASTM A325-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

.2 ASTM A514/A514M-14, Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding.

.3 ASTM A653/A653M-17, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM D429-14, Standard Test Methods for Rubber Property - Adhesion to Rigid Substrates.

.5 ASTM E84-18, Standard Test Method for Surface Burning Characteristics of Building Materials

.6 ASTM E90-09 (2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

.2 CSA International

.1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.

.3 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.3 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

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 ballistic panels and ballistic blocks. Include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements. Indicate VOC's during application and curing.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit shop drawings for AR500 steel plate, ballistic rubber panels, ballistic rubber blocks, and compression system show as system.

.3 Submit shop drawings stamped by an engineer licensed in the Province of Ontario. Indicate dimensions and thickness of steel panels, ballistic panels and blocks, fastening and anchoring methods, detail and location of joints, materials and finish, compliance with design criteria and requirements of related work. Verify and confirm in writing that support conditions are located, designed and engineered so that existing supports are not overloaded.

.4 Samples:

.1 Submit 1 (one) ballistic rubber block sample. Ballistic block will be returned to Contractor for use on this project.

.2 Submit 1 (one) ballistic rubber panel sample. Ballistic panel will be returned to Contractor for use on this project.

.5 Certificates:

.1 Submit system assembly certificate signed by manufacturer certifying quality assurance.

.6 Test Reports:

.1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.

.7 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certifications: submit system assembly certificate signed by manufacturer certifying materials and assembled system comply with specified performance characteristics and criteria and physical requirements.

.3 Ballistic rubber bullet trap manufacturer must have experience in the manufacturing of ballistic rubber block traps and are regularly engaged in the design and manufacturing of the type of ballistic block traps specified. If requested, provide five (5) actual installations of compatible design, construction, and size with proven durability.

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 accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect all materials from damage.

.3 Replace defective or damaged materials with new.

.4 Develop Waste Reduction Workplan related to Work of this section.

1.6 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for ballistic rubber block bullet trap for incorporation into manual.

Part 2 Products

2.1 MATERIALS

.1 Shop primer: heat resistant primer paint to manufacturer's standard.

2.2 BALLISTIC RUBBER BLOCK BULLET TRAP

.1 Bullet trap performance requirements:

.1 Bullet trap for capturing jacketed, semi-jacketed and non-jacketed, shot and slug projectiles with minimum muzzle velocities of 183 meters per second (600 feet per second (FPS) to .308/7.62 mm grade, certified up to 5017 joules (3700 ft-lbs) of impact.

.2 Steel plates: to ASTM A514.

.1 AR500: abrasion resistant, low alloy steel plate, quench and tempered to a minimal hardness of 500 HBW.

.2 10mm (3/8”) thick material. 1219mm x 2438mm maximum panel size. Minimum heavy duty bolts per 1219mm x 2438mm steel panel.

.3 Steel Wall Seam Plates

.1 AR500: abrasion resistant, low alloy steel plate, quench and tempered to a minimal hardness of 500 HBW.

.2 10mm (3/8”) thick material. 150mm minimum x 2438mm panel seam.

.4 Connectors: high strength for structural requirements.

.1 High strength masonry anchor: to ASTM A325.

.2 Minimum 9 - 13mm diameter x 175 long heavy duty bolts per 1219mm x 2438mm steel panel for mounting to block wall.

.3 Minimum 6 - 13mm diameter x 175 long heavy duty bolts per steel panel seam plate for mounting to block wall.

.5 Ballistic Rubber Blocks

.1 Product: Dura-Bloc, manufactured by Range Systems.

.1 Rubber composite block by vulcanized or binder method.

.2 Size: 610mm long x 355mm deep x 229mm high.

.3 Edges: square.

.4 Colour: black.

.5 Stackable.

.6 Flat surface on top, bottom and sides. Recessed section on back side. Textured surface on face.

.7 Noise Reduction Coefficient (NRC) designation of 0.65.

.8 Density: 800 kg / m^3 (50 lbs / ft^3) minimum

.9 Durometer: 60±5

.10 Tensile Strength: 7.24MPa (1050 psi).

.11 Friction Coefficient: 1.20 Static; 1.03 Dynamic.

.12 Class A Flame Spread Rating to ASTM E84 provided by application of intumescent coating.

.6 Adhesive: to ASTM D429.

.1 As recommended by ballistic rubber panel manufacturer.

.7 Compression System

.1 Comprised of formed steel plates, bracketing, and tensioning springs.

.2 Designed to hold blocks in place.

.3 Quick release mechanism.

.8 Acoustic Ballistic Rubber Panels

.1 Product: Dura-Panel, manufactured by Range Systems

.1 Rubber composite panel by vulcanized or binder method.

.2 Thickness: 50 mm.

.3 Size: 610 x 610 mm.

.4 Edges: square.

.5 Colour: black.

.6 Wall mounted.

.7 Textured surface on the face side; flat surface on the back side.

.8 Noise Reduction Coefficient (NRC) designation of 0.65.

.9 Density: 800 kg / m^3 (50 lbs / ft^3) minimum

.10 Durometer: 60±5

.11 Tensile Strength: 7.24MPa (1050 psi).

.12 Friction Coefficient: 1.20 Static; 1.03 Dynamic.

.13 Class A Flame Spread Rating to ASTM E84 provided by application of intumescent coating.

.9 Intumescent Coating:

.1 Product: Firefree 88, manufactured by Firefree Coatings Inc.

.2 Colour: Dark Grey

.10 Steel sections: to CSA G40.20/G40.21, Grade 300W.

.11 Welding materials: to CSA W59.

.12 Welding Electrodes: to CSA W48 Series (low-hydrogen-producing electrodes for AR500).

2.3 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 All bolted connections to be “bearing” type connections except where subject to stress reversal which are to “slip resistant” type connections.

.5 Steel plate joint where each steel panel connects to another steel panel shall include AR500 iron plates to overlap the joint created from connecting the next adjacent panel so there is not potential for small gaps were bullets or bullet fragments might escape.

.6 The joints on all steel plates must be covered by AR500 angle plates on at least 98% of the joint distance to provide for maximum coverage against rounds breaching the joint area.

.7 All joints shall be constructed such that no small gaps remain through which bullet fragments might escape the joint by deflecting a total of less than three consecutive 90 degree impacts.

.8 All joints shall be capable of containing high power rifle rounds.

2.4 FINISHES

.1 Shop coat primer: MPI – INT 5.1B.

2.5 SHOP PAINTING

.1 Primer: VOC limit 250 g/L maximum.

.2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.4 Clean surfaces to be field welded; do not paint.

2.6 EXTRA MATERIALS

.1 Provide extra materials in accordance with Section 01 78 00 – Closeout Submittals.

.2 Provide 50 additional ballistic panels for maintenance purposes.

.3 Provide 80 additional ballistic blocks for maintenance purposes.

.4 Provide 5 – 18.9L pails of FF88 intumescent paint for maintenance purposes. Include manufacturer’s written instruction for application and storage.

.5 Deliver to Site and store where directed by Departmental Representative.

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 ballistic rubber block bullet trap 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 Comply with requirements of provincial and local environmental regulatory agencies except where more stringent requirements are specified herein.

.2 Install ballistic rubber block bullet trap in accordance with reviewed shop drawings and manufacturer's instructions, using factory trained personnel.

.3 Steel Plates

.1 Install steel plates after building substrate materials are dry.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Connections between panels shall be mechanical (not welded) and include a dual wall seam plate system to provide continuous ballistic protection.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Make field connections with bolts. Secure bolt work to take care of full design loads and to provide structural integrity as required.

.6 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.

.4 Ballistic Rubber Blocks

.1 Install ballistic rubber blocks after AR500 steel panels are installed.

.2 Fit ballistic blocks tight to adjacent blocks. Butt joints tightly, align vertical and horizontal joints.

.3 Cut and trim ballistic blocks neatly to fit flush to ballistic ceiling baffles.

.4 Provide compression system to maintain position of blocks.

.5 Compression System

.1 Install compression system to maintain position of blocks.

.2 Compression system to be self-adjusting with tension springs installed behind the ballistic blocks.

.3 Apply adhesive and mechanical fasteners to AR500 steel plates in accordance with manufacturer's recommendations.

.6 Acoustic Ballistic Rubber Panels on Steel Plates

.1 Install ballistic panels after steel plates are installed.

.2 Fit ballistic panels tight to adjacent panels. Butt joints tightly, align vertical and horizontal joints.

.3 Cut and trim ballistic panels neatly to fit spaces and around adjacent materials.

.4 Apply adhesive to ballistic panel and steel plate surface in accordance with

manufacturer's recommendations.

.7 Do welding work in accordance with CSA W59 unless specified otherwise.

.8 Supply components for work by other trades in accordance with shop drawings and schedule.

3.3 FIELD QUALITY CONTROL

.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 stamped post-installation certification by engineer licensed in the Province of Ontario that ballistic rubber block bullet trap system has been installed in accordance with stamped and reviewed engineered shop drawings.

.3 Provide written certification from manufacturer that intumescent coating has been applied in accordance with requirements for ballistic rubber block bullet trap system to provide Class A flame spread rating to ASTM E84.

3.4 TESTING

.1 Acceptance Test:

.1 Any defects disclosed by the tests shall be corrected. Tests of previously defective items repaired or replaced by the Contractor shall be accomplished at no additional cost to the Owner.

3.5 COMMISSIONING

.1 Test and adjust complete system for proper function and leave in perfect working order.

.2 Conduct demonstration to accommodation maintenance staff on care and replacement of ballistic rubber block bullet trap for a period of 4 – two hour sessions, to instruct all shifts for the Departmental Representative’s and Owner’s operating and maintenance personnel in the proper operation, maintenance, and servicing of the bullet traps.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.

.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 00 10 – General Instructions

.3 Waste Management: separate waste materials for reuse and 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.

3.7 PROTECTION

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

.2 Repair damage to adjacent materials caused by installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 05 73 – Wood Treatment

.2 Section 06 10 00 – Rough Carpentry

.3 Section 09 80 00 – Acoustic Treatment

1.2 REFERENCE STANDARDS

.1 ASTM International Inc.

.1 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts and Studs,60,000 PSI Tensile Strength.

.2 ASTM A325-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

.3 ASTM A514/A514M-14, Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding.

.4 ASTM A563-15, Standard Specification for Carbon and Alloy Steel Nuts.

.5 ASTM A641/A651M-09a(2014), Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

.6 ASTM C645-14e1, Standard Specification for Non-structural Steel Framing Members.

.7 ASTM A1023/A1023M-15, Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes.

.8 ASTM F436-16, Standard Specification for Hardened Steel Washers.

.2 Canadian Standards Association (CSA International)

.1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

.3 CSA W59-M03(R2008), Welded Steel Construction (Metal Arc Welding).

.3 Master Painters Institute

.1 Architectural Painting Specification Manual - current edition.

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

.1 Material Safety Data Sheets (MSDS).

1.3 SUMMARY

.1 Range baffles shall be for the purpose of containing or redirecting misdirected rounds within a shooting range towards the bullet trap.

.2 Baffles shall be capable of mounting from the structure above, positioned in flat and angled manners.

.3 Baffle panels shall consist of rectangular AR500 sheet steel. The fabrication of these panels shall not include any field cut-outs. Baffle panels shall not be formed by welding two or more plates together.

.4 Rounds fired into the baffles shall not reflect splatter back toward the shooter. All lead fragments shall either be contained by the baffle or shall be expelled toward the bullet trap.

.5 Baffles shall interconnect one to another in a modular fashion so that they may be taken apart, moved, and replaced.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for sections, plates, channels, bolts, nuts, and washers and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide certified mill test report for steel plate

.3 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.1 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.

.2 Indicate materials, core thicknesses, finishes, connections, and joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories. Verify and confirm in writing that support conditions are located, designed and engineered so that existing supports are not overloaded. Include all potential interferences with baffle supports such as ductwork into shop drawings.

.4 Mock-up: construct mock-ups in accordance with Section 01 45 00 - Quality Control and to requirements supplemented as follows:

.1 Provide mock-up for evaluation of assembly, workmanship, and installation.

.2 Co-ordinate type and location of mock-ups with project requirements.

.3 Mock-up will be one complete 1.22m x 2.44m baffle assembly including supports, hangers, and connectors.

.4 Do not proceed with remaining work until assembly, workmanship, and installation are approved by Departmental Representative.

.5 When accepted, mock-up will demonstrate minimum standard of quality required for this work.

.1 Approved mock-up may remain as part of finished work.

.5 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan and Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Low-Emitting Materials:

.1 Submit listing of paints and coatings used in building, comply with VOC and chemical component limits or restrictions requirements.

1.5 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Range baffle manufacturer must have a minimum of ten (10) years' experience in the manufacturing of range baffles and who are regularly engaged in the design and manufacturing of the type of range baffles specified. If requested, provide five (5) actual installations of compatible design, construction, and size with proven durability.

.4 Provide stamped post-installation certification by Engineer licensed in the Province of Ontario that firing range baffles have been installed in accordance with stamped and reviewed engineered shop drawings.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 1 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 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and Waste Reduction Workplan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Baffle assembly:

.1 Entrap bullets within the assembly.

.2 Designed to eliminate all 'line of sight' openings, to the ceiling above, from all shooting positions on the firing line.

.3 Protect lighting fixtures, HVAC ductwork, and fire protection system.

.4 Direct ricochets towards the bullet trap to prevent harm to range users.

.2 Angles: to CSA G40.21, Grade 350W. Sizes as indicated. To be verified and adjusted as required by engineered shop drawings.

.3 Steel plates: to ASTM A514

.1 AR500: abrasion resistant, low alloy steel plate, quench and tempered to a minimal hardness of 500 HBW.

.4 Spacers: to ASTM C645

.1 Metal furring channels

.2 Size as indicated.

.5 Plywood: in accordance with Section 06 10 00 – Rough Carpentry and Section 06 05 73 – Wood Treatment.

.6 Acoustical treatment on underside of Firing Range Baffles: in accordance with Section 09 80 00 – Acoustic Treatment

.7 Suspension System: to ASTM A307 and ASTM A1023.

.1 Baffle supplier shall be responsible for design of the adjustable suspension system for the baffle assembly. Chain shall be used for suspension to allow for dissipation of energy by motion rather than transmission through the building structure.

.8 Baffle Support System: baffle supplier shall be responsible for design of the baffle support system.

.1 Steel sections and plates: to CSA G40.20/G40.21, Grade 350W.

.2 Welding materials: to CSA W59.

.3 Bolts, nuts and washers: high strength for structural requirements, conforming to ASTM A325.

.9 Connectors: high strength for structural requirements.

.1 Bolts: to ASTM A325.

.2 Nuts: to ASTM A563

.3 Washers: to ASTM F436.

.4 Wire rope cable: to ASTM A641

.10 Steel sections: to CSA G40.20/G40.21, Grade 300W.

.11 Welding materials: to CSA W59.

.12 Welding electrodes: to CSA W48 Series (low-hydrogen-producing electrodes for AR500)

.13 Anchor bolts: new material conforming to CSA G40.21, Grade 260W.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

.5 All bolted connections to be “bearing” type connections except where subject to stress reversal which are to “slip resistant” type connections.

.6 Baffle joint where each steel baffle panel connects to another steel baffle panel shall include angle iron to overlap the joint created from connecting the next adjacent panel so there is not potential for small gaps were bullets or bullet fragments might escape.

.7 The joints on all baffle plates must be covered by steel angle iron on at least 98% of the joint distance to provide for maximum coverage against rounds breaching the joint area.

.8 All joints shall be constructed such that no small gaps remain through which bullet fragments might escape the joint by deflecting a total of less than three consecutive 90 degree impacts.

.9 All joints shall be capable of containing high powered rifle rounds.

2.3 FINISHES

.1 Shop coat primer: MPI – INT 5.1B.

2.4 SHOP PAINTING

.1 Primer: VOC limit 250 g/L maximum.

.2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.4 Clean surfaces to be field welded; do not paint.

2.5 ANGLES

.1 Steel angles: prime painted, sizes indicated. Provide 150 mm minimum bearing at ends.

.2 Weld angles to baffle plates as per Firing Range Baffle Suppliers written instructions.

.3 Bolt back-to-back angles to profiles as per Firing Range Baffle Suppliers written instructions.

.4 Finish: shop painted.

.1 Primer: VOC limit 250 g/L maximum.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications 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 ERECTION

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Departmental Representative and as documented in engineered shop drawings such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Supply components for work by other trades in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CSA S16 and welded field connection to CSA W59.

.7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel as required by engineered shop drawings.

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of:

.1 Primer: maximum VOC limit 250 g/L.

.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

.1 Primer: maximum VOC limit 250 g/L.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.

.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 00 10 – General Instructions.

.3 Waste Management: separate waste materials for reuse and 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 metal fabrications installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 06 05 73 – Wood Treatment

.2 06 10 00 – Rough Carpentry

1.2 REFERENCE STANDARDS

.1 ASTM International Inc.

.1 ASTM E84-18, Standard Test Method for Surface Burning Characteristics of Building Materials.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 71-GP-24M-AMEND-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.

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

.1 Material Safety Data Sheets (MSDS).

1.3 SUMMARY

.1 Ballistic rubber panels to be designed to virtually eliminate the hazards of ricochet and splatter, minimize airborne lead contaminants, reduce reverberation time within Firing Range, and protect onsite personnel. The panels are not designed to stop or encapsulate bullets.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for panels and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements. Indicate VOC’s during application and curing.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Indicate dimensions and thickness of panels, fastening and anchoring methods, detail and location of joints, materials and finish, compliance with design criteria and requirements of related work.

.4 Samples:

.1 Submit 300 x 300 mm sample of acoustic ballistic panel.

.5 Certificates:

.1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.6 Test Reports:

.1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.

.7 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

.1 Acoustic Ballistic Rubber Panel manufacturer must have a minimum of ten (10) years' experience in the manufacturing of Acoustic Ballistic Rubber Panels and who are regularly engaged in the design and manufacturing of the type of panels specified. If requested, provide five (5) actual installations of compatible design, construction, and size with proven durability.

.2 Provide written certification from manufacturer that intumescent coating has been applied in accordance with requirements for acoustic ballistic rubber panels to provide Class A flame spread rating to ASTM E84.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 1 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 specified materials from damage.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and Waste Reduction Workplan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.7 EXTRA MATERIALS

.1 Provide extra materials of acoustic ballistic panels in accordance with Section 01 78 00 – Closeout Submittals.

.2 Provide 25 additional acoustic ballistic panels for maintenance purposes.

.3 Deliver to Owner and store where directed by Departmental Representative.

Part 2 Products

2.1 ACOUSTIC BALLISTIC PANEL

.1 Product: Dura-Panel, manufactured by Range Systems

- .1 Rubber composite panel by vulcanized or binder method.
- .2 Thickness: 50 mm
- .3 Size: 610 x 610 mm.
- .4 Edges: square.
- .5 Colour: black.
- .6 Wall mounted.
- .7 Textured surface of the face side; flat surface on the back side.
- .8 Noise Reduction coefficient (NRC) designation of 0.65.
- .9 Density: 1120 kg / m^3 (70 lbs / ft^3) minimum
- .10 Durometer: 60±5
- .11 Tensile Strength: 7.24MPa (1050 psi).
- .12 Friction Coefficient: 1.20 Static; 1.03 Dynamic.
- .13 Class A Flame Spread Rating to ASTM E84 provided by application of intumescent coating.

.2 Intumescent Coating:

- .1 Product: Firefree 88, manufactured by Firefree Coatings Inc.
- .2 Colour: Dark Grey

2.2 ADHESIVE

.1 Adhesive: to CGSB 71-GP-24M

- .1 As recommended by ballistic rubber panel manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for ballistic panel application 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 Fit ballistic panels tight to adjacent panels.

.2 Cut and trim ballistic panels neatly to fit spaces. Butt joints tightly, align vertical and horizontal joints.

.3 Apply adhesive to ballistic panel and wall surface in accordance with manufacturer's recommendations.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.

.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 00 10 – General Instructions.

.3 Waste Management: separate waste materials for reuse and 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 Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
- .1 ASHRAE 90.1-2016, Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 National Fire Protection Association (NFPA)
- .1 NFPA (Fire) 13, Installation of Sprinkler Systems, 2016 edition.

.3 National Research Council Canada
- .1 NRCC NBCC-2015, National Building Code of Canada.

1.2 GENERAL

.1 This section covers items common to all sections of Divisions 20, 21 & 23.

.2 Coordinate location & installation of all equipment with all trades to ensure the equipment is serviceable.

.3 Prime mechanical contractor shall be responsible to ensure that all requirements of Divisions 20, 21 & 23 are met and comply with all other divisions and contract documents.

.4 The word "provide" shall mean "supply and install".

.5 Conform to the requirements of Division 00, Division 01 and Instructions to Tenderers.

1.3 EQUIPMENT

.1 General:
- .1 Mechanical equipment that is not regulated by the Green Energy Act, shall carry a permanent label installed by the manufacturers stating the equipment complies with the requirement of ASHRAE 90.1.
- .2 The minimum equipment efficiency, standard rating and operating conditions shall be as per ASHRAE 90.1, unless indicated otherwise on contract documents.
- .3 Provide new materials and equipment of proven design, quality and of current models with published ratings for which replacement parts are readily available.
- .4 Uniformity: Use product of one manufacturer unless otherwise specified, for equipment or material of the same type of classification.

.2 Installation:
- .1 Unions, flanges and/or couplings: provide for ease of maintenance and disassembly.
- .2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer, Code or as indicated; whichever is the more stringent.
- .3 Equipment drains: pipe to floor drains in a manner which is non-obstructing.
- .4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.
- .5 Unless otherwise specified, follow manufacturer's recommendations for safety, adequate access for inspection, maintenance and repairs.
- .6 Permit equipment maintenance and disassembly with minimum disturbance to connecting piping and duct systems without interference with building structure or other equipment.
- .7 Lubrication: Provide accessible lubricating means for bearings, including permanent lubrication "Lifetime" bearings. Extended grease nipples to be supplied.

1.4 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other divisions.

1.5 TRIAL USAGE

.1 Departmental Representative may use equipment and systems for test purposes or for continuity of operation prior to acceptance. Supply labour, material, and instruments required for testing & operation.

.2 For continuous use, refer to Section 23 05 01 - Use of Mechanical Systems During Construction.

1.6 PROTECTION OF OPENINGS

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

1.7 ELECTRICAL

.1 Electrical work to conform to Division 26 including the following:
  .1 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems. Refer to Division 26 for quality of materials and workmanship.

.2 Any costs associated with deviation of mechanical equipment rating affecting electrical Division 26 shall be carried by the mechanical contractor.

.3 All control wiring & conduit associated with Building Automation System & HVAC controls shall be provided by Divisions 20, 21 & 23 including power wiring to all control panels & other field mounted control devices. Emergency power circuits are provided by Division 26 in the vicinity of the power source.

1.8 PAINTING

.1 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.2 Prime and touch up marred finished paintwork to match original. Use primer or enamel to match original. Do not paint over nameplates.

.3 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

.4 Hangers, supports and equipment fabricated from ferrous metals shall be given at least one coat of corrosion resistant primer paint before shipment to job site.

.5 Touch-up damaged surfaces of all mechanical equipment and materials, to the satisfaction of Departmental Representative. Use primer or enamel to match original. Do not paint over nameplates.

1.9 SPARE PARTS

.1 Furnish spare parts as indicated in various sections.

1.10 SPECIAL TOOLS

.1 Provide one set of special tools required to service equipment as recommended by manufacturers.

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Waste Reduction Workplan (WRW):
- .1 Perform work in accordance with project's WRW. If one does not exist, provide the following:
  - .1 Identify opportunities for reduction, re-use and/or recycling of materials.
  - .2 Post workplan or summary where workers on site are able to review it's content.

.2 Materials Source Separation Program (MSSP):
- .1 Perform all work in accordance with project's MSSP. If one does not exist, provide the following:
  - .1 Provide containers for collection of re-usable and/or recyclable materials.
  - .2 Transport off-site salvaged materials to authorized recycling facility or to users of material for re-use.

.3 Disposal of Waste:
- .1 Disposal of waste, volatile materials, mineral spirits, oil, paint thinner, etc. into waterways, storm or sanitary sewers is prohibited.

.4 Storage, Handling and Protection:
- .1 Store materials for re-use in a secure area as directed by project manager, where they will not be damaged. Provide protection of materials as necessary.
- .2 Unless otherwise specified, removed materials become the Contractor's property. Contractor shall be responsible for transport & delivery of non-salvageable items to a licensed disposal facility.

1.12 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and ons servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Where specified elsewhere in Divisions 20, 21 & 23, manufacturers to provide demonstrations and instructions.

.3 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Where deemed necessary, Departmental Representative may record these demonstrations on video tape for future reference.

.6 Furnish trained instructors to instruct Departmental Representative's operating staff in the operation, maintenance and adjustment of all mechanical equipment; and, instruct personnel on any changes to or modifications of any equipment made under terms of the guarantee.

.7 The instructions shall take place during regular working hours before systems are accepted and turned over to Departmental Representative's staff.

.8 Ensure that the Departmental Representative's operating personnel have received and been given opportunity to review the Operating and Maintenance Manuals prior to commencing instruction.

1.13 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual in accordance with Div. 01 - General Requirements.

.2 Operation and maintenance manual (O&M) to be approved by, and final copies deposited with, Departmental Representative before final inspection.

.3 For all equipment listed in O&M manuals provide a schedule detailing the supplied component, name, address & phone no. of equipment vendor, parts supplier and warranty agent.

.4 Operation data to include:
- .1 Control schematics for each system including environmental controls.
- .2 Description of each system and its controls.
- .3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
- .4 Operation instruction for each system and each component.
- .5 Description of actions to be taken in event of equipment failure.
- .6 Valves schedule and flow diagram.

.5 Maintenance data shall 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.

.6 Performance data to include:
- .1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
- .2 Equipment performance verification test results.
- .3 Special performance data as specified elsewhere.
- .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing.

.7 Approvals:
- .1 Submit electronic format (pdf) copy of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless so directed by . Departmental RepresentativePDF file to include tabs to allow navigation to each section of the manual.
- .2 Make changes as required and re-submit as directed by Departmental Representative.
- .3 Upon acceptance by Departmental Representative submit one (1) electronic format (pdf) and three (3) hardcopies of O&M manuals to Departmental Representative.

.8 Additional data:
- .1 Prepare and insert additional data into operation and maintenance manual when the need becomes apparent during demonstrations and instructions specified above.

1.14 ACCEPTABLE PRODUCTS

.1 Design is based on first manufacturer's name under acceptable products. Subsequent manufacturer's names indicate that those named are acceptable providing they meet specifications and space limitations and are subject to acceptance by Shop Drawing Review.

1.15 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit single electronic (pdf) copy of shop drawings and product data along with transmittal, in accordance with Div. 01 - General Requirements. Hard copy shop drawings shall not be accepted.

.2 Shop drawings and product data shall show:
- .1 Mounting arrangements.
- .2 Operating and maintenance clearances. eg. access door swing spaces.

.3 Shop drawings and product data shall be accompanied by:
- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on full equipment performance curves.
- .4 Manufacturer to certify as to current model production.
- .5 Certification of compliance to applicable codes.

.4 The information to be indicated on manufacturers' shop drawings submitted for review shall include the following:
- .1 General arrangement drawings showing component parts. Where the equipment proposed, or a component part thereof, includes modifications to a manufacturers' standard to meet the requirements of a specification, a complete assembly drawing must be submitted.
- .2 Overall dimensions, roughing-in dimensions and clearance dimensions of all major components.
- .3 Mounting details and dimensions.
- .4 Complete certified performance data for the specified application with particular reference to rate of flow, operating pressure and temperatures, entering and leaving conditions of air or fluid, operating weights, operating limitation, electrical characteristics and BHP requirements.
- .5 Gauge of fabricated material and finish specification.
- .6 Vibration isolators and resilient hangers stating locations and weight distribution.
- .7 Electrical wiring diagrams, control panel boards, motor test data, motor starters and controls for electrically-operated equipment furnished by mechanical trades.

.5 Review of shop drawings or detail drawings will not relieve the obligation of ensuring that the equipment, materials, or layouts meet the functional requirements of the specifications, and that all necessary mounting space and clearance requirements are met. Thus, the Departmental Representative's review is for assistance only.

.6 No equipment will be accepted on the job site without shop drawings having been reviewed by the Departmental Representative.

1.16 CLEANING

.1 Prior to turnover to client, clean interior and exterior of all new systems. Vacuum interior of new and modified ductwork and air handling units.

1.17 AS-BUILT DRAWINGS

.1 Site records:
- .1 Mechanical sub-contractor shall mark all changes as work progresses and as changes occur.
- .2 On a weekly basis, transfer information to record set of documents, revising to show all work as actually installed.
- .3 Use different colour waterproof ink for each service.
- .4 Make available for reference purposes and inspection at all times.

.2 As-built drawings:
- .1 Prior to start of Testing, Adjusting and Balancing (TAB), 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 hard copy to Departmental Representative for approval and make corrections as directed.
- .4 TAB to be performed using as-built drawings.
- .5 Following approval, submit completed hard copy as-built drawings with Operating and Maintenance Manuals.

.3 Submit copies of as-built drawings for inclusion in final TAB report.

1.18 CONFLICT/CO-ORDINATION DRAWINGS

.1 For congested areas, prior to installation the contractor shall prepare interference drawings indicating proposed location of all systems & equipment including ductwork, piping, fans, diffusers, VAV boxes, conduits, lighting fixtures, etc. Prior to installation the contractor shall submit the drawings to the Departmental Representative for review.

.2 Architectural, structural and electrical outlines may be shown to assist in coordination of work; confirm final arrangements before layout of mechanical work.

.3 Do not scale.

.4 Except where dimensioned, drawings indicate general mechanical layouts only.

.5 Provide field drawings to show relative positions of various services. Obtain approval before beginning work. As a minimum provide layout/coordination drawings for mechanical rooms & corridor ceilings. Drawings must show coordination between all equipment and systems within the given space. All sub-trades to coordinate their work in conjunction with others.

.6 Within six (6) weeks of Letter of Intent, mechanical & electrical trades to verify that proposed rooms, shafts, chases, reflected ceiling elevations, etc. provide adequate space for the installation of mechanical & electrical systems. This is to identify if there are any spatial shortcomings and to give adequate time for construction manager, Departmental Representative and trades to make any dimensional changes and to make clear to all trades where items are to be installed. Installation and layout will not be on a first come first layout basis.

.7 Request for information (RFI) to be submitted if necessary with contractor's proposed solution & issue of concern. RFI's must be submitted with proposed solution and clearly identify the issues or conflicts so can respond appropriately.Departmental Representative

.8 If this procedure is not followed the contractor shall be responsible for all modifications required to integrate the systems & equipment.

1.19 FEES AND PERMITS

.1 Pay all fees and obtain all permits, taxes relating to the mechanical scope of work.

1.20 FIRE ALARM BYPASS

.1 Contractor to pay all costs assocatied with fire alarm bypass as required to perform mechanical work.

1.21 WARRANTY

.1 Unless indicated otherwise provide one (1) year warranty starting at substantial completion for all new systems including materials, equipment & labour.

1.22 LOCATION OF MECHANICAL EQUIPMENT

.1 Allow for 1500 mm of adjustment for exact location of air handling units, pumps, ducts, piping, etc. at no extra cost or credit.

1.23 ELECTRONIC DRAWINGS

.1 Goodkey, Weedmark & Associates Limited will agree to supply the mechanical drawings in the form of electronic documents for the project to the User for the convenience of the User in carrying out it's work. The User shall sign a License Agreement before drawings will be released.

1.24 CUTTING, PATCHING & CORING

.1 Provide cutting, patching and coring of all walls, ceiling & concrete slabs and other surfaces as required for mechanical work. Check with Departmental Representative prior to core drilling and cutting of structure regarding building requirements and policies. Provide notification, clearance & protection.

.2 The following procedure shall be followed for cutting & core drilling:

- .1 Contractor to coordinate and summarize all new cores and openings in building structure. Contractor to investigate on site and locate any existing available hole which may be re-used for new systems.
- .2 Contractor to prepare a layout sketch showing all existing openings & holes and required new openings & holes, with size and locations to the closest grid line in both directions, and submit for review and approval by the Departmental Representative.
- .3 Structural engineer to provide written report outlining acceptance of the openings, as well as specific requirements for reinforcing at each location.
- .4 Contractor to proceed with reinforcing tracing as per report and scanning for electrical conduit. Scanning to be completed using ground penetrating Radar (GPR) technology.
- .5 Contractor shall identify at each location prior to coring and cutting the location, direction and layer of each reinforcing bar and conduit.
- .6 Any core or opening where reinforcing steel was cut during the cutting & coring process must be retained on site, and the Contractor must inform the Departmental Representative with the following information: size of the reinforcing bar, reinforcing layer location (top steel or bottom slab steel) and direction of the bar (east - west or north - south).

.3 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval. Match existing material, colour, finish and texture or as indicated otherwise.

.4 Provide dust tight screens or partitions to localize dust generating activities and for protection of finished areas of work, workers and public.

1.25 MECHANICAL COST BREAKDOWN

.1 Upon award of contract, provide mechanical cost breakdown as per attached schedules for Departmental Representative's review and for progress billing purposes.

.2 Costs such as site trailers, mobilization, shop drawings, engineering, etc. to be included as part of material and labour for each piece of equipment.

.3 Controls programming and commissioning to be billed upon completion of commissioning.

.4 Fire protection engineering costs to be included as part of material and labour costs.

.5 Closeout documents including O&M manuals, as-built drawings, approved air & hydronic TAB reports, seismic letters, NFPA letters, etc. shall constitute 5% of the total mechanical construction cost and shall be approved as a single lump sum line item after submission to and final acceptance by Departmental Representative. Contractor to indicate cost as a separate line item in Progress Billing.

.6 Proposed billings to be submitted a minimum of fourteen (14) calendar days prior to submission of first billing, for review and approval by Departmental Representative.

.7 Equipment costs are to be broken down into specific equipment grouping and submitted with proposed billing submittal.

Example: Grilles, VAV boxes, air handling units, VSD's to be separated.

Grilles	$_____
VAV boxes	$_____
Air handling units	$_____
VFD's	$_____

1.26 FINAL INSPECTION

.1 Do not request final inspection until:
- .1 Deficiencies are less than 25 items.
- .2 All systems have been tested and are ready for operation.
- .3 All air & water balancing has been completed as applicable.
- .4 The Departmental Representative's operating personnel have been instructed in the operation of all systems and equipment.
- .5 The complete operation and maintenance data books have been delivered to the Departmental Representative.
- .6 All inspection certificates have been furnished including but not limited to seismic certification, NFPA (Fire) 13 certification, City's final plumbing inspection.
- .7 All record drawings have been completed and approved.
- .8 All fire extinguishers have been installed.
- .9 All spare parts and replacement parts have been provided and receipt of same acknowledged.
- .10 The cleaning up is finished in all respects.
- .11 Upon completion of above, contractor to request in writing for final site review with a minimal 72 hour notification.

.2 Final installation shall be subject to the approval of the Departmental Representative.

Project: Date:

Fire Protection		Total Contract Amount	to Date	Total to Date	Previous Amount Invoiced	Amount this Claim	Balance Remaining
Mobilization – Admin., Site Set-up							
Engineering							
Fabrication							
Sleeving	Material						
	Labour						
Sprinklers	Material						
	Labour						
Close-out Documentation (5%)							
TOTAL ORIGINAL CONTRACT AMOUNT							
Change Orders							
Architect's CO #	GWA CCO or SI #						
#	#						
#	#						
Total Change Order Amount							
TOTAL CONTRACT AMOUNT							

NOTE: Change Orders that do not reference the Architect s Change Order number and Goodkey Weedmark s Contemplated Change Order (CCO) or Site Instruction (SI) number will not be reviewed.

Project:

Date:

HVAC		Total Contract Amount	to Date	Total to Date	Previous Amount Invoiced	Amount this Claim	Balance Remaining
Mobilization – Admin., Site Set-up							
Drafting & Coordinating							
Sleeving	Material						
	Labour						
Sheet Metal	Material						
	Labour						
Grilles, Diffusers	Material						
	Labour						
Silencers	Equipment						
	Labour						
Smoke/Fire Dampers	Equipment						
	Labour						
Insulation	Material						
	Labour						
Close-out Documentation (5%)							
TOTAL ORIGINAL CONTRACT AMOUNT							
Change Orders							
Architect's CO #	GWA CCO or SI #						
#	#						
#	#						
Total Change Order Amount							
TOTAL CONTRACT AMOUNT							

NOTE: Change Orders that do not reference the Architect s Change Order number and Goodkey Weedmark s Contemplated Change Order (CCO) or Site Instruction (SI) number will not be reviewed.

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 RELATED DOCUMENTS

.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Section, apply to work specified in this section.

1.3 DEFINITIONS

.1 Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, water and hot gases through penetrations in fire rated wall and floor assemblies.

1.4 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

.1 Only tested firestop systems shall be used in specific locations as follows:
- .1 Penetrations for the passage of duct, piping, and other mechanical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions
- .2 Repetitive plumbing penetrations in fire-rated floor assemblies. Penetrations exist for the installation of tubs, showers, aerators and other plumbing fixtures.

1.5 RELATED WORK OF OTHER SECTIONS

.1 Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:
- .1 Section 03 30 00 - Cast-In-Place Concrete
- .2 Section 04 20 00 - Masonry Work
- .3 Section 07 84 00 - Firestopping
- .4 Section 09 20 00 - Plaster and Gypsum Board

1.6 REFERENCES

.1 Test Requirements: ULC-S115-M or CAN4-S115-M, "Standard Method of Fire Tests of Through Penetration Fire Stops".

.2 International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgements.

.3 Inspection Requirements: ASTM E2174-14b, "Standard Practice for On-site Inspection of Installed Fire Stops.

.4 CAN/ULC-S102-M, Standard Test Method for Surface Burning Characteristics of Building Materials.

.5 All major building codes: NBC.

.6 NFPA (Fire) 101 - Life Safety Code, 2018 Edition

.7 ASTM G21-15, Standard Practice for Determining Resistance of Synthetic Polymeric

1.7 QUALITY ASSURANCE

.1 Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

.2 Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

.3 For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgement derived from similar ULC or cUL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgement drawings must follow requirements set forth by the International Firestop Council.

1.8 SUBMITTALS

.1 Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of ULC or cUL firestop systems to be used and manufacturer's installation instructions to comply with Division 01.

.2 Manufacturer's engineering judgement identification number and drawing details when no ULC or cUL system is available for an application. Engineer judgement must include both project name and contractor's name who will install firestop system as described in drawing.

.3 Submit material safety data sheets provided with product delivered to job-site.

.4 Submit documentation showing products are formaldehyde free and low in VOC content in accordance with LEED requirements.

.5 Submit a complete firestopping and smokeseal schedule. Schedule is to include complete details, cut sheets, system descriptions and location of each proposed firestopping & smokeseal application.

1.9 INSTALLER QUALIFICATIONS

.1 Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1.10 DELIVERY, STORANGE AND HANDLING

.1 Deliver materials undamaged in manufacturer's clearly labelled, unopened containers, identified with brand, type, and ULC or cUL label where applicable.

.2 Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

.3 Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

.4 Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

.5 Do not use damaged or expired materials.

1.11 PROJECT CONDITIONS

.1 Do not use materials that contain flammable solvents.

.2 Scheduling:
- .1 Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
- .2 Schedule installation of Drop-In firestop devices after placement of concrete but before installation of the pipe penetration. Diameter of sleeved or cored hole to match the listed system for the device.
- .3 Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

.3 Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

.4 Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

.5 During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

.1 Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

.2 Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

.3 Firestopping Materials are either "cast-in-place" (integral with concrete placement) or "post installed." Provide cast-in-place firestop devices prior to concrete placement.

.4 Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with ULC S-115.
- .1 L-Rating: Not exceeding 25.4 L/s/sq.m (5.0 cfm/sq.ft.) of penetration opening at both ambient and elevated temperatures.

.5 Mold Resistance: Provide penetration firestoppping with mold and mildew resistance rating of 0 as determined by ASTM G21.

2.2 ACCEPTALBE MATERIALS

.1 Hilti (Canada) Corporation (1-800-363-4458), 3M (1-800-328-1687), or as alternative materials approved by addendum in accordance with Instructions to Tenderers.

2.3 MATERIALS

.1 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

.2 Pre-Installed firestop devices for use with non-combustible and combustible pipes (closed and open systems) penetrating concrete floors and/or gypsum walls.

.3 Sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT).

.4 Sealants or caulking materials for use with sheet metal ducts.

.5 Intumescent sealants or caulking materials for use with combustible items (penetrates consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe.

.6 Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems) tested to 50 Pa. differential.

.7 Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways.

.8 Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways.

.9 For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected.

.10 For penetrations through a Fire Separation wall provide a firestop system with a "F" Rating as determined by ULC or cUL as indicated below:

Fire Resistance Rating of Separation	Required ULC or cUL "F" Rating of Firestopping Assembly
30 minutes	20 minutes
45 minutes	45 minutes
1 hour	45 minutes
1.5 hours	1 hour
2 hours	1.5 hours
3 hours	2 hours
4 hours	3 hours

.11 For combustible pipe penetrations through a fire separation provide a firestop system with a "F" rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.

.12 For penetrations through a Fire Wall or horizontal Fire Separation provide a firestop system with a "FT" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
- .1 Verify penetrations are properly sized and in suitable condition for application of materials.
- .2 Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
- .3 Ensure all service lines are in place, tested and acceptable to the authority having jurisdiction, prior to application of fire stopping and smoke seal.
- .4 Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
- .5 Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
- .6 Do not proceed until unsatisfactory conditions have been corrected.

3.2 COORDINATION

.1 Coordinate construction of openings and penetrations to ensure that the fire stop systems are installed according to specified requirements.

.2 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems.

.3 Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.

3.3 INSTALLATION

.1 Regulatory Requirements: Install firestop materials in accordance with ULC Fire Resistance Directory or UL Products Certified for Canada (cUL) Directory or Omega Point Laboratories Directory.

.2 Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.
- .1 Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
- .2 Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of ULC or cUL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
- .3 Protect materials from damage on surfaces subjected to traffic.

3.4 FIELD QUALITY CONTROL

.1 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

.2 Keep areas of work accessible until inspection by applicable code authorities.

.3 Inspection of through-penetration firestopping shall be performed in accordance with ASTM E2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.

.4 Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.5 IDENTIFICATION & DOCUMENTATION

.1 The firestop contractor is to supply documentation for each single application addressed. This documentation shall identify each penetration and joint location on the entire project.

.2 The Documentation Form for through penetrations is to include:
- .1 A Sequential Location Number
- .2 The Project Name
- .3 Date of Installation
- .4 Detailed description of the penetrations location
- .5 Tested System or Engineered Judgement Number
- .6 Type of assembly penetrated
- .7 A detailed description of the size and type of penetrating item
- .8 Size of opening
- .9 Number of sides of assemblies addressed
- .10 Hourly rating to be achieved
- .11 Installers Name

.3 Submit the record document to the Departmental Representative at the completion of the project.

.4 Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
- .1 The words: "Warning -Through Penetration Firestop System-Do Not Disturb. Notify Building Management of Any Damage."
- .2 Contractor's Name, address, and phone number.
- .3 Through-Penetration firestop system designation of applicable testing and inspecting agency.
- .4 Date of Installation.
- .5 Through-Penetration firestop system manufacturer's name.
- .6 Installer's Name.

3.6 ADJUSTING AND CLEANING

.1 Remove equipment, materials and debris, leaving area in undamaged, clean condition.

.2 Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

3.7 WASTE MANAGEMENT

.1 Separate and recycle waste materials in accordance with Waste Management Plan as specified in Section 01 74 19, and place in designated areas for recycling.

.2 Place materials defined as hazardous or toxic waste in designated containers. Before disposing of containers, relieve containers of any remaining foam and pressure. Allow foam to fully cure before disposing. Never dispose of foam in a liquid state.

.3 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections in Divisions 20, 21, 23 & 25.

1.2 REFERENCES

.1 Ontario Regulation
  .1 ONTARIO OBC-2012, 2012 Ontario Building Code Compendium.

.2 National Fire Protection Association (NFPA)
  .1 NFPA (Fire) 13, Standard for the Installation of Sprinkler Systems, 2016 Edition.

.3 National Research Council Canada
  .1 NRCC NBCC-2015, National Building Code of Canada.

1.3 DEFINITIONS

.1 SRS: acronym for Seismic Restraint System.

1.4 QUALIFICATIONS

.1 Prime mechanical contractor shall engage a Seismic Engineer who shall be responsible for all mechanical sections to ensure all mechanical sections listed in Item 1.1.1 are covered. Prime mechanical contractor shall ensure the Seismic Engineer is a Professional Engineer holding a Certificate of Authorization in the Province of Ontario with a minimum of 5 years experience in seismic design, and is covered with a minimum of $2M Professional Liability Insurance.

.2 The Manufacturer shall be a member of VISCMA (Vibration Isolation and Seismic Control Manufacturers Association). They shall have a letter issued to their Supplier confirming that they have reviewed and accepted the engineering practices used by the Seismic Engineer. The letter shall also state that the manufacturer accepts the Supplier to act as their representative for the product.

.3 Acceptable Suppliers: HTS Engineering, Master Group, Walmar, E.H. Price. Alternate to be approved by Addendum (only).

1.5 GENERAL DESCRIPTION

.1 This section covers design, supply and installation of complete SRS for all systems, equipment specified for installation on this project. This includes fire protection piping & mechanical equipment and systems, both vibration isolated and statically supported.

.2 SRS to be fully integrated into & compatible with:
  .1 Noise and vibration controls specified elsewhere in this project specification.
  .2 Structural, mechanical, electrical design of project.

.3 During a seismic event, SRS to prevent systems and equipment from causing personal injury and from moving from normal position unless noted otherwise. Specified critical systems as noted below must remain operational during and after an seismic event:
- .1 All systems for buildings as listed in NBC Table 4.1.8.18 - non-structural components.
- .2 Life safety systems.
- .3 Natural gas & fuel oil systems.

1.6 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Seismic Engineer shall be a Professional Engineer specializing in design of SRS and registered in Province of Ontario. The following submittals shall bear the SRS Design Engineer's seal and signature:
- .1 A complete list of documents reviewed & list of exclusion.
- .2 Full details of design criteria, calculations for all equipment & associated systems.
- .3 A spreadsheet identifying all equipment requiring or not requiring seismic restraints and include all calculations.
- .4 Copy of shop drawings and product data sent to Structural Engineer for review of connection points to building structure.

1.7 FINAL CERTIFICATION SUBMITTAL

.1 Seismic Engineer shall be a Professional Engineer specializing in design of SRS and registered in Province of Ontario. The following shall bear the SRS Design Engineer's seal and signature:
- .1 SRS installation inspections.
- .2 SRS final certification letter for the project.

.2 The Fire Protection Contractors shall be responsible for their respective discipline as it relates to Seismic restraints system. The contractor shall adhere to Section 20 05 49.01 and/or more stringent code (i.e. NFPA (Fire) 13, 14 & 20).

.3 The final certification letter shall be formatted to identify the following within the body of the letter:
- .1 The date of the final inspection.
- .2 A statement that lists ALL contract documents which were reviewed including but not limited to the mechanical drawings, project change orders, site instructions, etc.
- .3 A statement which clearly identifies any exclusions of scope of service.
- .4 A statement that certifies the complete mechanical seismic installation meets the latest version of NBC & applicable codes & standards.

1.8 MAINTENANCE DATA

.1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 20 05 01 - Mechanical General Requirements.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Definitions
- .1 Seismic System: isolation and seismic restraint products supplied by one supplier.
- .2 Manufacturer: manufacturer of the isolation and seismic restraint system.
- .3 Supplier: manufacturers' and seismic engineer's representative

.2 Each contractor shall use one Supplier to provide seismic design, isolation, and seismic restraint.

.3 Seismic restraints are to be provided for all operational and functional components of building services in accordance with the current National Building Code, and NFPA (Fire) 13, 14 & 20.

.4 The contractor shall utilize a Supplier familiar with the design of seismic systems to provide a comprehensive package of isolation and seismic restraint for the project. Provide detailed shop drawings showing the proposed restraint system for all required equipment, piping, and ductwork on the project. The shop drawings submittals shall include all items listed in Item 1.6.
- .1 Acceptable Manufacturers: Kinetics / Vibron, Tecoustics, Mason, Gripple Seismic.
- .2 Alternates to be approved by Addendum only.

.5 Cable restraint systems, rod stiffener clamps and seismic isolator capacities to be verified by an independent test laboratory. Connection materials and site specific designs to be by the Seismic Engineer. The Seismic Engineer may specify material and anchors provided by the contractor where this is appropriate. It is the contractors' responsibility to ensure that the Seismic Engineers' requirements and specification have been met.

.6 At the completion of the project, the Supplier and the Seismic Engineer shall review the installations on site, and shall prepare a written report, with a sealed letter from the Seismic Engineer, certifying that the installations have been completed in accordance with their design and shop drawings. Refer to item 1.1.

2.2 SEISMIC FORCE

.1 The Importance Factor for this project is:
- .1 I = 1.0 - All other buildings i.e.: Office & General Buildings.

Note: As per NBCC.

.2 The site classification for seismic site response and shear wave velocity parameters shall be as indicated on structural documents and as recorded in the geotechnical report.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install Seismic Restraint Systems in accordance with Seismic Engineer's and manufacturer's recommendations.

.2 Install SRS at least 25 mm from all other equipment, systems, services.

.3 Co-ordinate connections with all disciplines.

3.2 INSPECTION AND CERTIFICATION

.1 SRS to be inspected and certified by Manufacturer upon completion of installation.

.2 Seismic Design Engineer shall provide written report to Departmental Representative certifying that SRS has been installed in accordance with the SRS drawings. The report shall bear the seal and signature of the SRS Design Engineer.

3.3 COMMISSIONING DOCUMENTATION

.1 Upon completion and acceptance of certification, hand over to Departmental Representative complete set of construction documents, revised to show "as-built" conditions.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Submit catalogue details for each type of door illustrating profiles, dimensions and methods of assembly.

PART 2 - PRODUCTS

2.1 ACCESS DOORS

.1 Supply and install as necessary to gain access to all concealed mechanical equipment for operating, inspecting, adjusting, servicing.

.2 Sizes: Except as indicated otherwise, to be minimum sizes as follows:
- .1 For body entry: 600 x 600 mm (24" x 24").
- .2 For hand entry: 300 x 300 mm (12" x 12").

.3 Construction: Rounded safety corners, concealed hinges, screwdriver latch, anchor straps, able to open 180°.

.4 Materials
- .1 Tiled or marble surfaces and other special areas: Stainless steel with brushed satin or polished finish as directed by Departmental Representative.
- .2 All other areas: Prime coated steel.

.5 Fire Rating
- .1 Access doors fire rating to match that of wall, ceiling or floor the access door is installed in. Coordinate with architectural drawings.

2.2 EXCLUSIONS

.1 Lay-in tile ceilings. In this instance, use unobtrusive identification locators.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Installation in accordance with Manufacturer's installation instructions for particular surface.

3.2 LOCATION

.1 Location: Ensure that equipment is clearly within view and accessible for operating, inspecting, adjusting, servicing without the need for special tools.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 National Fire Protection Association
  .1 NFPA (Fire) 13, Standard for the Installation of Sprinkler Systems, 2016 Edition.

.2 Ontario Regulation
  .1 ONTARIO OBC-2012, 2012 Ontario Building Code Compendium.

.3 National Research Council Canada
  .1 NRCC NBCC-2015, National Building Code of Canada.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements and in accordance with NFPA (Fire) 13, working plans and design requirements.

.2 Pipe layout shall be the Contractors responsibility and fully coordinated with other trades.

1.4 ENGINEERING DESIGN CRITERIA

.1 Design system in accordance with NFPA (Fire) 13 using following parameters:
  .1 System shall be wet pipe systems as indicated.
  .2 All areas shall be designed for hazard coverage indicated with design area and associated densities.
  .3 Pipe size and layout:
    .1 Hydraulic design.
    .2 Sprinkler layout to NFPA (Fire) 13 and with sprinkler centred in short direction of ceiling tile and no less than 300 mm from the tile's edge. Sprinkler contractor shall be responsible to provide sprinkler and piping layout fully coordinated with other systems.
    .3 The hydraulic design shall be sized to accommodate the highest and most remote zones.
    .4 Allow for additional sprinklers and pipe distribution to suit electrical, architectural and structural coordination.
    .5 Sprinklers shown are for architectural coordination, coverage to suit NFPA (Fire) 13 requirements. Provide additional sprinklers as required.

.4 Water supply:
.1 Base design on NFPA (Fire) 13 and obtain water supply data from nearest fire hydrant. Hydraulic calculations shall commence at water main connection at street. Provide as part of hydraulic calculation submission, fire hydrant flow test data and deduct 10% as safety factor based on available pressure value.
.5 Drawings and calculations shall be certified by a Professional Engineer licensed in the Province of Ontario.
.6 Sprinkler system to be seismically restrained to National Building Code and NFPA (Fire) 13 requirements.
.7 Final installations to be reviewed by Professional Engineer licensed in the Province of Ontario. NFPA (Fire) 13 compliance letter to be stamped by Hydraulic Design Engineer and submitted at end of contract.

1.5 DRAWING PREPARATION

.1 Review architectural, structural, mechanical and electrical drawings to determine interferences affecting the distribution layout prior to shop drawing submission.

1.6 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

1.7 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Provide spare sprinklers and tools as required by NFPA (Fire) 13.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS AND VALVES

.1 Pipe:
.1 Ferrous: to NFPA (Fire) 13.
.2 Ferrous hot dipped galvanized: to NFPA (Fire) 13 in corrosive or damp environments.

.2 Fittings and joints to NFPA (Fire) 13:
.1 Ferrous: screwed, welded, flanged or roll grooved.
.2 All exposed piping shall be rigid piping.

.3 Valves:
.1 ULC listed for fire protection service.
.2 Up to NPS 2: bronze, screwed ends, OS&Y rising stem gate or ball valve.
.3 NPS 2-1/2 and over: cast iron, flanged or roll grooved ends, OS&Y rising stem gate or butterfly type.
.4 Check valves: swing type as above.
.5 Ball drip check valve.

.4 Pipe hangers:
.1 ULC listed for fire protection services.

.5 Sprinkler system shall be rated at 1380 kPa (200 psi).

2.2 SPRINKLERS

.1 General: to NFPA (Fire) 13 and ULC listed for fire services.

.2 All sprinklers shall have low zinc content (less than 10%) brass alloy and metal to metal sealing mechanism in the water ways.

.3 Acceptable materials: Viking, Grinnell, Victaulic and Tyco.

2.3 CONCEALED SPRINKLER

.1 Fully concealed pendent, quick response for hazard coverage as indicated, 5.6 K factor, enclosed escutcheon, separate two-piece design of mounting cup and coverplate, internal threaded closure, 68°C (155°F) rated, 13 mm (½") adjustment, FM approved, white enamel chrome finish, glass bulb type and white finish cover.

2.4 UPRIGHT SPRINKLER

.1 Upright bronze, quick response for hazard coverage as indicated, 5.6 K factor, FM approved, chrome finish, glass bulb type c/w wire guard; 68°C (155°F) rated, 13 mm (½") orifice.

2.5 SIDEWALL SPRINKLER

.1 Sidewall quick response for hazard occupancy as indicated, FM approved, 5.6 K factor, chrome finish glass bulb with adjustable escutcheon plate, 68°C (155°F) rated, 13 mm (½") orifice.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install, inspect and test to acceptance in accordance with NFPA (Fire) 13.

.2 Testing to be witnessed by Authority having jurisdiction.

.3 Install and test equipment to manufacturers' standards.

.4 Provide adequate pipe supports and bracing as per NFPA (Fire) 13 requirements and as follows:
.1 Fire protection contractor shall carry a structural engineer to design and certify the support system for any piping distribution system exceeding 100 mm (4") or where piping is grouped such that the distributed weight exceeds the building structure limits. (Note: In steel building structure the piping supports shall never be supported by a single joist or off the bottom chord of the joist or truss).

3.2 TESTING

.1 Pressure test all piping systems as required by NFPA and provide pressure test verification documents.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 USE OF SYSTEMS

.1 Use of new and/or existing permanent heating and ventilating systems for supplying temporary heat and ventilation is permitted only under the 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 from any cause.
- .5 Supply ventilation systems are protected by 60% filters, which shall be inspected daily, changed every 2 weeks or more frequently as required.
- .6 Return systems have approved filters over all openings, inlets, outlets.
- .7 All systems will be:
  - .1 operated as per manufacturer's recommendations or instructions.
  - .2 operated by Contractor.
  - .3 monitored continuously by Contractor.
- .8 Warranties and guarantees do not commence until equipment is turned over to Departmental Representative.
- .9 Regular preventive and all other manufacturers recommended maintenance routines are performed by Contractor at his own expense and under supervision of Departmental Representative.
- .10 Before turn-over to Departmental Representative, entire system to be refurbished, cleaned internally and externally and restored to "as- new" condition. Filters in air and water systems are to be replaced.

.2 Filters referred to herein are over and above those specified elsewhere in this specification.

.3 Exhaust systems are not included in any 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 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers.
  .1 ASHRAE 90.1-2016, Energy Code for Buildings Except Low-Rise Residential Buildings.

.2 Electrical Equipment Manufacturers' Advisory Council (EEMAC)

.3 National Electrical Manufacturers Association (NEMA)
  .1 NEMA MG 1-2016, Motors and Generators.

.4 Ontario Regulation
  .1 ONTARIO OBC-2012, 2012 Ontario Building Code Compendium.

.5 National Research Council Canada
  .1 NRCC NBCC-2015, National Building Code of Canada.

1.3 ELECTRICAL

.1 Electrical work to conform to Division 26 including the following:
  .1 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 Divisions 20, 21 & 23. Refer to Division 26 for quality of materials and workmanship.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Motors to be premium efficiency, in accordance with NEMA 1 premium motor standards and the requirements of ASHRAE 90.1.

2.2 MOTORS

.1 Provide premium efficiency motors for mechanical equipment to NEMA MG 1 Part 31.

.2 Motors efficiency must exceed the following:

Open Drip-Proof (ODP) Type

Motor Size	Speed (RPM) 1200	1800	3600
HP	NEMA Premium Nominal Efficiency		
1 & below	82.5%	85.5%	77.0%
1.5	86.5%	86.5%	84.0%
2	87.5%	86.5%	85.5%
3	88.5%	89.5%	85.5%
5	89.5%	89.5%	86.5%
7.5	91.0%	91.0%	88.5%
10	91.7%	91.7%	89.5%
15	91.7%	93.0%	90.2%
20	92.4%	93.0%	91.0%
25	93.0%	93.6%	91.7%
30	93.6%	94.1%	91.7%
40	94.1%	94.1%	92.4%
50	94.1%	94.5%	93.0%
60	94.5%	95.0%	93.6%
75	94.5%	95.0%	93.6%
100	95.0%	95.4%	93.6%
125	95.0%	95.4%	94.1%
150	95.4%	95.8%	94.1%
200	95.4%	95.8%	95.0%

Totally Enclosed Fan-Cooled (TEFC) Type

Motor Size	Speed (RPM) 1200	1800	3600
HP	NEPA Premium Nominal Efficiency		
1 & below	82.5%	85.5%	77.0%
1.5	87.5%	86.5%	84.0%
2	88.5%	86.5%	85.5%
3	89.5%	89.5%	86.5%
5	89.5%	89.5%	88.5%
7.5	91.0%	91.7%	89.5%
10	91.0%	91.7%	90.2%
15	91.7%	92.4%	91.0%
20	91.7%	93.0%	91.7%
25	93.0%	93.6%	91.7%
30	93.0%	93.6%	91.7%
40	94.1%	94.1%	92.4%
50	94.1%	94.5%	93.0%
60	94.5%	95.0%	93.6%
75	94.5%	95.4%	93.6%
100	95.0%	95.4%	94.1%
125	95.0%	95.4%	95.0%
150	95.8%	95.8%	95.0%
200	95.8%	96.2%	95.4%

.3 Motors under 373 W (½ HP): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.4 Motors 373 W (½ HP) to 14.92 kW (20 HP): EEMAC Class B/F, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 45°C/60°C over ambient of 30°C, 3 phase, 600 V, unless otherwise specified or indicated.

.5 Motors 18.65 kW (25 HP) and larger: EEMAC Class B/F, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 45°C/60°C over ambient of 30°C, 3 phase, 600 V, c/w integral thermistor protection, unless otherwise specified or indicated. Thermistors shall be factory installed, copper RTD type, one on each phase, wired to identified terminals in motor terminal box and wired to starter/VFD (wiring, conduit & connections by Div. 26).

.6 Two speed motors shall be double winding type.

.7 Motors coupled with VFD shall be premium efficiency, inverter duty type to NEMA MG 1 Part 31 and shall have as a minimum EEMAC Class F insulation. Inverter ready motors shall not be acceptable.

.8 Motors coupled with VFD's shall include a shaft grounding ring.

.9 Motors located outside to be TEFC type, unless located in insulated weatherproof enclosure.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Departmental Representative for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.

.3 For motor 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 to be determined during start-up and commissioning.

.6 Minimum drive rating: 1½ 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.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;
- .1 Expanded metal screen welded to steel frame.
- .2 Minimum 1.6 mm (16 ga). sheet metal tops and bottoms.
- .3 38 mm (1½") dia holes on both shaft centres for insertion of tachometer.
- .4 Removable for servicing.
- .5 OSHA approved.
- .6 Sized to allow either sheave to be increased by two sizes.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Plenum fan assembly must have an enclosed safety screen as per OSHA standards.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Fasten securely in place.

.2 Ensure motor installation is easily removable for servicing.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)
- .1 ASME B31.1-2016, Power Piping, (SI Edition).

.2 American Society for Testing and Materials (ASTM)
- .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A125-96(2013)e1, Specification for Steel Springs, Helical, Heat-Treated.
- .3 ASTM A153/A153M-16a, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .4 ASTM A307-14e1, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .5 ASTM A563-15, Specification for Carbon and Alloy Steel Nuts (Metric).
- .6 ASTM D1929-16, Standard Test Method for Determining Ignition Temperature of Plastics.

.3 Factory Mutual (FM)

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
- .1 MSS SP-58-2009, Pipe Hangers and Supports - Materials, Design, Selection, Manufacture, Application, and Installation.

.5 Underwriter's Laboratories of Canada (ULC).

1.3 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 SP-58.

.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 all 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 to be in accordance with MSS SP-58.

1.4 DESIGN FOR SEISMIC EVENTS

.1 Design supports, platforms, hangers, racks to withstand seismic events as specified Section 20 05 49.01 - Seismic Restraint Systems (SRS).

1.5 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Submit shop drawings and product data for following items:
- .1 All bases, hangers and supports.
- .2 Connections to equipment & structure.
- .3 Structural assemblies.

1.6 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP-58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:
- .1 Pipe hangers and supports: galvanized after manufacture.
- .2 Use electro-plating galvanizing process or hot dipped galvanizing process.
- .3 Ensure steel hangers in contact with copper piping are copper plated or 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 and carbon steel retaining clip.
  - .1 Rod: 9 mm UL listed.
- .2 Cold piping NPS 2½ or greater, all hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS SP-58.

.3 Upper attachment structural: Suspension from upper flange of I-Beam.
- .1 Cold piping NPS 2 maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP-58.
- .2 Cold piping NPS 2½ or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.

.4 Upper attachment to concrete.
- .1 Ceiling: Carbon steel welded rod, clevis plate, clevis pin and cotters with forged weldless steel nut.
- .2 Concrete wedge anchor with knockout protector plate UL listed to MSS SP-58. Anchor installation to be via concrete pre-drilling. Impact insert type anchor not allowed.

.5 Manufacturer assemblies:
- .1 Sway braces for seismic restraint systems: to Section 20 05 49.01 - Seismic Restraint Systems (SRS).

.6 Hanger rods: threaded rod material to MSS SP-58.
- .1 Ensure that hanger rods are subject to tensile loading only.
- .2 Provide linkages where lateral or axial movement of pipework is anticipated.
- .3 Do not use 22 mm or 28 mm rod.

.7 Pipe attachments: material to MSS SP-58.
- .1 Attachments for steel piping: carbon steel black.
- .2 Attachments for copper piping: copper plated black steel.
- .3 Use insulation shields for hot pipework.
- .4 Oversize pipe hangers and supports.

.8 Adjustable clevis: material to MSS SP-58 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis. Ensure "U" has hole in bottom for riveting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-58.

.10 U-bolts: carbon steel to MSS SP-58 with 2 nuts at each end to ASTM A563.
- .1 Finishes for steel pipework: black.
- .2 Finishes for copper, glass, brass or aluminum pipework: black, with formed portion epoxy coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-58, Type 43.
- .1 Finish: Hot dipped galvanized steel.
- .2 Acceptable material: Tolco or approved equal.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: black carbon steel to MSS SP-58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSS SP-58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping: 64 kg/m^3 density insulation plus insulation protection shield to: MSS SP-58, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping: 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 SP-58.

2.5 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 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.

2.6 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger to be complete with factory calibrated travel stops.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.7 EQUIPMENT SUPPORTS

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

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

.2 For attachment to concrete, provide concrete wedge anchors with knockout protection plate UL listed. Anchor installation to be via concrete pre-drilling. Impact insert type anchor not allowed.

2.9 HOUSEKEEPING PADS

.1 For base-mounted equipment: Concrete, at least 100 mm high, 50 mm larger than equipment all around, with chamfered edges and anchored to the structural slab.

.2 Concrete: to Section 03 30 00 - Cast-in-place Concrete.

2.10 PIPE, DUCT, CONDUIT PENETRATIONS THROUGH SLABS

.1 Where piping or conduits penetrate through the floor of mechanical room, a 100 mm high housekeeping pad shall be installed with minimum 150 mm between conduit/pipe and the edge of the pad. This pad shall be bonded to the existing slab through which the pipes, ducts or conduit shall pass.

2.11 ROOF MOUNTED SUPPORTS

.1 Pressure treated lumber supports are only acceptable when roofed in/covered by general trades. Exposed applications are not acceptable.

.2 Portable Support System: Engineered, portable system specifically designed for installation without the need for roof penetrations or flashings, and without damage to the roofing membrane.
- .1 Design system using high density polypropylene bases and structural steel framing.
- .2 Custom design system to fit piping, conduits, equipment, or walkways to be installed and actual conditions of service and loading.
- .3 Piping Supports: Provide suitable hangers and supports.
- .4 Pipe support system shall have seismic ratings and meet Section 20 05 49.01 - Seismic Restraint Systems (SRS).

.3 Bases: Injection molded high density polypropylene with UV-inhibitors or recycled rubber conforming to the following:
- .1 Moisture content: Negligible.
- .2 Shrinkage/swelling due to moisture: Negligible.
- .3 Density: 894 kg/m^3 (55.8 lbs./$ft.^3$).
- .4 Insect resistance: No known insect damage potential.
- .5 Chemical resistance (oil, brake fluid, gasoline, diesel, antifreeze, battery acid, sulfuric acid: no visual or physical change apparent.
- .6 Flammability: No ignition after 10 minutes, 25 kW/m, when tested in accordance with ASTM D1929.
- .7 Sized as required by loading conditions and as indicated on the drawings.
- .8 Shop fabricated with inserts for square tubing or threaded rods as required.
- .9 Colour: Integral black colour as molded.

.4 Steel Framing:
- .1 Strut Types: 1-5/8 in. (41.3 mm) B22TH or 1-7/8 in. (47.6 mm) BTS22H, as required for loading conditions.
- .2 Thickness: 12 gauge (2.7 mm).
- .3 Form: Roll-formed 3-sided or tubular shape, perforated with 9/16 in. (14.3 mm) holes at 1-7/8 in. (47.6 mm) centres on three (3) sides.
- .4 Finish: Hot dip galvanize in accordance with ASTM A123/A123M after fabrication, free of roughness, whiskers, unsightly spangles, icicles, runs, barbs, sags, droplets, and other surface blemishes.

.5 Pipe Supports and Hangers: Conform to MSS SP-58 and as follows:
- .1 Fabricate of carbon steel where framing is carbon steel; fabricate of stainless steel where framing is stainless steel; finished same as framing.
- .2 Sizes 2-1/2 in. (63 mm) and smaller: Single roller supports for piping subject to expansion and contraction; 3-sided channels and pipe clamps.
- .3 Sizes 3 in. (76 mm) and larger: Rollers, clevis hangers, or band hangers, to allow for expansion and contraction without movement of the bases or framing.

.6 Accessories: Clamps, bolts, nuts, washers, and other devices as required for a complete system:
- .1 Carbon steel: Hot-dip galvanized in accordance with ASTM A153/A153M.
- .2 Stainless steel: mill finish.

.7 Acceptable material: Portable Pipe Hangar Model PPH-D, Miro Industries Model 8-DS, Mifab CPORT-2015, Big Foot Systems, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install in accordance with: manufacturer's instructions and recommendations.

.2 Vibration Control Devices:
- .1 Install on piping systems at pumps and elsewhere 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 be to industry standards.
- .3 Steel pipes: Install below coupling or shear lugs welded to pipe.
- .4 Cast iron pipes: Install below joint.

.4 Clevis plates:
- .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:
- .1 vertical movement of pipework is 13 mm or more,
- .2 transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:
- .1 transfer of load to adjacent piping or to connected equipment is not critical.
- .2 variation in supporting effect does not exceed 25% of total load.

.8 When attaching to open web steel joists provide additional hangers for pipes with diameters of 75 mm or greater in order to reduce the magnitude of the concentrated load and spread the load to the joists equally. In these cases the allowable spacing of hangers for pipes permitted under ASME /MSS SP-58 will be reduced and additional hangers will be required as directed by steel fabricator and/or structural engineer.

.9 Locate hangers at the top of open web steel joists where the horizontal and diagonal members meet at a joint.

.10 All installations must be in conjunction with Section 20 05 49.01 - Seismic Restraint System.

3.2 HANGER SPACING

.1 Plumbing piping: most stringent requirements of Manufacturer's recommendations, Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.

.2 Fire protection: to applicable fire code.

.3 Gas & fuel piping: to applicable code.

.4 Copper piping: up to NPS ½: every 1.5 m.

.5 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.6 Within 300 mm of each elbow.

Maximum Pipe Size: NPS	Maximum Spacing Steel	Maximum Spacing Copper	Maximum Spacing XFR
up to 1¼	2.1 m	1.8 m	1.6 m
1½	2.7 m	2.4 m	1.6 m
2	3.0 m	2.7 m	1.8 m
2½	3.6 m	3.0 m	1.8 m
3	3.6 m	3.0 m	2.2 m
4	4.2 m	3.6 m	2.6 m
6	5.1 m		3.1 m
8	5.7 m		3.6 m
10	6.6 m		4.0 m
12	6.9 m		4.4 m

.7 Pipework greater than NPS 12: to MSS SP-58.

3.3 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.

3.4 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4° 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.

3.5 FINAL ADJUSTMENTS

.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: Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps: Hammer jaw firmly against underside of beam.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB).
- .1 CAN/CGSB-24.3-92, Identification of Piping Systems.

.2 Canadian Standards Association (CSA).
- .1 CSA B149.1-15, Natural Gas and Propane Installation Code.
- .2 CSA Z7396.1-17. Medical Gas Pipeline Systems - Part 1: Pipelines for Medical Gases, Medical Vacuum, Medical Support Gases, and Anaesthetic Gas Scavenging Systems.

.3 National Fire Protection Association
- .1 NFPA (Fire) 13, Installation of Sprinkler Systems, 2016 Edition.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Product data to include paint colour chips, all other products specified in this section.

1.4 SAMPLES

.1 Submit samples in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers to be 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.

.2 Construction:
.1 1/8" thick laminated plastic , matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:
.1 Conform to following table:

Size #	Height Sizes (mm)	No. of Lines	Height of Letters (mm)
1	40	1	20
2	75	1	50

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:
.1 Terminal cabinets, control panels: Use size #1.
.2 Equipment in Mechanical Rooms: Use size #2.

2.3 IDENTIFICATION DUCTWORK SYSTEMS

.1 150 mm (6") high stencilled letters and directional arrows 150 mm (6") long x 50 mm (2") high.

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

2.4 LANGUAGE

.1 Identification to be in English.

PART 3 - EXECUTION

3.1 TIMING

.1 Provide identification only after all painting specified in Architectural section is complete re: Interior Painting has been completed.

3.2 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and CSA registration plates as required by respective agency.

3.3 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 in any way.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at least one is visible from any one viewpoint in operating areas and walking aisles. At not more than 17 m (55 ft.) 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, other confined spaces, at entry and exit points, and at each access opening.

.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, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification to be easily and accurately readable from usual operating areas and from access points.

.10 Position of identification to be 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.

.11 At branch take-offs on both main and branch.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
.1 ASHRAE 110-2016, Method of Testing Performance of Laboratory Fume Hoods.

1.3 GENERAL

.1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do all other work as specified in this section.

1.4 QUALIFICATIONS OF TAB PERSONNEL

.1 Names of all personnel it is proposed to perform TAB to be submitted to and approved by Departmental Representative within 14 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

1.5 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 so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.6 EXCEPTIONS

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

1.7 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as 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.

.3 Coordinate TAB with controls, mechanical and electrical contractors.

1.8 PRE-TAB REVIEW

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

.2 Review specified standards and report to Departmental Representative in writing all proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.

1.9 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Divisions 20, 21 & 23.

1.10 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.

1.11 START OF TAB

.1 Notify Departmental Representative 7 days prior to start of TAB.

.2 Start TAB only when building is essentially completed, including:
- .1 Installation of ceilings, doors, windows, other construction affecting TAB.
- .2 Application of weatherstripping, sealing, caulking.
- .3 All pressure, leakage, other tests specified elsewhere in Divisions 20, 21 & 23.
- .4 All provisions for TAB installed and operational.

.3 Start-up, verification for proper, normal and safe operation of all 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 All outlets installed, volume control dampers open.

1.12 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:
  .1 All HVAC systems: plus 5%, minus 5%.

1.13 ACCURACY TOLERANCES

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

1.14 INSTRUMENTS

.1 Prior to TAB, submit to Departmental Representative list of instruments to be 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.

1.15 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.16 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.

1.17 TAB REPORT

.1 Format to be in accordance with Associated Air Balancing Council (AABC/CAABC).

.2 TAB report to show all results in SI units or Imperial (IP), to match drawings and specifications, and to include:
  .1 Project record drawings.
  .2 System schematics.

.3 Submit pdf electronic copy of TAB Report to Departmental Representative for verification and approval.

1.18 VERIFICATION

.1 All reported results subject to verification by Departmental Representative.

.2 Provide manpower and instrumentation to verify up to 30% of all reported results.

.3 Number and location of verified results to be at discretion of Departmental Representative.

.4 Bear costs to repeat TAB as required to satisfaction of Departmental Representative.

.5 At request of commissioning agent, provide manpower and instrumentation to verify an additional 30% of all reported results.

1.19 SETTINGS

.1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings.

.2 Permanently mark all settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.20 COMPLETION OF TAB

.1 TAB to be considered complete only when final TAB Report received and approved by Departmental Representative.

1.21 SYSTEMS

.1 Quality assurance: Perform TAB under direction of supervisor qualified by AABC.

.2 Air Systems: Include both specified and measured data.
- .1 Air Handling Equipment:
  - .1 Maximum air flow volume.
  - .2 Fan total pressure.
  - .3 Motor volts, amps and power.
  - .4 Minimum outside air volume.
  - .5 Fan rotational speed.
  - .6 Fan Power, calculate fan efficiency.
  - .7 Inlet and outlet dry bulb, wet bulb and dewpoint temperatures.
  - .8 Equipment static pressure profile.
  - .9 Noise.
  - .10 Vibration.
- .2 Duct Air Quantities - Mains and Branches:
  - .1 Duct size.
  - .2 Number of pressure/velocity readings per traverse.
  - .3 Sum of velocity measurements.
  - .4 Average velocity.
  - .5 Duct air flow volume.
  - .6 Barometric pressure and duct air temperature.
- .3 Air Outlets:
  - .1 Outlet location and designation.
  - .2 Manufacturers catalogue identification and type.
  - .3 Air outlet flow factors. Use 1.0 when flow hood is used.
  - .4 Air flow volumes.
  - .5 Deflector vane or diffuser cone settings.

1.22 OTHER SYSTEMS

.1 Zone pressure differences:
  .1 Adjust HVAC systems, equipment, controls to establish specified air pressure differentials, with all systems in all possible combinations of normal operating modes.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 BALANCING AND ADJUSTING PREPARATION

.1 Perform testing, adjusting and balancing work after equipment and systems starting procedures have been properly completed.

.2 Perform balancing during heating and cooling season of first year of operation, and at times when directed by Departmental Representative, to ensure proper settings of controls under both summer and winter peak load conditions.

.3 Vary load to verify operation of system under partial load conditions. Test start-up, shut-down, emergency conditions, safety controls operation and automatic and manual resets and interlocks.

.4 Cap all instrument test ports. Obtain caps from sheet metal contractor and install.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)
- .1 ASTM A480/A480M-17, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
- .2 ASTM A924/A924M-17a, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.2 Canadian Standards Association (CSA)
- .1 CSA B228.1-1968, Pipe, Ducts and Fittings for Residential Type Air Conditioning Systems.
- .2 CSA W48.2-M1992 (R1998), Chromium and Chromium-Nickel Steel Covered Electrodes for Shielded Metal Arc Welding.

.3 National Fire Protection Association (NFPA)
- .1 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2018 Edition.
- .2 NFPA (Fire) 90B, Installation of Warm Air Heating and Air Conditioning Systems, 2018 Edition.
- .3 NFPA (Fire) 96, Ventilation Control and Fire Protection of Commercial Cooking Operations, 2017 Edition.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .1 SMACNA 016-2012, HVAC Air Duct Leakage Test Manual, 2nd Edition.
- .2 SMACNA 1966-2005, HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate following:
- .1 Sealants
- .2 Tape
- .3 Proprietary Joints

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

PART 2 - PRODUCTS

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum System Total Pressure Pa	SMACNA Seal Class
500	A
250	A
125	A

.2 Seal classification:
- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant.

.3 Application:
- .1 All new & existing supply ductwork.
- .2 All new return & exhaust ductwork.

2.2 SEALANT

.1 Sealant: Indoor/outdoor water based duct sealant c/w UV inhibitors. Flame spread rating of 0. Smoke developed rating of 0. Temperature range of minus 20°F to plus 200°F.
- .1 Acceptable material: Carlisle Hardcast CCWI-181, or equal.

2.3 DUCT LEAKAGE

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

2.4 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:
- .1 Rectangular: standard radius: 1.5 times width of duct.
- .2 Round: 1.5 times diameter.

.3 Mitred elbows, rectangular:
- .1 To 400 mm (16"): with single thickness turning vanes.
- .2 Over 400 mm (16"): with double thickness turning vanes.

.4 Branches:
- .1 Rectangular main and branch: with 45° entry on branch.
- .2 Round main and branch: enter main duct at 45° with conical connection.
- .3 Provide volume control damper in branch duct near connection to main duct.

.5 Transitions:
- .1 Diverging: 20° maximum included angle.
- .2 Converging: 30° maximum included angle.

.6 Offsets:
- .1 Full radiused elbows.

.7 Obstruction deflectors: maintain full cross-sectional area. Maximum included angles: as for transitions.

2.5 FIRESTOPPING

.1 Retaining angles all around duct, on both sides of fire separation.

.2 Firestopping material and installation must not distort duct.

2.6 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A924/A924M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

2.7 ESCUTCHEON ANGLES

.1 40 mm x 40 mm angle iron frame on both sides of exposed rectangular or round ducts, on both sides of non-rated partitions. Escutcheon angles material & gauge shall be equal to base material.

2.8 HANGERS AND SUPPORTS

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger:. 500 mm (20").

.2 Hanger configuration: to SMACNA.

.3 Hangers: black steel angle with black steel rods to SMACNA and following table:

Duct Size (in).	Angle Size (in.)	Rod Size (in.)
up to 30	1 x 1 x 1/8	¼
31 to 42	1½ x 1½ x 1/8	¼
43 to 60	1½ x 1½ x 1/8	2/5
61 to 84	2 x 2 x 1/8	2/5
85 to 96	2 x 2 x 1/5	2/5
97 and over	2 x 2 x ¼	2/5

.4 Upper hanger attachments:
- .1 For concrete: manufactured concrete inserts.
- .2 For steel joist: manufactured joist clamp or steel plate washer.
- .3 For steel beams: manufactured beam clamps.

PART 3 - EXECUTION

3.1 GENERAL

.1 Do work in accordance with NFPA (Fire) 90A, NFPA (Fire) 90B, CSA B228.1 and SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 100 mm (4") beyond insulated duct.

.3 Support risers in accordance with ASHRAE and SMACNA.

.4 Install breakaway joints in ductwork on each side of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths to accommodate installation of acoustic duct lining.

.7 Install escutcheon sheet metal angles on both sides of exposed rectangular or round ducts on both sides of non-rated partitions. Seal void with acoustic sealant.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with SMACNA as follows:

Duct Size mm (in.)	Spacing m (ft.)
to 1500 (60)	3 (10)
1525 (61) and over	2.5 (8)

3.3 SEALING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

3.4 LEAKAGE TESTS

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

.2 Do leakage tests for supply duct; maximum leakage rate 1% at 1½ times operating static pressure.

.3 Make trial leakage tests as instructed to demonstrate workmanship.

.4 Install no additional ductwork until trial test has been passed.

.5 Test section minimum of 100 ft. long with not less then 3 branch takeoffs and two 90° elbows.

.6 Complete test before insulation or concealment.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)
- .1 ASTM C423-17, Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
- .2 ASTM E90-09(2016), Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .3 ASTM E477-13e1, Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.

.2 National Research Council Canada
- .1 NRCC NBCC-2015, National Building Code of Canada.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Provide system shop drawings complete with product data.

.3 Submit acoustic calculations for all systems with silencer to demonstrate that the resultant duct borne and breakout noise is in accordance within specified levels in the space.

1.4 PERFORMANCE RATING DATA

.1 Provide performance rating data, certified by a professional engineer or accredited test laboratory and supported by calculations and verified by test results in accordance with referenced standards as follows:
- .1 Silencer: insertion loss, pressure drop at design conditions, generated noise level.
- .2 Acoustic plenums: transmission loss and acoustical absorption.
- .3 Acoustical performance measurements to be made in accordance with ASTM E477, ASTM E90 and ASTM C423, except where specified otherwise.

PART 2 - PRODUCTS

2.1 ABSORPTION AND INSULATING MEDIA

.1 Acoustic quality, glass fibre, free of shot and odour; bacteria and fungus resistant; free of corrosion causing or accelerating agents; packed to density to meet performance requirements; and meet NBC fire requirements or requirements of authority having jurisdiction for duct lining.

2.2 SILENCERS

.1 Factory manufactured of prime coated or galvanized steel, compatible with ductwork specified elsewhere and to ASHRAE and SMACNA standards.

.2 Outer casing and galvanized steel inner casing with clean cut circular perforations to enclose acoustic media. Outer casing where silencer is located within the occupied space, casing thickness shall be 16 gauge. Inner casing to have half-splitter and/or pods running full length of silencer where any cross sectional dimension exceeds 450 mm. Protect media from erosion with glass fibre cloth between media and perforated metal.

.3 Performance: refer to schedule.

.4 Acceptable material: Vibron, Vibro-Acoustics & Kinetics, E.H. Price, VAW Systems.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Noise flanking: where indicated, install in wall sleeve with uniform clearance all around to ensure no contact of silencer with wall sleeve. Pack with flexible, non hardening caulking on both sides of sleeves.

.3 Instrument test ports: install at inlet and outlet to permit measurement of insertion loss and pressure loss.

.4 Suspension: to manufacturer's instructions.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
- .1 CSA B228.1-1968, Pipes, Ducts and Fittings for Residential Type Air Conditioning.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate the following:
- .1 Flexible connections.
- .2 Duct access doors.
- .3 Instrument test ports.

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Manufacture in accordance with CSA B228.1.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 0.6 mm thick 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°C to plus 90°C, density of 1.3 kg/m^2.

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: 2 sash locks complete with safety chain.
- .2 301 to 450 mm: 4 sash locks complete with safety chain.
- .3 451 to 1000 mm: piano hinge and minimum 2 sash locks.
- .4 Doors over 1000 mm: piano hinge and 2 handles operable from both sides.
- .5 Hold open devices.

2.4 INSTRUMENT TEST PORTS

.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.

.5 Acceptable material: Duro Dyne IP1 or IP2.

2.5 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 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 each side of flexible connection to be in alignment.
  - .2 Ensure slack material in flexible connection.

.2 Access doors and viewing panels:
- .1 Size:
  - .1 450 x 450 mm for person size entry.
  - .2 450 x 450 mm for servicing entry.

.3 300 x 300 mm for viewing.
.4 As indicated.

.2 Location:
.1 At fire and smoke dampers.
.2 At control dampers.
.3 At devices requiring maintenance.
.4 At locations required by code.
.5 At reheat coils.
.6 Elsewhere as indicated.

.3 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 At ducted inlets to roof and wall exhausters.
.2 At inlets and outlets of other fan systems.
.3 At 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.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACA)
  .1 SMACNA 1966-2005, HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

.1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm (4").

.3 For rectangular ducts adjustable lever with shaft extension to accommodate insulation thickness.

.4 For round branch ducts adjustable lever with shaft extension to accommodate insulation thickness.

.5 Inside and outside nylon end bearings.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

2.3 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: 100 mm (4").

.4 Bearings: self-lubricating nylon.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

.7 Maximum leakage: 0.07% at 750 Pa.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 All dampers to be vibration free.

.6 Ensure damper operators are observable and accessible.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate the following:
.1 Performance data.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

PART 2 - PRODUCTS

2.1 BACK DRAFT DAMPERS

.1 Automatic gravity operated, multi leaf, aluminum construction with nylon bearings, counterweighted, assist-open.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Ensure dampers are observable and accessible.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 National Fire Protection Association (NFPA)
  .1 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2018 Edition.

.2 Underwriters Laboratories of Canada (ULC)
  .1 CAN/ULC S112-10, Fire Test of Fire Damper Assemblies.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate the following:
  .1 Fire dampers.
  .2 Smoke dampers.
  .3 Fire stop flaps.
  .4 Operators.
  .5 Fusible links.

1.4 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 20 05 01 - Mechanical General Requirements.

1.5 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

PART 2 - PRODUCTS

2.1 FIRE DAMPERS

.1 Fire dampers: arrangement Type B or C, listed and bear label of ULC, meet requirements of NFPA (Fire) 90A authorities having jurisdiction. Fire damper assemblies to be 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.

.3 Top hinged: offset single damper, round or square; interlocking type; sized to maintain full duct cross section as indicated.

.4 Fusible link actuated, weighted to close and lock in closed position when released.

.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 Rating: 1½ hr.

.7 Acceptable material: AMI, NCA, Nailor, Ruskin, Ventex/Alumavent, Greenheck, E.H. Price.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install in accordance with NFPA (Fire) 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. Refer to Section 23 33 00 - Duct Accessories.

.5 Coordinate with installer of firestopping.

.6 Ensure access door/panels, fusible links, and/or damper operators are easily observed and accessible.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 National Fire Protection Association (NFPA)
- .1 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2018 Edition.
- .2 NFPA (Fire) 90B, Installation of Warm Air Heating and Air Conditioning Systems, 2018 Edition.

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .1 SMACNA 1966-2005, HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition.

.3 Underwriters Laboratories (UL)
- .1 UL 181, Factory Made Air Ducts and Connectors.

.4 Underwriters' Laboratories of Canada (ULC)
- .1 CAN/ULC S110-13, Fire Tests for Air Ducts.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

.2 Indicate the following:
- .1 Thermal properties.
- .2 Friction loss.
- .3 Acoustical loss.
- .4 Leakage.
- .5 Fire rating.

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Factory fabricated to CAN/ULC S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC - UNINSULATED

.1 Type 2: spiral wound flexible aluminum with triple lock mechanical joints.

.2 Performance:
- .1 Factory tested to 2.5 kPa without leakage.
- .2 Maximum relative pressure drop coefficient: 3.
- .3 Maximum length: 1.5 m.

.3 Acceptable material: Flexmaster Type T/L.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

.1 Install in accordance with: CAN/ULC S110, UL 181 Amendment 1, NFPA (Fire) 90A, NFPA (Fire) 90B SMACNA.

.2 Maximum length of flexible duct: 1500 mm (5 feet).

3.2 APPLICATION

.1 Branch ductwork to diffuser where concealed.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)
  .1 ASTM C177-13, Standard Test Method for Steady-State Heat Flux and Thermal Measurements Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

.2 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-51.10-92, Thermal Insulation, Mineral Fibre, Block or Board, for Ducting, Machinery and Boilers.

.3 National Fire Protection Association (NFPA)
  .1 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2018 Edition.
  .2 NFPA (Fire) 90B, Installation of Warm Air Heating and Air Conditioning Systems, 2018 Edition.

.4 Underwriters' Laboratories of Canada
  .1 CAN/ULC S102-10, Surface Burning Characteristics of Building Materials and Assemblies.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

PART 2 - PRODUCTS

2.1 DUCT LINER

.1 General:
  .1 Fibrous glass or "textile" fibrous glass duct liner: air stream side faced with 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.

.2 Rigid:
  .1 Use on flat surfaces where indicated.
  .2 25 mm (1") thick, to CAN/CGSB-51.10, fibrous glass rigid board duct liner.
  .3 Density: 24 kg/m^3 (1.5 PCF) minimum.
  .4 Thermal resistance to be minimum 0.76 m^2.°C/W for 25 mm thickness when tested in accordance with ASTM C177, at 24°C mean temperature.

2.2 FASTENERS

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

2.3 JOINT TAPE

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

2.4 SEALER

.1 Meet requirements of NFPA (Fire) 90A and NFPA (Fire) 90B.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68°C to plus 93°C.

PART 3 - EXECUTION

3.1 GENERAL

.1 Do work in accordance with recommendations of SMACNA duct liner standards as indicated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, except as specified otherwise.

.2 Line inside of ducts where indicated.

.3 Duct dimensions, as indicated, are clear inside duct lining.

3.2 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.
  .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres.

3.3 JOINTS

.1 Seal all butt joints, exposed edges, weld pin and clip penetrations and all damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's recommendations, and as follows:
  .1 Bed tape in sealer.
  .2 Apply 2 coats of sealer over tape.

.2 Replace badly damaged areas of liner at discretion of Departmental Representative.

.3 Protect leading and trailing edges of each duct section with sheet metal nosing having 25 mm overlap and fastened to duct.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

1.2 REFERENCES

.1 Definitions:
- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

.2 Reference Standards:
- .1 CSA Group
  - .1 CSA C22.1-18, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations (24th Edition).
  - .2 CAN3-C235-83 (R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
  - .3 CSA C282-15, Emergency Electrical Power Supply for Buildings.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
  - .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 Electrical Safety Authority (ESA)
  - .1 ESA OESC-2012, Ontario Electrical Safety Code, 25th Edition.
- .4 Health Canada/Workplace Hazardous Materials Information Systems (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

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 new electrical equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit WHMIS MSDS.

.3 Submit for review updated as-built single line electrical diagram (emergency power) to be installed under plexiglass and locate as indicated.
- .1 Electrical power generation and distribution systems.

.4 Shop drawings:
- .1 Submit seismic restraint system drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .2 Submit shop drawings with signed review stamp by general contractor.
- .3 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
- .4 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
- .5 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.6 Submit required number of copies of drawings and product data to inspection authorities.
.7 If changes are required, notify Departmental Representative of these changes before they are made.

.5 Certificates:
.1 Provide CSA certified equipment and material.
.2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.
.3 Submit test results of installed electrical systems and instrumentation.
.4 Permits and fees: in accordance with General Conditions of contract.
.5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative including ESA.

.6 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 00 10 - General Instructions.

.2 Operation and Maintenance Data: submit operation and maintenance data for power generation & distribution for incorporation into manual.
.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
.2 Operating instructions to include following:
.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
.3 Safety precautions.
.4 Procedures to be followed in event of equipment failure.
.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
.4 Post instructions where directed.
.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

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 off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect new equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials 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 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates and labels for all equipment English and French.

.4 Use one nameplate or label for each language.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction inspection authorities before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring and conduit: in accordance with Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction.

.2 Porcelain enamel decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for copper conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, lettering accurately aligned and engraved into core mechanically attached with self tapping screws. Emergency Power & Fire Alarm Systems: red face, white letters. Normal: blackface, white letters.

.2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture. Provide both English & French nameplates & labels for each piece of equipment.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. " as directed by Departmental Representative.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

.9 Generators: indicate capacity, and voltages.

.10 Automatic transfer switches. Indicate all voltage sources & load.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour. Match existing building standard or as follows if no standard exists:

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Emerg. up to 600V	Yellow	Red
Fire Alarm	Red	

2.9 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
.1 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y1.

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 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 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

3.3 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.
.1 Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.5 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings and as indicated.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.

3.6 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.
- .1 Local switches: 1200 mm.
- .2 Wall receptacles:
  - .1 General: 400 mm.
- .3 Panelboards: as required by Code or as indicated.
- .4 Fire alarm manual pullstations: 1100 mm.
- .5 Fire alarm horns: 2100 mm.
- .6 Fire alarm strobe lights: 2100 mm.
- .7 Emergency battery unit and remote heads: 2100 mm.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.8 FIELD QUALITY CONTROL

.1 Load Balance:
- .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
- .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
- .2 Circuits originating from branch distribution panels.
- .3 Lighting and its control.
- .4 Motors and associated control equipment including sequenced operation of systems where applicable.
- .5 Insulation resistance testing:
  - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
  - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
  - .3 Check resistance to ground before energizing.

.3 Notify and carry out tests in presence of Departmental Representative if requested.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 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 Perform initial installation performance field tests in accordance with CSA C282.

3.9 SYSTEM STARTUP

.1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.10 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 00 10 - General Instructions.
- .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 00 10 - General Instructions.

.3 Waste Management: separate waste materials for reuse and 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 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 26 05 00 - Common Work Results for Electrical, all electrical sections, and all other disciplines related to the project.

1.2 DEFINITIONS

.1 SRS: acronym for Seismic Restraint System.

1.3 GENERAL DESCRIPTION

.1 This section covers design, supply and installation of complete SRS for all systems, equipment specified for installation on this project by Division 26. This includes, but is not limited to:
- Electrical light fixtures.
- Diesel generators.
- Automatic transfer switches.
- Fire alarm.
- Electrical distributionequipment and systems
- Associated conduit and cables.
- Both vibration isolated and statically supported.

.2 Cable restraint systems, rod stiffener clamps and seismic isolator capacities to be verified by an independent test laboratory. Connection materials and site specific designs to be by the Seismic Engineer. The Seismic Engineer may specify material and anchors provided by the contractor where this is appropriate. It is the contractors' responsibility to ensure that the Seismic Engineers' requirements and specification have been met.

1.4 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CSA S832-14, Seismic Risk Reduction of Operational and Functional Components (OFCs) of Buildings.

.2 National Research Council Canada
  .1 NRCC NBCC-2015, National Building Code of Canada 2015.

1.5 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Submit seismic restraint shop drawings, c/w seal of Professional Engineer registered in Province of Ontario, clearly identifying equipment/systems reviewed and the equipment/systems requiring restraint. Shop drawings must clearly show all forces transferred to structure.

.3 Seismic Design Engineer shall provide a spreadsheet identifying all equipment and systems requiring or not requiring seismic restraints and include all circulations.

.4 Submit additional copy of shop drawings and product data to project Structural Engineer for review of connection points to building structure.

1.6 MAINTENANCE DATA

.1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 26 05 00 - Common Work Results for Electrical.

1.7 SEISMIC FORCE

.1 The Importance Factor for this project is:
.1 I = 1.0 - All other buildings i.e.: Office & General Buildings.
Note: As per NBCC.

PART 2 - PRODUCTS

2.1 SRS MANUFACTURER

.1 SRS to be from one manufacturer regularly engaged in production of same, 5 years experience.

2.2 GENERAL

.1 Design to be by Professional Engineer specializing in design of SRS and registered in Province of Ontario. Division 26 to include all costs associated with this work as it relates to Division 26 installations.

.2 SRS to be fully integrated into, compatible with:
.1 Noise and vibration controls specified elsewhere in this project specification, telecommunications.
.2 Structural, mechanical, electrical design of project.

.3 During seismic event, SRS to prevent systems and equipment from causing personal injury, interfering with other systems, and from moving from normal position.

.4 Design and installation in accordance with NBCC & CSA S832.

.5 SRS to provide gentle and steady cushioning action and avoid high impact loads

.6 SRS to restrain seismic forces in all directions.

.7 Fasteners and attachment points to resist same load as seismic restraints.

.8 SRS of conduit systems to be compatible with:
.1 Expansion, anchoring and guiding requirements.
.2 Equipment vibration isolation and equipment SRS.

.9 SRS utilizing cast iron, threaded pipe, other brittle materials not permitted.

.10 Attachments to RC structure:
.1 Use high strength mechanical expansion anchors.
.2 Drilled or power driven anchors not permitted.

.11 Seismic control measures not to interfere with integrity of firestopping.

2.3 SRS FOR STATIC EQUIPMENT, SYSTEMS

.1 Floor-mounted equipment, systems:
- .1 Anchor equipment to equipment supports.
- .2 Anchor equipment supports to structure.
- .3 Use size of bolts scheduled in approved shop drawings.

.2 Suspended equipment, systems:
- .1 Use one or combination of following methods:
  - .1 Install tight to structure.
  - .2 Cross-brace in all directions.
  - .3 Brace back to structure.
  - .4 Slack cable restraint system.
- .2 SRS to prevent sway in horizontal plane, "rocking" in vertical plane, sliding and buckling in axial direction.
- .3 Hanger rods to withstand compressive loading and buckling.

2.4 SRS FOR VIBRATION ISOLATED EQUIPMENT

.1 Floor mounted equipment, systems:
- .1 Use one or combination of following methods:
  - .1 Vibration isolators with built-in snubbers.
  - .2 Vibration isolators and separate snubbers.
  - .3 Built-up snubber system approved by Departmental Representative, consisting of structural elements and elastomeric layer.
- .2 SRS to resist complete isolator unloading.
- .3 SRS not to jeopardize noise and vibration isolation systems. Provide 4-8 mm clearance between seismic restraint snubbers and equipment during normal operation of equipment and systems.
- .4 Cushioning action to be gentle and steady by utilizing elastomeric material or other means in order to avoid high impact loads.

.2 Suspended equipment, systems:
- .1 Use one or combination of following methods:
  - .1 Slack cable restraint system.
  - .2 Brace back to structure via vibration isolators and snubbers.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install Seismic Restraint Systems in accordance with Seismic Engineer's and manufacturer's recommendations.

.2 Install SRS at least 25 mm from all other equipment, systems, services.

.3 Co-ordinate connections with all disciplines.

3.2 INSPECTION AND CERTIFICATION

.1 SRS to be inspected and certified by Manufacturer upon completion of installation.

.2 Seismic Design Engineer shall provide written report to Departmental Representative certifying that SRS has been installed in accordance with the SRS drawings. The report shall bear the seal and signature of the SRS Design Engineer.

3.3 COMMISSIONING DOCUMENTATION

.1 Upon completion and acceptance of certification, hand over to Departmental Representative complete set of construction documents, revised to show "as-built" conditions.

- END OF SECTION -

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
- .1 CAN/CSA C22.2 No. 18-98 (R2003), Outlet Boxes, Conduit Boxes and Fittings.
- .2 CSA C22.2 No. 65-13, Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
- .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

1.2 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 wire and box connectors from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA-C22.2 No. 65, with current carrying parts of copper copper alloy sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA-C22.2 No. 65, with current carrying parts of copper alloy sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
- .1 Connector body and stud clamp for stranded copper conductors.
- .2 Clamp for stranded copper conductors.
- .3 Clamp for ACSR conductors.
- .4 Stud clamp bolts.
- .5 Bolts for copper conductors.
- .6 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, TECK cable flexible conduit, as required to: CAN/CSA-C22.2 No. 18.

.5 Compression butt connectors for copper conductor splices 3/0 AWG to 1,000 kcmil. Tin-electroplated copper barrel connectors type YS-L with 1,000V insulating heat shrink tube covering entire splice.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and cables and:
- .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA-C22.2 No. 65.
- .2 Install fixture type connectors and tighten to CSA-C22.2 No. 65. Replace insulating cap.
- .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.
- .4 Connect existing feeder conductors to new conductors with compression butt splice kits to manufacturers recommendations. Install heat shrink covering to 100 mm on each side of compression barrel and install all splices inside individual splice boxes.

3.2 CLEANING

.1 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 - General Instructions.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 26 05 00 - Common Work Results for Electrical, all electrical sections, and all other disciplines related to the project.

1.2 PRODUCT DATA

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

1.3 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors as indicated : size as indicated, with 1000 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE as indicated, Non Jacketted.

.3 A wiring and cable circuit conductors and feeders to be sized in accordance with latest edition of Canadian Electrical Code and applicable Bulletins, or larger if indicated.

2.2 TECK 90 CABLE

.1 Conductors:
- .1 Grounding conductor: copper.
- .2 Circuit conductors: copper, size as indicated.

.2 Insulation:
- .1 Cross-linked polyethylene XLPE.
- .2 Rating: 1000 V.

.3 Inner jacket: polyvinyl chloride material.

.4 Armour: interlocking aluminum.

.5 Overall covering: thermoplastic polyvinyl chloride.

.6 Fastenings:
- .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
- .2 Channel type supports for two or more cables at 1000 mm centres.

.3 Threaded rods: 6 mm diameter to support suspended channels.

.7 Connectors:
.1 Watertight approved for TECK cable.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

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

.2 Perform megohm tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:
.1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF TECK 90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable exposed, securely supported by hangers.

.3 Provide expansion fittings at building expansion joints.

- 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 for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 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.

PART 2 - PRODUCTS

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, suspended and set in poured concrete walls and ceilings.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Secure equipment to poured concrete with expandable inserts.

.2 Provide plastic and caps on all exposed channel ends.

.3 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.4 Fasten exposed conduit or cables to building construction or support system using straps.
- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.5 Suspended support systems.
- .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.6 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.

.7 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.8 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.9 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.

.11 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 00 10 - General Instructions.
  .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 00 10 - General Instructions.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 26 05 00 - Common Work Results for Electrical, all electrical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)
  .1 CSA C22.1-18, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations (24th Edition).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
  .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

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.

PART 2 - PRODUCTS

2.1 SPLITTERS

.1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Terminations: connection blocks to match required size and number of incoming and outgoing conductors as indicated.

.3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

2.2 JUNCTION, SPLICE AND PULL BOXES.

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on turned edge covers.

.4 Splice boxes sized for individual feeder conductors in and out.

.5 Plated steel lugs suitable for copper conductors.

2.3 CABINETS

.1 Construction: welded sheet steel as indicated hinged door, handle, latch and catch

PART 3 - EXECUTION

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, SPLICE, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

.4 Install all conductor splices in cabinet mounted on walls or suspended from hangers. Label all splice boxes with load designation.

3.3 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.

.2 Identification Labels: size 2 indicating system name, voltage and phase or as indicated.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 26 05 00 - Common Work Results for Electrical, all electrical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)
  .1 CSA C22.1-18, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations (24th Edition).

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

.6 Conduit boxes and fittings to be compatible with conduits specified in Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

.1 Cast FS boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.6 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

- END OF SECTION -

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
- .1 CAN/CSA C22.2 No. 18-98 (R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
- .2 CSA C22.2 No. 56-17, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .3 CSA C22.2 No. 83-M1985 (R2017), Electrical Metallic Tubing.
- .4 CSA C22.2 No. 211.2-06 (R2016), Rigid PVC (Unplasticized) Conduit.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
- .1 Submit cable manufacturing data.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

PART 2 - PRODUCTS

2.1 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.2 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.3 Flexible metal conduit: to CSA C22.2 No. 56, steel liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller.
- .1 Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1.5 m on centre.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS.

.1 Fittings: to CAN/CSA C22.2 No. 18, manufacturered for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90° bends for 25 mm and larger conduits.

.3 Watertight steel connectors and couplings for EMT.
.1 Cast connectors with Set-screws are not acceptable.

2.4 FISH CORD

.1 Polypropylene.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits in new block wall or concrete construction.

.3 Surface mount conduits except as noted above.

.4 Use electrical metallic tubing (EMT) except in cast concrete.

.5 Use rigid pvc conduit under slab or direct buried in concrete.

.6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment.

.7 Use nylon bushings on ends of all empty conduits.

.8 Minimum conduit size for lighting and power circuits: 21 mm.

.9 Bend conduit cold:
.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.10 Mechanically bend steel conduit over 19 mm diameter.

.11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.12 Install fish cord in empty conduits.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended or surface channels.

.5 Do not pass conduits through structural members except as indicated or where approved by Departmental Representative.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in concrete toppings.

3.5 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.6 CLEANING

.1 Proceed in accordance with Section 01 00 10 - General Instructions.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 26 05 00 - Common Work Results for Electrical, all electrical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 CSA International
  .1 CSA C22.2 No. 29-2015, Panelboards and Enclosed Panelboards.

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 panelboards and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
  .1 Include on drawings:
    .1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 00 10 - General Instructions.

.2 Operation and Maintenance Data: submit operation and maintenance data for panelboards 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.

PART 2 - PRODUCTS

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No. 29 and product of one manufacturer.
  .1 Install circuit breakers in panelboards before shipment.
  .2 In addition to CSA requirements manufacturer's nameplate must show current fault that panel including breakers has been built to withstand.

.2 208V panelboards rated for minimum 10 kA (symmetrical) interrupting capacity.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Minimum of 2 flush locks for each panel board.

.6 Two keys for each panelboard and key panelboards alike.

.7 Copper bus with neutral of same ampere rating of mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked enamel light grey.

.11 Sprinklerproof enclosure with drip shield.

2.2 BREAKERS

.1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker where indicated, separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

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 panelboards 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 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical or as indicated.

.3 Connect loads to circuits.

.4 Connect neutral conductors to common neutral bus with respective neutral identified.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 00 10 - General Instructions.
.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 00 10 - General Instructions.

3.4 PROTECTION

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

.2 Repair damage to adjacent materials caused by panelboards installation.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 26 05 00 - Common Work Results for Electrical, all electrical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 CSA International
- .1 CSA C22.2 No. 42-10 (R2015), General Use Receptacles, Attachment Plugs and Similar Devices.
- .2 CAN/CSA C22.2 No. 42.1-13, Cover plates for flush-mounted wiring devices (Bi-National standard, with UL 514D.
- .3 CSA C22.2 No. 55-15, Special Use Switches.
- .4 CSA C22.2 No. 111-10 (R2015), General-Use Snap Switches (Bi-national standard, with UL 20).

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 wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

PART 2 - PRODUCTS

2.1 SWITCHES

.1 20 A, 347 V, single pole,, three-way, switches to: CSA C22.2 No. 55 and CSA C22.2 No. 111.

.2 Manually-operated general purpose AC switches with following features:
- .1 Terminal holes approved for No. 10 AWG wire.
- .2 Silver alloy contacts.
- .3 Urea or melamine moulding for parts subject to carbon tracking.
- .4 Suitable for back and side wiring.
- .5 Brown toggle.

.3 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No. 42 with following features:
- .1 Brown urea moulded housing.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Eight back wired entrances, four side wiring screws.
- .5 Triple wipe contacts and riveted grounding contacts.

.2 Other receptacles with ampacity and voltage as indicated.

.3 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

.1 Cover plates for wiring devices to: CAN/CSA C22.2 No. 42.1.

.2 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.3 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

2.4 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Switches:
- .1 Install single throw switches with handle in "UP" position when switch closed.
- .2 Install switches in gang type outlet box when more than one switch is required in one location.
- .3 Mount toggle switches at height in accordance with Section 26 05 00 - Work Common Results for Electrical and as indicated.

.2 Receptacles:
- .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
- .2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results for Electrical and as indicated.
- .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.3 Cover plates:
- .1 Install suitable common cover plates where wiring devices are grouped.
- .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
- .3 Label with P-touch panelboard and circuit number.

3.2 CLEANING

.1 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 - General Instructions.

3.3 PROTECTION

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

.2 Repair damage to adjacent materials caused by wiring device installation.

- END OF SECTION -

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section shall be read in conjunction with specification Section 26 05 00 - Common Work Results for Electrical, all electrical sections, and all other disciplines related to the project.

1.2 REFERENCES

.1 CSA International
  .1 CSA C22.2 No. 5-16, Molded-case Circuit Breakers, Molded-case Switches and Circuit-breaker Enclosures.

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 circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Certificates:
  .1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.
    .1 Production certificate of origin must be submitted to Departmental Representative for approval.
  .2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.
  .3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.
  .4 Production certificate of origin must contain:
    .1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.
    .2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.
    .3 Contractor's name and address and person responsible for project.
    .4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.
    .5 Name and address of building where circuit breakers will be installed:
      .1 Project title.
      .2 End user's reference number.
      .3 List of circuit breakers.

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.

PART 2 - PRODUCTS

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, Circuit breakers, and ground-fault circuit-interrupters: to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient, 10 KAIC at 240V.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have minimum 30K symmetrical rms interrupting capacity rating or as required in accordance with short circuit study.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.2 Complete with on-off locking device.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install circuit breakers in new panelboards specified in Section 26 24 16.01 - Panelboards Breaker Type.

3.2 CLEANING

.1 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 - General Instructions.

- END OF SECTION -

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.2 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval review by Departmental Representative.
- .3 Photometric data to include: VCP Table where applicable spacing criterion.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials 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 for reuse packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Divert unused metal materials from landfill to metal recycling facility.

.5 Disposal and recycling of fluorescent lamps as per local regulations.

.6 Disposal of old PCB filled ballasts.

PART 2 - PRODUCTS

2.1 LED FIXTURES

.1 Except as otherwise indicated, provide LED luminaires, of types and sizes indicated on lighting fixture schedules on drawings.

.2 Include the following features unless otherwise indicated:
- .1 Each Luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply).
- .2 Luminaire optics shall consist of precision formed optical assembly with positively retained high grade acrylic lenses and reflectors designed to provide directional distribution.
- .3 Each luminaire shall be rated for a minimum operational life of 50,000 hours utilizing a maximum ambient temperature of (25ºC).
- .4 Light Emitting Diodes tested under LM-80 Standards for a minimum of 12,000 hours.

.5 Colour Rendering Index (CRI) of 82 at a minimum (85 Typical).
.6 Colour temperature 3500K, unless otherwise indicated.
.7 Rated lumen maintenance at 70% lumen output for 50,000 hours, unless otherwise indicated.
.8 Five (5) year luminaire warranty, minimum.
.9 Photometry must comply with IESNA LM-79.
.10 Luminaries shall be Design Lights Consortium Qualified.
.11 The individual LEDs shall be constructed such that a catastrophic loss of the failure of one (1) LED will not result in the loss of the entire luminaire.
.12 Luminaire shall be constructed such that driver may be replaced or repaired without the replacement of the whole fixture.

.3 Technical Requirements:
.1 The luminaire shall not consume power in the off state.
.2 Operation Voltage: The luminaire shall operate from a SO HZ to 60 HZ AC line over a voltage ranging from 120 VAC to 277 VAC or as specified in the lighting schedule. The fluctuations of line voltage shall have no visible effect on the luminous output.
.3 Power Factor: The luminaire shall have a power factor of 0.9 or greater.
.4 THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 20 percent.
.5 Operational Performance: The LED circuitry shall prevent visible flicker to the unaided eye over the voltage range specified above.

.4 Thermal Management:
.1 The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.
.2 The LED manufacturer's maximum thermal pad temperature for the expected life shall not be exceeded.
.3 Thermal management shall be passive by design. The use of fans or other mechanical devices shall not be allowed.
.4 The luminaire shall have a minimum heat sink surface such that LED manufacturer's maximum junction temperature is not exceeded at maximum rated ambient temperature.

2.2 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.3 LUMINAIRES

.1 As indicated in luminaire schedule.

2.4 DIMMING CONTROLS

.1 Slider type manual dimmer switches with positive "OFF" setting at bottom. Low voltage 1% to 100% dimmer switches compatible with LED drivers.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

3.2 WIRING

.1 Connect luminaires to lighting circuits:
  .1 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.4 CLEANING

.1 Clean in accordance with Section 01 00 10 - General Instructions.

- END OF SECTION -

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
- .1 CSA C22.2 No. 141-15, Unit Equipment for Emergency Lighting.
- .2 CSA C860-11 (R2016), Performance of Internally-Lighted Exit Signs.

.2 National Building Code (NBC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

PART 2 - PRODUCTS

2.1 EXIT LIGHTS

.1 Exit lights: to CSA C22.2 No. 141 and CSA C860.

.2 Housing: extruded aluminum, brushed aluminum finish white finish.

.3 Face and back plates: extruded aluminum.

.4 Lamps: LED with 25-year rated life.

.5 Pictogram: aluminum frame, opal diffuser panel, pictogram panel with multiple films for direction selection, and clear protective panel. Pictogram panel shall consist of green pictogram and white graphic symbol meeting the visibility specifications referred to in ISO 3864-1, and conform to the dimensions indicated in ISO 7010.

.6 Suitable for 347V or 120V normal supply.

.7 Die cast mounting bracket for wall, ceiling, or end mounting as indicated.

.8 Provide circuit labels at all exit signs.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install exit lights to manufacturer's recommendations, listing requirements, NBC standard and local regulatory requirements.

.2 Connect fixtures to 120V exit light circuit.

.3 Ensure that exit light circuit breaker is locked in on position.

3.3 CLEANING

.1 Proceed in accordance with Section 01 00 10 - General Instructions.

- END OF SECTION -