



EXTERIOR SHELL REPAIR - BLOC A HEALTH CANADA OFFICES AND LABORATORIES

Architecture and Engineering General Requirements and Technical Specifications

VOLUME 2

SR5r1 TENDER – January 19, 2018

No / Dossier RRA : 1631
No / Dossier SPAC : R.042 037.001



PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 09 91 23.01 - Painting.
- .2 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 REFERENCE STANDARDS

- .1 "Code de construction du Québec - Chapitre I - Bâtiment".

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 all material and specified equipment listed in this specification.
- .3 Shop drawings:
 - .1 Drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .2 Drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .3 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .2 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .3 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .4 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

COMMON WORK RESULTS FOR MECHANICAL

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- .5 Approvals:
- .1 Submit two copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .6 Additional data:
- .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
- .1 Departmental Representative will provide one set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .8 As-Built drawings:
- .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Departmental Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

- .1 Not Used.

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 nitrogen tank, liquid chiller.
 - .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 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 23.01 - Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units located inside the work area.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.5 PROTECTION

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

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 09 91 23.01 - Painting.
- .2 Section 21 05 01 - Common Work Results for Mechanical.

1.2 REFERENCE STANDARDS

- .1 "Code de construction du Québec - Chapitre I - Bâtiment 2010".
- .2 NFPA 13-2013, Standard for the installation of sprinkler systems.
- .3 NFPA 14-2010, Standard for the installation of standpipe and hose systems.

1.3 GENERAL INFORMATIONS ON PROJECT WORK

- .1 Temporarily remove the eschutcheon plates of the siamese outlets. Reinstall the escutcheons plates after the exterior shell repair work is completed
- .2 Protect Siamese and other fire protection equipment installed on the exterior wall during construction. The fire protection systems of the building must remain operational for the duration of the shell repair work. Coordinate with the Contractor for the work required to maintain permanent access to the Siamese outlets.
- .3 Identify, as existing, all the wall installed equipments.

PART 2 - PRODUCTS

- .1 Not Used.

PART 3 - EXECUTION**3.1 EXAMINATION**

- .1 Verification of Conditions: before the exterior shell repair work.
 - .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 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 23.01 - Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.4 PROTECTION

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

END OF SECTION

PART 1 - GENERAL**1.1 GENERAL INFORMATION ON PROJECT WORK**

- .1 Materials and installation methods associated with the work listed below, as well as accessories and other components of such systems. All this work is required in order to allow work to be done to repair the building's envelope. Once the repairs have been completed in the area, the equipment, fittings and piping will be reinstalled on the original site.
 - .1 Temporary liquid nitrogen tank relocation, vaporizer and all externally installed components of the nitrogen supply system. Work on the relocation of the nitrogen tank and its components must be carried out without interruption of the nitrogen supply to the Departmental Representative.
 - .2 Temporary relocation of the nitrogen supply system shall be carried out by the nitrogen supplier.
 - .3 Temporary relocation and relocation work on the initial location of the nitrogen feed system shall be coordinated with the Contractor. The nitrogen pipe between the temporary site and the building must be installed so as not to interfere with the Contractor's operations and be safe from accidental breakage: without interruption.
 - .4 Temporary dismantling of laboratory gas vents. Supply and installation of new laboratory gas vent piping, once repairs are completed in the area.
 - .5 Temporary dismantling of diesel fuel supply and oil vent pipe. Re-installation of the piping once the repairs are completed in the area.

1.2 RELATED SECTIONS

- .1 Section 21 05 01 - Common Work Results for Mechanical.

1.3 REFERENCE STANDARDS

- .1 American Petroleum Institute (API).
 - .1 API STD 1104-e01, Welding of Pipelines and Related Facilities.
- .2 American Society of Mechanical Engineers (ASME).
 - .1 ASME B16.11-2009, Forged Fittings Socket Welding and Threaded.
- .3 American Society for Testing and Materials International (ASTM).
 - .1 ANSI/AWS A5.8, Brazing Filler Material.

- .2 ASTM B88-09, Standard Specification for Seamless Copper Water Tube.
- .3 ASTM B819, Standard Specification for Seamless Copper Tube for Medical Gas Systems.
- .4 ASTM A48/A48M-00, Standard Specification for Grey Iron Castings.
- .5 ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .6 ASTM A181/A181M-01, Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.
- .7 ASTM A216/A216M-93(03), Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
- .4 Canadian Standards Association (CSA International).
 - .1 CAN/CSA Z7396.1 - Medical Gas Pipeline Systems.
 - .2 CAN/CSA B96, Compressed Gas Cylinder Valve Outlet and Inlet Connections.
 - .3 CSA-B139-09, Installation Code for Oil Burning Equipment.
- .5 National Fire Protection Association (NFPA).
 - .1 NFPA 55, Compressed Gases and Cryogenic Fluids Code.
- .6 Compressed Gas Association (CGA).
 - .1 P-8.7, Safe location of Oxygen and Inert Gas vents.
 - .2 G-10.1, Commodity Specification for Nitrogen.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet.
 - .2 Submit WHMIS MSDS, which must comply with this system. Indicate VOC's for adhesive and solvents during application and curing.

- .3 Shop Drawings:
 - .1 Submit Shop Drawings to indicate project layout, including:
 - .1 Vertical and horizontal piping locations and elevations and connections details.
 - .2 Schedule identifying units and their locations.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.5 QUALITY ASSURANCE

- .1 Conform to Section 01 45 00 - Quality Control.
- .2 Provide products of this section from same manufacturer.
- .3 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

PART 2 - PRODUCTS

2.1 NITROGEN SYSTEMS AND LABORATORIES GAS VENTS

- .1 All piping required for gas services shall be in degreased and clogged copper tube for transport, type "L" or "K", in accordance with ASTM B88-09 and ASTM B819, such as existing piping.
- .2 For systems with pressures greater than 1,379 kPa, the piping shall be type "K".
- .3 All fittings used for the assembly of copper pipes shall be made of copper, brass or wrought bronze and shall be manufactured in accordance with a solder connection.
- .4 Seals:
 - .1 Except for joints which may be made using flared brass fittings approved for gas hoses, and those used for faucets or other equipment requiring threaded connections, all joints of the piping is made by brazing with a silver alloy in accordance with AWS BCuP-5 or other metal with a minimum melting point of 977°F. The use of the fondant is strictly forbidden.
 - .2 All brazing work must be carried out by an enterprise that holds a certificate registered with the "Régie du bâtiment du Québec" certifying that the brazing method is accepted.

- .3 The company shall ensure that its employee, who performs the brazing work for the purposes of this standard, holds a valid brazing certificate issued by the Pipefitting Inspection Service of the "Ministère de l'Habitation" et de la Protection du Consommateur.
- .4 Threaded joints used with insulation taps and outlet taps shall be installed by swishing the male thread with soft welds. However, it is permitted to use litharge and glycerin or an oxygen compatible filler or sealant.
- .5 Supply and install supports and fasteners.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 PREPARATION

- .1 Obtain approval of authorities having jurisdiction prior to commencing work of this section.

3.3 INSTALLATION

- .1 Nitrogen systems:
 - .1 Mount nitrogen tank and vaporizer on housekeeping pad.
 - .2 The temporary location of the tank shall take account of the accessibility of filling the tank during the period of the envelope repair work.

3.4 CLEANING

- .1 Perform cleaning operations as specified in Section 01 74 11.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 21 05 01 - Common Work Results for Mechanical.
- .2 Section 23 05 01 - Use of HVAC Systems During Construction.

1.2 PAYMENT PROCEDURES FOR TESTING LABORATORY SERVICES

- .1 Engage and pay for services of independent testing laboratory in accordance with the general informations for the work.

1.3 REFERENCE STANDARDS

- .1 National Air Duct Cleaners Association (NADCA).
 - .1 ACR Standard, 2006 edition: Assessment, Cleaning and Restoration of HVAC Systems.
- .2 North American Insulation Manufacturers Association (NAIMA).
 - .1 NAIMA 2005, Cleaning Fibrous Glass Insulated Duct Systems - Recommended Practices.
- .3 United States Environmental Protection Agency (US EPA).
 - .1 US EPA 1999, 40 CFR Parts 152 and 156.

1.4 DEFINITIONS

- .1 HVAC System: complete air duct system from outside air intake louvers to furthest air supply terminal unit and including:
 - .1 Rigid supply and return ductwork;
 - .2 Flexible ductwork;
 - .3 Mixing plenum boxes;
 - .4 Return air plenums including ceiling plenums;
 - .5 Diffusers, registers and terminal units;
 - .6 Dampers and controls.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Site Evaluation: conduct site visit 2 weeks before start of work to establish specific co-ordinated video survey and cleaning plan to establish specific co-ordinated video survey and cleaning plan determining how areas of facility and HVAC systems will be protected during cleaning operations.
 - .1 Organize and lay out plan for video survey and identify camera and cleaning apparatus insertion points.
 - .2 Ensure plan identifies sequence and schedule of survey and cleaning operations for each individual HVAC system and for complete facility.
 - .1 Take account of elbows, bends, turning vanes, dampers, transitions, take-offs.
 - .3 Departmental Representative to review cleaning plan one week minimum prior to start of work.
 - .1 Proceed with survey and cleaning work only after receiving written approval from Departmental Representative.
- .2 Scheduling: Hours of Operation: complete work during non-business hours as follows:
 - .1 Monday to Thursday between 18:00 hours and 07:00 hours.
 - .2 Friday from 18:00 h to Monday at 07:00 h.
 - .3 Hours of operation are subject to change with 12 hours notice.
- .3 Project Co-ordination: assign Project Co-ordinator to oversee air duct cleaning processes.
 - .1 Provide Departmental Representative with contact information of Project Co-ordinator including: name, telephone number, cell phone number.
- .4 Security: Departmental Representative will pay costs and provide security escort at times requested on Contractor's submitted work schedule.
 - .1 Cancellation of security escort requires 72 hours minimum written notice.
 - .2 Failure to cancel security escort requirements 72 hours minimum before scheduled event will result in Contractor paying for security costs.
- .5 Damaged or broken equipment and components found during initial testing and inspection will be repaired or replaced by Departmental Representative.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit video survey and cleaning plan developed during site evaluation.
 - .1 Ensure plan includes sequence of operation, identification of camera and cleaning apparatus insertion points and schedule for work.
- .3 Product Data:
 - .1 Submit manufacturer's printed product literature and data sheets for antimicrobial agents and include product characteristics, performance criteria and limitations.
 - .2 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements for antimicrobial agents or coatings.
- .4 Testing Laboratory Services: submit name and address of laboratory engaged for work of this Section.
 - .1 Submit laboratory analysis report of particulate collection indicating:
 - .1 Location of collection;
 - .2 Particulate grade;
 - .3 Particulate size;
 - .4 Percentage concentration of individual particulates in each sample.
- .5 US EPA Registration: submit verification of EPA Registration of antimicrobial agent.
- .6 Submit verification of delivery of hazardous or toxic waste materials to contaminated waste facility, as described in PART 3 - CLEANING - Waste Management.

1.7 CLOSEOUT SUBMITTALS

- .1 Provide submittals in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Post Cleaning Inspection Report: submit four copies of Final Inspection Report, including data collected, observations and recommendations as well as following information:
 - .1 Name and address of facility;
 - .2 Name and address of HVAC cleaning contractor;
 - .3 Description of HVAC systems with drawings, sketches identifying systems cleaned;

- .4 Identification scheme for location points in systems that were inspected with accompanying notes describing methods of inspection or tests used;
 - .5 Identification of points where samples were collected and type of analysis used for each collection;
 - .6 Identification of each sample collected;
 - .7 Comments complete with photographs of each sampling location and other observed system features;
 - .8 Identify systems tested, observations, actions taken and recommendations for future maintenance.
- .3 Record post cleaning video survey: submit two copies of video survey DVD media, and include on video survey following:
- .1 Areas tested for particulate analysis or microbial growth evaluation;
 - .2 Areas of special interest and location;
 - .3 Special internal features;
 - .4 Problems such as broken or damaged controls or components;
 - .5 Ensure system tested, locations, observations, actions taken and recommendations are clearly identified in French and English on video using text or voice over.
- .4 Submit verification of delivery of hazardous or toxic waste materials to contaminated waste facility.

PART 2 - PRODUCTS

2.1 ANTIMICROBIAL AGENT

- .1 Use antimicrobial agents registered with US EPA-40 CFR.

2.2 AIR DUCT CLEANING EQUIPMENT

- .1 Manually propelled full contact brushes:
 - .1 Ensure brushes are specifically manufactured and shaped to fit individual ducts, equipment and components of HVAC system.
 - .1 Ensure brushes are sized to fit various duct sizes in HVAC system.

- .2 Ensure brushes make scrubbing motion and full contact with HVAC system interior surfaces to be cleaned.
- .2 Brushes: manually propelled with integrally-mounted drive or other polypropylene or nylon bristles.
 - .1 Ensure motor has capacity to continue to push brush after bristles are distorted.
 - .2 Replace worn and ineffective brushes when required.

2.3 HEPA FILTER EVACUATION FAN

- .1 Evacuation Fan: includes fan, HEPA filter, flexible hose and motor capable of maintaining debris and particulates airborne in airstream until they reach evacuation fan and maintaining system under negative pressure.
 - .1 Ensure HEPA filters are clean and maintain evacuation fan and HEPA filter to run efficiently.

2.4 HEPA VACUUM UNIT

- .1 Vacuum Unit: includes vacuum fan, integral HEPA filter, suction hose and vacuum head, capable of maintaining HVAC System debris and particulates airborne in air stream until they reach vacuum unit and maintaining system under negative pressure.
 - .1 Ensure HEPA filters are clean and maintain vacuum unit and HEPA filter to run efficiently.

PART 3 - EXECUTION

3.1 GENERAL INFORMATION ON CLEANING WORK

- .1 Clean all rigid low pressure ducts, flexible conduits, distribution and inlet plenums, and mixing boxes located within the work area delimited by the temporary wall identified by note 4 on the drawings. See mechanical and architectural plans for temporary wall location.

3.2 PREPARATION

- .1 Close down HVAC system.
- .2 Locate and identify externally visible HVAC system features which may affect cleaning process including:
 - .1 Control devices;
 - .2 Fire and smoke control dampers;

- .3 Balancing dampers: indicate and record positions for resetting;
- .4 Air volume control boxes: indicate and record positions for resetting;
- .5 Fire alarm devices;
- .6 Monitoring devices and controls.

3.3 EXAMINATION / PRE-CLEANING INSPECTION

- .1 Verification of Conditions:
 - .1 Make visual inspection of interior of HVAC system using remote controlled robotic camera.
 - .2 Insert camera at pre-established strategic locations to evaluate condition and cleanliness of HVAC systems and components.
- .2 Evaluation and Assessment:
 - .1 Identify location and type of internal components.
 - .2 Identify extent of potential problems.
 - .3 If toxic or hazardous materials or deposits are suspected after initial inspection immediately stop work and inform Departmental Representative.
 - .1 Do not proceed further with inspection operations until written approval from Departmental Representative.

3.4 PARTICULATE COLLECTION

- .1 Before starting duct cleaning, identify locations for sample collection and collect particulate samples.
- .2 Take samples from interior surfaces of HVAC system using sterile wipes for submission to independent testing laboratory.
 - .1 For each HVAC system collect four samples at the locations indicated by the Departmental Representative.

3.5 LABORATORY ANALYSIS

- .1 Ensure independent testing laboratory has demonstrated experience in work associated with air duct cleaning.

- .2 Ensure Super Electron Microscope (SEM) is used for analyzing and determining components of particulate collection samples:
 - .1 Identify components by grade and size;
 - .2 Report findings including percentage concentration of components to Departmental Representative.
- .3 Proceed with HVAC System Cleaning only after laboratory analysis test results have been received.
- .4 Ensure cleaning technicians have safety equipment appropriate for toxic or hazardous conditions identified by laboratory analysis before proceeding with cleaning operations.

3.6 DUCT CLEANING

- .1 Do duct cleaning in accordance with NADCA ACR Standard.
- .2 Clean all ducts and plenums located inside the work area limited by the temporary wall.
- .3 Ensure vacuum units and evacuation fans are securely in place before starting cleaning operation of isolated section of HVAC air duct system.
- .4 Install HEPA filter evacuation fan at one end of zone section and insert full contact brushes at other end.
- .5 Clean HVAC supply air duct system and components where particulate sample collected from surfaces is greater than 75 mg of particulate per 0.01 m².
- .6 Clean exhaust, return, transfer ductwork and plenums, equipment and components where particulate sample collected from surfaces is greater than 75 mg of particulate per 0.01 m².
- .7 Energize brushes to travel from insertion point to HEPA filter evacuation fan.
 - .1 Pass brushes through sections as often as necessary to achieve required cleanliness.
 - .2 Change brush sizes as required to ensure positive contact with duct and component interiors.
 - .3 Clean corners and pockets where dirt and debris can accumulate.
- .8 Clean equipment, components and other features in isolated zone before moving to next zone of HVAC air duct system.

- .9 Advise Departmental Representative 72 hours minimum before deactivation of fire alarm and smoke detectors duct cleaning operations.

- .1 Departmental Representative will pay for costs of deactivation of fire alarm and smoke detector system.

3.7 ACOUSTICALLY LINED DUCTWORK CLEANING

- .1 Clean glass fibre acoustically insulated ducts to NAIMA recommended practices.
 - .1 Use specifically designed robotic apparatus that has been demonstrated not to damage acoustic glass fibre lining.
 - .2 Monitor cleaning process progress by onboard camera.

3.8 COMPONENTS AND EQUIPMENT CLEANING

- .1 Brush and vacuum air mixing terminal units.
- .2 When cleaning equipment and components by brushing and vacuuming is inappropriate or insufficient, dismantle and remove equipment or component and move to area designated by Departmental Representative for cleaning.
 - .1 Clean equipment and components in place only if there is no hazard to adjacent materials.
- .3 Proceed to next section in cleaning sequence only after written approval from Departmental Representative.
- .4 Compressed air and manual cleaning is acceptable only for cleaning individual components and small areas as follows and only after written approval from Departmental Representative:
 - .1 Dampers;
 - .2 Turning vanes;
 - .3 Controls;
 - .4 Sensor bulbs;
 - .5 Fire alarms;
 - .6 Smoke detectors.

3.9 ANTI MICROBIAL APPLICATION

- .1 Apply antimicrobial agents when fungal growth is suspected.

- .2 Apply antimicrobial agents after removal of surface deposits and debris.
 - .1 Verify air duct interiors are free from deposits and debris by visual inspection.
 - .2 Report findings to Departmental Representative.
 - .3 Proceed with application of antimicrobial agents after written approval from Departmental Representative.
- .3 Apply antimicrobial agents in accordance with manufacturer's written instructions and US EPA 40 CFR registration and listing.
- .4 Manual or robotic spray antimicrobial agents directly onto interior surfaces of HVAC air duct system.
 - .1 Do not use fog mist for downstream surfaces.

3.10 FIELD QUALITY CONTROL/FINAL INSPECTIONS

- .1 Post Cleaning Inspection: carry out final inspection using robotic camera and other visual inspection methods after final cleaning has been completed.
 - .1 Carry out video survey as directed by Departmental Representative.
 - .2 Include in final survey areas inspected by Departmental Representative prior to cleaning.
 - .3 Identify on HVAC system record drawings access points used for inspection and cleaning.
 - .4 Re-collect and analyse particulates collected at same locations where original samples were collected before cleaning.
 - .5 Reset components including dampers and sensors, which have been disturbed during cleaning operations.

3.11 SYSTEM STARTUP

- .1 Cover each inspection opening with access door or panel and secure in place after inspection and cleaning are completed.

3.12 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

PART 1 - GENERAL**1.1 SUMMARY**

- .1 Section Includes:
 - .1 Use of mechanical systems during construction.

1.2 USE OF SYSTEMS

- .1 Existing ventilating systems must remain operational during construction work.
 - .1 Contractor shall respect the following requirements, in order to insure the building's systems operation.
 - .2 There is no possibility of damage.
 - .3 Supply ventilation systems are protected by 60% filters, inspected daily, changed every week or more frequently as required.
 - .4 Return systems have approved filters over openings, inlets, outlets.
 - .5 Systems will be:
 - .1 Operated as per manufacturer's recommendations and instructions of the Departmental Representative.
 - .2 Operated by Contractor.
 - .3 Monitored continuously by Contractor.
 - .6 Warranties and guarantees are not relaxed.
 - .7 Regular preventive and other manufacturers recommended maintenance routines are performed by Contractor at own expense and under supervision of Departmental Representative.
 - .8 Refurbish entire system before static completion; clean internally and externally, restore to "as- new" condition, replace filters in air systems.
- .2 Exhaust systems are not included in approvals for temporary heating ventilation.

PART 2 - PRODUCTS

- .1 Not Used.

PART 3 - EXECUTION

.1 Not Used.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 21 05 01 - Common Work Results for Mechanical.

1.2 REFERENCE

- .1 Furthermore, the works will be done in accordance with any other code or norm having jurisdiction, as per the latest edition, notably including, but not limited to:
 - .1 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.3 SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

- .1 Not Used.

PART 3 - EXECUTION**3.1 CONNECTIONS TO EQUIPMENT**

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

3.2 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, and maintenance, and as recommended by manufacturer.

INSTALLATION OF PIPEWORK

- .2 Provide space for disassembly, removal of equipment and components (whichever is greater) without interrupting operation of other system, equipment, and components of network. Fitted out space has to be of dimensions as indicated on drawings or as recommended by manufacturer, the most raised value must be retained.

3.3 PIPEWORK INSTALLATION

- .1 Installed oil piping as recommended in CSA B139-09 Standard.
- .2 Installed gas piping as recommended in CSA B149.1-10 Standard.
- .3 Screwed fittings jointed with Teflon tape.
- .4 Protect openings against entry of foreign material.
- .5 Assemble piping using fittings manufactured to ANSI Standards.
- .6 Install exposed piping, equipment, rectangular cleanouts, and similar items parallel or perpendicular to building lines.
- .7 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .8 Group piping wherever possible or as indicated.
- .9 Ream pipes, remove scale, and other foreign material inside out before assembly. Clean also when Work is completed.
- .10 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .11 Provide for thermal expansion as indicated.

3.4 SLEEVES

- .1 Sealing.
 - .1 Foundation walls and below grade floors: Fire retardant, waterproof non-hardening mastic.
 - .2 Ensure no contact between copper pipe or tube and sleeve.

3.5 FLUSHING OUT OF PIPING SYSTEMS

- .1 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition.

3.6 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
- .2 Pipework: test as specified in relevant of 23 Division.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant of 23 Division.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of Departmental Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

3.7 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by Departmental Representative.
- .2 Request written approval 10 days minimum prior to commencement of Work.
- .3 Be responsible for damage to existing plant by this Work.
- .4 Ensure daily clean-up of existing areas.

3.8 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Division 23 - Heating, Ventilation and Air-Conditioning (HVAC).
- .2 Division 26 - Electrical.

1.2 SUMMARY

- .1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for air systems and hydronics systems.
- .2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.3 QUALIFICATIONS OF TAB PERSONNEL

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

- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.4 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads
- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.5 EXCEPTIONS

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

1.6 CO-ORDINATION

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.7 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 other aspects of design, and installation pertinent to success of TAB.
- .2 Review specified Standards and report to Departmental Representative in writing proposed procedures which vary from Standard.

- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.8 START-UP

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in contractual documents.

1.9 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.

1.10 START OF TAB

- .1 Notify Departmental Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
 - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
 - .2 Application of weatherstripping, sealing, and caulking.
 - .3 Provisions for TAB installed and operational.
 - .4 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including, but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Duct systems clean.
 - .2 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .3 Outlets installed, volume control dampers open.

1.11 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 Air systems: plus or minus 10%.

1.12 ACCURACY TOLERANCES

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

1.13 INSTRUMENTS

- .1 Prior to TAB, submit to Departmental Representative list of instruments used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced Standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

1.14 SUBMITTALS

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

1.15 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.

1.16 TAB REPORT

- .1 Format in accordance with referenced Standard.
- .2 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.

- .3 Submit six copies of TAB Report to Departmental Representative for verification and approval, in both official languages, in "D-ring" binders, complete with index tabs.

1.17 VERIFICATION

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

1.18 SETTINGS

- .1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.19 COMPLETION OF TAB

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

1.20 AIR SYSTEMS

- .1 Standard: TAB to most stringent of this section or TAB Standards of AABC, NEBB, SMACNA or ASHRAE.
- .2 Do TAB of systems, equipment, components, controls specified in contractual documents.
- .3 Qualifications: Personnel performing TAB qualified to Standards of AABC or NEBB.
- .4 Locations of equipment measurements: To include as appropriate:
 - .1 At controllers and controlled device.
- .5 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.21 OTHER TAB REQUIREMENTS

- .1 General requirements applicable to work specified this paragraph:
 - .1 Qualifications of TAB personnel: As for air systems specified this section.
 - .2 Quality assurance: As for air systems specified this section.

PART 2 - PRODUCTS

- .1 Not Used.

PART 3 - EXECUTION

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL**1.1 CODES AND REFERENCES**

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
 - .1 ANSI/ASHRAE/IESNA 90.1-01, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 American Society for Testing and Materials International (ASTM).
 - .1 ASTM C335-95, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .2 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .3 ASTM C547-00, Specification for Mineral Fiber Pipe Insulation.
 - .4 ASTM C553-11, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .3 Canadian General Standards Board (CGSB).
 - .1 CGSB 51-GP-52Ma-89, Vapor Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Thermal Insulation Association of Canada (TIAC), National Insulation Standards (C1999).
- .5 Underwriters Laboratories of Canada.
 - .1 CAN/ULC-S102-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 DEFINITIONS

- .1 For the present section the following definitions apply:
 - .1 Concealed elements: Insulated piping, ductwork and mechanical equipment located above suspended ceilings or in inaccessible construction spaces.
 - .2 Visible elements: Elements that are not concealed (as per the definition above).
 - .3 Insulation: Includes the insulating material, accessories for fixing and jackets.

DUCT INSULATION

- .4 Ductwork: Overall duct network including the ducts, the joints and all related accessories.
- .2 Insulation thickness is the thickness needed to cover every component of the insulated element, including reinforcements, angles, T-joints, flanges, etc.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data.
 - .1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Manufacturers' Instructions.
 - .1 Provide manufacture's written duct insulation jointing recommendations and special handling criteria, installation sequence, and cleaning procedures.

1.4 QUALITY ASSURANCE

- .1 The mechanical quality insulation standards manual of the Thermal Insulation Association of Canada (TIAC), as well as its authorized amendments, must be used as the standard reference and is part of the specifications of this project.
- .2 The Contractor responsible for the thermal insulation installation must keep a copy of this quality standard manual as a reference on the jobsite.

PART 2 - PRODUCTS**2.1 FIRE AND SMOKE RATING**

- .1 To CAN/ULC-S102-10 Standard.
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Thermal conductivity coefficient (coefficient "K") must not exceed the prescribed value at mean temperatures of 24°C, in accordance with ASTM C335 Standard.

DUCT INSULATION

- .2 Type **D-2 insulation**: Bat made of mineral fibres in accordance with ASTM C553-11 Standard, with factory installed vapour barrier envelop in accordance with CGSB 51-GP-52Ma Standard.
 - .1 Mineral fibers: In accordance with ASTM-C553-11 Standard.
 - .2 Vapour barrier: In accordance with CGSB 51-GP-52Ma Standard.
 - .3 Thermal conductivity coefficient "K" no greater than 0,035 W/m•°C at mean temperature of 24°C.
 - .4 Temperature limit: 120°C.
 - .5 Density: 24 kg/m³.
 - .6 Acceptable product: Manson Alley Wrap FSK; Knauf; Dispro.

2.3 GLUES, TAPES AND ATTACHMENTS

- .1 Tapes: Self-adhesive aluminum, of 100 mm in width, approved by the ULC for the following characteristics: Flame spread index inferior to 25 and a fumigant property index of at most 50.
- .2 Quick set contact glue.
- .3 Sealing Glue for Overlaps: Quick set glue used to seal the joints and the overlaps of the vapour barriers.
- .4 Pegs.
 - .1 Pegs to weld to the duct once the insulation is set, of a 4 mm diameter, with a 35 mm head diameter, of an appropriate length to the thickness of the insulator.
 - .2 Pegs to weld on the duct before the insulation is set, of a 2 mm diameter, of an appropriate length to the thickness of the insulator, equipped with a nylon square holding small plate of 32 mm side.

PART 3 - EXECUTION**3.1 PRE-INSTALLATION REQUIREMENTS**

- .1 Pressure test ductwork systems completed, witnessed, and certified.
- .2 Ensure surfaces are clean, dry, and free from foreign material.

DUCT INSULATION

3.2 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers' instructions and as indicated.
- .3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 If there are elevated joints, cover them by overlapping sections or with a flexible insulating material with an integrated vapour barrier.
- .5 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Ensure hangers, and supports are outside vapour retarder jacket.
- .6 Fasteners: Install at 300 mm on centre in horizontal and vertical directions, minimum two rows each side.

3.3 DUCTWORK INSULATION SCHEDULE

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

NETWORKS AND EQUIPMENTS		THICKNESS OF INSULATION mm	TYPE OF INSULATION
.1	The networks of conditioning supply air ducts. Insulate new pipes and rectify existing insulation at the connection points of new pipes in the works area.	25	D-2

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 21 05 01 - Common Work Results for Mechanical.
- .2 Section 23 01 31 - Air Duct Cleaning for HVAC Systems.

1.2 REFERENCE STANDARDS

- .1 Code de construction du Québec - Chapitre I - Bâtiment 2010.

PART 2 - PRODUCTS

- .1 Not Used.

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

3.2 INSTALLATION

- .1 Coordinate temporary demolition of equipment in the work area with the Contractor and the Departmental Representative.
- .2 Protect existing control/control devices from dust and impact in the work area. Replace, at no cost to the Departmental Representative, any equipment that has been damaged due to lack of proper protection.
- .3 Connect equipment that has been temporarily removed. Check operation and re-calibrate.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

PART 1 - GENERAL**1.1 SECTION INCLUDES**

- .1 Materials and installation for piping, valves, and fittings for gas fired equipment systems in building services piping.

1.2 RELATED SECTIONS

- .1 Section 23 05 05 - Installation Pipework.

1.3 REFERENCE

- .1 Unless otherwise indicated, all of the Works will be done in accordance with the in force edition of the National Building Code.
- .2 Furthermore, the Works will be done in accordance to any other code or standard having jurisdiction, as per the latest edition, notably including, but not limited to:
 - .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME B16.5-03, Pipe Flanges and Flanged Fittings.
 - .2 ASME B16.18-2012, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ASME B16.22-2001, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
 - .4 ASME B18.2.1-96, Square and Hex Bolts and Screws Inch Series.
 - .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A47/A47M-99(2004), Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
 - .3 ASTM B75M-99, Standard Specification for Seamless Copper Tube Metric.
 - .4 ASTM B837-01, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.

- .3 Canadian Standards Association (CSA International).
 - .1 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel.
- .4 Canadian Standards Association (CSA)/Canadian Gas Association (CGA)
 - .1 CAN/CSA B149.1.10 HB-00, Natural Gas and Propane Installation Code Handbook.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Closeout Submittals.
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals and include following:
 - .1 Product data from manufacturer must specify servicing requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal.
 - .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

PART 2 - PRODUCTS

2.1 BLACK STEEL PIPE

- .1 Steel Pipe for Heating: Complying with ASTM A53/A53M Standard, grade B, schedule 40.
 - .1 NPS to 2: Screwed
 - .2 NPS 2½ and above: Plain end.

2.2 PIPE JOINTS FOR BLACK STEEL

- .1 Screwed Fittings: PTFE tape or lead-free pipe dope.
- .2 Welded Joints: To CSA W47.1 Standard.

2.3 FITTINGS

- .1 Fittings for Piping: Screwed or welded end to end:
 - .1 Screwed Fittings: Malleable iron, to ASME B16.3 Standard, Class 150.
 - .2 Butt-Welding Fittings.
 - .3 Unions: Malleable iron, in accordance to ASTM A47/A47M Standard.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- .1 Install pipe work in accordance with Section 23 05 05 - Installation of Pipework.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 PIPING

- .1 Install in accordance with Section 23 05 05 - Installation of Pipework, applicable Provincial/Territorial Codes, CAN/CSA B149.1-10 Standard, supplemented as specified.
- .2 Install Drip Points:
 - .1 At low points in piping system.

3.4 FIELD QUALITY CONTROL

- .1 Site Tests/Inspection:
 - .1 Test system in accordance with CAN/CSA B149.1-10 and requirements of authorities having jurisdiction.

3.5 ADJUSTING

- .1 Purging: Purge after pressure test in accordance with CAN/CSA B149.1 Standard.

3.6 CLEANING

- .1 Cleaning: In accordance with CAN/CSA B149.1-10 Standard, supplemented as specified.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 23 05 05 - Installation Pipework.
- .2 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 REFERENCE

- .1 Unless otherwise indicated, all of the works will be done in accordance with the in force edition of the National Building Code.
- .2 Furthermore, the works will be done in accordance to any other code or standard having jurisdiction, as per the latest edition, notably including, but not limited to:
 - .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME B16.1-98, Cast Iron Pipe Flanges and Flanged Fittings.
 - .2 ASME B16.3-2011, Malleable Iron Threaded Fittings.
 - .3 ASME B16.5-03, Pipe Flanges and Flanged Fittings.
 - .4 ASME B16.9-01, Factory-Made Wrought Butt welding Fittings.
 - .5 ASME B18.2.1-03, Square and Hex Bolts and Screws (Inch Series).
 - .6 ASME B18.2.2-87(R1999), Square and Hex Nuts (Inch Series).
 - .2 American Water Works Association (AWWA).
 - .1 AWWA C111-00, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - .3 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A47/A47M-99, Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
 - .3 ASTM A536-84(1999)e1, Standard Specification for Ductile Iron Castings.
 - .4 ASTM B61-02, Standard Specification for Steam or Valve Bronze Castings.

HYDRONIC SYSTEMS STEEL

- .5 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .6 ASTM E202-00, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.
- .4 Canadian Standards Association (CSA International).
 - .1 CSA B242-M1980(R1998), Groove and Shoulder Type Mechanical Pipe Couplings.
 - .2 CAN/CSA W48-01, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).
- .5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67-02, Butterfly Valves.
 - .2 MSS-SP-70-98, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71-97, Cast Iron Swing Check Valves Flanged and Threaded Ends.
 - .4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
 - .5 MSS-SP-85-02, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Closeout Submittals.
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

PART 2 - PRODUCTS**2.1 BLACK STEEL PIPE**

- .1 Steel Pipe for Heating: Complying with ASTM A53/A53M Standard, Grade B, Schedule 40.

2.2 PIPE JOINTS FOR BLACK STEEL

- .1 NPS 2 and under: Screwed fittings with PTFE tape or lead-free pipe dope in accordance to ASTM.

- .2 Pipe Thread: Taper.

2.3 FITTINGS FOR BLACK STEEL

- .1 Screwed Fittings: Malleable iron, to ASME B16.3 Standard, Class 150.
- .2 Unions: Malleable iron, to ASTM A47/A47M and ASME B16.3.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- .1 Install pipe work in accordance with Section 23 05 05 - Installation of Pipework.
- .2 Temporary relocation and relocation work on the initial location of the liquid cooler (glycol) shall be coordinated with the Contractor. The glycol piping between the temporary site and the building must be installed in a manner that will not interfere with the Contractor's operations and be protected from accidental breakage during the repair of the building's envelope.

3.2 TESTING

- .1 Test system in accordance with Section 23 05 05.

END OF SECTION

PART 1 - GENERAL**1.1 REFERENCES**

- .1 American Society for Testing and Materials, (ASTM).
 - .1 ASTM A47/A47M-99, Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A278M-01, Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (345 degrees C).
 - .3 ASTM A516/A516M-96(e1), Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
 - .4 ASTM A536-84(1999)e1, Specification for Ductile Iron Castings.
 - .5 ASTM B62-93, Specification for Composition Bronze or Ounce Metal Castings.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA B51-09, Boiler, Pressure Vessel, and Pressure Piping Code.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 QUALITY ASSURANCE

- .1 Health and Safety Requirements.
 - .1 In accordance with section 01 35 29.06 - Health and Safety Requirements.

PART 2 - PRODUCTS**2.1 AUTOMATIC AIR VENT**

- .1 Air vent with float, industrial type: body in iron with NPS ½ joint designed for nominal work pressure of 860 kPa.
 - .1 Float: designed for working temperature of 115°C.

.2 Usage:

.1 On piping diameter less than NPS 2 with water-glycol mixer.

.2 Install a bronze ball valve at every air vent.

2.2 ETHYLENE GLYCOL FLUID

.1 Supply and install a 50% ethylene glycol (Dowtherm or Domcol) and 50% distilled water mix with rust inhibitors in sufficient quantity for the glycol cooling circuit (relocation of the fluid cooler).

.2 Minimal alkalinity of 10.0 ml.

.3 Calculate volume require.

PART 3 - EXECUTION

3.1 GENERAL

.1 Recover glycol prior to relocation of fluid cooler. Fill to 60% of the capacity of the existing glycol pressurization tank. Be sure to use the same type of glycol with the same concentration as the existing glycol solution. After replacing the glycol cooler on the initial location, make sure to keep the glycol in the tank at the existing level prior to the work.

3.2 AIR VENT

.1 Install air vent on piping and for equipment, upstream at high points, before each fluid drop, and where specifically indicated.

.2 Air vent must comply with indications and have an isolation valve.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials International (ASTM).
 - .1 ASTM A480/A480M-03c, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A635/A635M-02, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
 - .3 ASTM A653/A653M-03, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .5 National Fire Protection Association (NFPA).
 - .1 NFPA 90A-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B-02, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- .6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition 1995 and Addendum No. 1, 1997.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.
 - .3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.

1.3 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 QUALITY ASSURANCE

- .1 Certification of Ratings.
 - .1 Catalogue or published ratings are those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to Codes and Standards.
- .2 Health and Safety.
 - .1 Apply pertinent safety rules in accordance with section 01 35 29.06 - Health and Safety Requirements.

PART 2 - PRODUCTS

2.1 SEAL CLASSIFICATION

- .1 Seal classification for ductwork is to be determined by the following table:

Maximum Pressure	Seal Classification
500 Pa	A (SMACNA)

- .2 Seal Classification:
 - .1 Class A: Longitudinal seams, transverse joints and connections made airtight with sealing product or tape embedded in sealing product.
 - .2 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.2 SEALANT

- .1 Transverse Joints:
 - .1 Rectangular or round ducts with slotted or "S" joints.
 - .1 Tube applied sealant.
 - .1 Acceptable products: Mulco-Butyle; Ductmate 5511M.

- .2 "T" joints and flanged joints.
 - .1 Waterproof tape.
 - .1 Acceptable products: Ductmate 440 Gasket tape.
- .2 Longitudinal Joints:
 - .1 Round duct.
 - .1 Tube applied sealant of sealant product.
 - .1 Acceptable products: Mulco-Butyle; Ductmate 5511M.
 - .2 Rectangular duct.
 - .1 Tube sealant.
 - .1 Acceptable products: Mulco-Butyle; Ductmate No. 5511M.
- .3 Miscellaneous:
 - .1 For installation temperature higher than -7°C.
 - .1 Sealing product: sealing product for air duct, water based, ULC certified, with fire spread factor smaller than 26 and smoke density rating lower than 51, usable within -7°C to 93°C temperature range.
 - .1 Acceptable products: Duro Dyne DWN or equivalent.

2.3 TAPE

- .1 Tape: Polyvinyl treated, open weave fiberglass tape, 50 mm wide.
 - .1 Acceptable products: Duro Dyne FT-2 or equivalent.

2.4 FITTINGS

- .1 Fabrication: According to SMACNA.
- .2 Rounded Elbows:
 - .1 Rectangular ducts: Elbows bend radius equal to one times the width of the duct.
 - .2 Ducts round: Elbows bend radius equal to 1.5 times the diameter of the pipe "Standard manufacturers."

- .3 90° Elbows: Rectangular Ducts:
 - .1 Ducts whose largest dimension is less than or equal to 400 mm equipped with baffles elbows single thickness.
 - .2 Ducts whose largest dimension is greater than 400 mm equipped with baffles elbows double thickness.
- .4 Bypass Fittings:
 - .1 Main and branch ducts, rectangular:
 - .1 Lateral entry at 90°: With damper in the branch closest to the main duct.
 - .2 Lateral entry to 45°: Radius of curvature equal to one time the width of the duct with damper in the branch closest to the main duct.
 - .2 Ducts, main, and branch, round: Entering the main duct with conical fitting.
- .5 Transition Elements:
 - .1 Divergent elements: Transition angle of up to 20°.
 - .2 Elements converging transition angle exceeding 30°.
- .6 Offsets: 90° bends or elbows rounded, as indicated.
- .7 Deflectors for obstacles to keep the same effective area. The angles of maximum transition must be the same as in the case of regular transformations.

2.5 FIRE STOPPING

- .1 Angle restraints must be installed around the sleeves on each side of fire separations.
- .2 Fire stopping material and installation must not distort duct.

2.6 GALVANIZED STEEL

- .1 Lock Forming Quality: To ASTM A653/A653M, Z90 zinc coating.
- .2 Design Criteria: Pressure of 500 Pa.
- .3 Thickness, Manufacturing and Reinforcement: To ASHRAE and SMACNA recommendations.

- .4 Joints.
 - .1 Complying with ASHRAE and SMACNA for following usage:
 - .1 Ducts, with greater dimension up to 1,200 mm or 900 mm diameter.
 - .2 Prefab trade marked flanged joints for air ducts, for following usage.
 - .1 Ducts, with greater dimension up to 1,200 mm or 900 mm diameter.
 - .2 Acceptable products: Ductmate Canada or equivalent.
- .5 Circular and Oval Ducts.
 - .1 Ducts: Factory manufactured, spiral, with assorted fittings and special parts, in accordance with SMACNA.
 - .2 Transverse joints for ducts up to 900 mm diameter: Interlocked type, use sealing product and tape for tightness.
 - .3 Transverse joints for ducts over 900 mm diameter: Vanstone.
 - .4 Acceptable products: Spiro Metal Canada Inc.; Ductmate Canada.

2.7 HANGERS

- .1 Hanging Straps: Used for ducts with greater dimension up to 500 mm Same material as suspended duct, one gauge thicker than suspended duct material.
- .2 Hangers Configuration: In accordance with ASHRAE and SMACNA recommendations.
- .3 Angles and hanger rods; angles made from galvanized steel, retained by galvanized steel rods, in accordance with ASHRAE and SMACNA recommendations and following table:

DUCT SIZE mm	ANGLES SIZE mm	RODS SIZE mm
Up to 750	25 x 25 x 3	6
From 751 to 1,050	40 x 40 x 3	6
From 1,051 to 1,500	40 x 40 x 3	10
From 1,501 to 2,100	50 x 50 x 3	10
From 2,101 to 2,400	50 x 50 x 5	10
Over 2,400	50 x 50 x 6	10

- .4 "Ramset" type impact anchors and simply laid anchors (drop-in anchors) are prohibited.
- .5 Hanger Attachment Devices.
 - .1 Attachment for concrete works; prefab concrete anchorage.
 - .2 Steel beam attachment: prefab concrete clamps.
 - .3 Steel beam attachment: prefab clamps.

PART 3 - EXECUTION

3.1 GENERAL

- .1 Do work in accordance with NFPA 90A, NFPA 90B, ASHRAE, and SMACNA, as indicated.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .3 Insulate strap hangers 100 mm beyond insulated duct. Ensure diffuser is fully seated.
- .4 Support risers in accordance with ASHRAE and SMACNA, as indicated.
- .5 Install breakaway joints in ductwork on sides of fire separation.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining, as indicated.

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 ASHRAE and SMACNA recommendations, as follows:

Duct Size (mm)	Spacing (mm)
To 1,500	3,000
1,501 and over	2,500

3.3 SEALING AND TAPING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.

- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.
- .3 Seal every opening in air ducts (i.e.: openings for instruments, dampers liking parts, coils, etc.), using sealing product or neoprene or silicone trim. Equipment installed within the duct must be allowed to move freely as required.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 23 05 93 - Testing, adjusting and balancing for HVAC.

1.2 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
 - .1 ASHRAE Handbook, Fundamentals and Systems Volumes.
- .2 American Society for Testing and Materials International (ASTM).
 - .1 ASTM A480/A480M, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A525, Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanised) by the Hot-Dip Process (Metric).
 - .3 ASTM A621/A621M, Specification for Steel Sheet and Strip, Carbon, Hot Rolled, Drawing Quality.
 - .4 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Department of Justice of Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA).
- .4 National Air Duct Cleaners Association (NADCA).
 - .1 Assessment, Cleaning and Restoration of HVAC Systems (ACR 2006).
- .5 National Fire Protection Association (NFPA).
 - .1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).

- .7 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA, HVAC Duct Construction Standards - Metal and Flexible.
 - .2 SMACNA, HVAC Air Duct Leakage Test Manual.
 - .3 IAQ Guideline for Occupied Buildings under Construction (Duct Cleanliness for New Construction Guidelines).

1.3 SUBMITTALS

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

1.4 QUALITY ASSURENCE

- .1 Certification of Ratings:
 - .1 Catalogue or published ratings are those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .2 Health and Safety:
 - .1 Apply pertinent safety rules in accordance with section 01 35 29.06 - Health and Safety Requirements.

1.5 PRESSURE OF DUCT DESIGN

- .1 Hot and cold air supply duct upstream of mixing boxes.
 - .1 Supply: 2,150 Pa (maximum pressure).

PART 2 - PRODUCTS

2.1 DUCTS AND FITTINGS

- .1 Materials:
 - .1 Galvanized steel ducts with G90 zinc coating, flexible, lock forming quality, to ASTM A653/A653M.
 - .2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA.

- .2 Construction of round ducts:
 - .1 Ducts: Manufactured in the factory, with matching fittings and special parts according to SMACNA.
 - .2 Transverse joints of ducts with a diameter of 900 mm or less: nesting type, sealed with sealant and sealing tape.
 - .3 Traverse joints for duct 900 mm diameter and larger: flanges type.
 - .4 Fittings:
 - .1 Elbows: centerline radius 1.5 times the standard duct diameter or 5 pieces 90°, 45° 3 pieces type.
 - .2 Branches: Concentric transitions with reduced branch at 45° and curved branch at 45°.
- .3 Firestopping:
 - .1 Retaining angles around duct, on both sides of the fire separation.
 - .2 Firestopping material and installation must not distort duct.

2.2 SEAL CLASSIFICATION

- .1 Class A: longitudinal seams, traverse joints and connections made airtight with sealant, tape, or combination thereof.

2.3 SEALANT

- .1 General:
 - .1 Tapes and sealants shall conform to CAN/ULC-S109 (tape), NFPA 90A and 90B standards and have a maximum flame spread of 25 and a smoke index of not more than 50.
- .2 For temperatures above -7°C:
 - .1 Sealant for air duct, ULC approved water base having a flame spread index of not more than 25 and a Smoke Index of not more than 50 that may be used in a range of operating temperature ranging from -7°C to 93°C.
 - .1 Acceptable products: Duro Dyne DWN or equivalent.

- .3 Sealing tape: Fiberglass tape, loose, 50 mm wide, polyvinyl-treated.
 - .1 Acceptable Products: Duro Dyne FT-2 or equivalent.
- .4 Seal packing.
 - .1 Acceptable Products: Ductmate or equivalent.

2.4 HANGERS AND SUPPORTS

- .1 Hanger straps: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500 mm.
- .2 Hanger configuration: to ASHRAE and SMACNA.
- .3 Angles and hanger rods: galvanized steel angles retained by galvanized steel rods to ASHRAE and SMACNA and the indications in the following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
Up to 750	25 x 25 x 3	6
751 to 1,050	40 x 40 x 3	6
1,051 to 1,500	40 x 40 x 3	10
1,501 to 2,100	50 x 50 x 3	10
2,101 to 2,400	50 x 50 x 5	10
2,401 and higher	50 x 50 x 6	10

- .4 "Ramset" impact anchors and simply laid anchors (drop-in anchors) are prohibited.
- .5 Upper hanger attachments:
 - .1 Concrete: zinc-plated steel anchor bolts with a hexagon head and internal threaded washer.
 - .2 Concrete:
 - .1 Galvanized steel expansion anchor (6 mm diameter to 25 mm diameter):
 - .3 Steel joist: prefabricated steel joist clamp or steel plate.

- .4 Steel beam: prefabricated beam clamps.

PART 3 - EXECUTION

3.1 GENERAL

- .1 Do work in accordance with ASHRAE and SMACNA, as well as ANSI/NFPA 90A and ANSI/NFPA 90B.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 100 mm beyond insulated duct.
- .3 Support risers in accordance with ASHRAE and SMACNA, and as indicated.
- .4 Install breakaway joints in ductwork on sides of fire separation

3.2 HANGERS

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

Duct Size (mm)	Spacing (mm)
To 1,500	3,000
1,501 and over	2,500

3.3 SEALING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturer's recommendations.
- .3 Seal all openings in air ducts, such as instrumentation openings, damper linkage, coils, etc., using neoprene or silicone sealant, while allowing the normal movement of the equipment installed in the ducts.

3.4 LEAKAGE TESTS

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

- .2 Make trial leakage tests (to detect air leakage) as instructed to demonstrate workmanship.
- .3 Install no additional ductwork until trial test has been passed.
- .4 Test section minimum of 30 m long with not less than three branch takeoffs and two 90° elbows.
- .5 Do not insulate or conceal ducts before completing required tests and having the test report be approved.

END OF SECTION

PART 1 - GENERAL**1.1 REFERENCES**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 95.
- .3 National Fire Protection Association (NFPA).
 - .1 NFPA 90A-2009, Installation of Air Conditioning and Ventilating Systems.
 - .2 NFPA 90B-2009, Installation of Warm Air Heating and Air Conditioning Systems.
- .4 Underwriter's Laboratories of Canada (ULC).
 - .1 CAN/ULC-S110-M86(R2001), Fire Tests for Air Ducts.
 - .2 UL 181-1996, Factory Made Air Ducts and Connectors

1.2 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data.
 - .1 Submit manufacturer's printed product literature, specifications, and data sheet. Indicate the following:
 - .1 Flexible connections.
 - .2 Duct access doors.
 - .3 Turning vanes.
 - .4 Instrument test ports.
 - .2 Submit Material Safety Data Sheets (MSDS).

AIR DUCT ACCESSORIES

- .3 Test Reports: Submit independent laboratory test reports in order to certify that the products and materials satisfy the performance criteria.
 - .1 Technical data provided by the manufacturer must be reliable and confirmed by tests performed by the manufacturer or by independent laboratories in order to certify their compliance to the standards.
- .4 Certificates: Submit documents signed by the manufacturer in order to certify that the products and materials satisfy the performance criteria.
- .5 Instructions: Submit manufacturer's installation instructions.
- .6 On-field Manufacturer Inspection: Submit reports for these inspections.
- .7 Closeout Submittals: Submit maintenance data sheets and join them to the manual mentioned in section 01 78 00 - Closeout Submittals.

1.3 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Apply required measures in accordance with section 01 35 29.06 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal.
 - .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .2 Collect and separate for disposal packaging material in appropriate on-site bins for recycling, in accordance with Waste Management Plan.
 - .3 Divert unused metal materials from landfill to recycling facility as approved by Departmental Representative.

PART 2 - PRODUCTS**2.1 GENERAL**

- .1 Accessories to be manufactured in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 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, 20 mm x 10 mm.
- .4 Hardware.
 - .1 Doors, up to 300 mm x 300 mm: Two locks, Duro Dyne SL-1, with chain.
 - .2 Doors, up to 301 mm x 450 mm: Four locks, Duro Dyne SL-1, with chain.
 - .3 Doors, from 451 to 1,000 mm height: One continuous piano type hinge and at least two locks, Duro Dyne SL-1.
 - .4 Doors, over 1,000 mm height: One continue piano type hinge and three handles operable from both inside and outside.
 - .5 Door holder: Device to keep doors in open position.

2.3 TURNING VANES

- .1 Factory or shop fabricated single or double thickness, to recommendations of SMACNA and as indicated.

PART 3 - EXECUTION

3.1 INSTRUCTIONS DU FABRICANT

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

3.2 INSTALLATION

- .1 Access Door Duct.
 - .1 Size:
 - .1 610 x 1,520 mm for person size entry.

AIR DUCT ACCESSORIES

- .2 460 x 460 mm for handhole.
 - .3 300 x 200 mm for viewing.
 - .4 As indicated.
- .2 Locations:
 - .1 Devices requiring maintenance.
 - .2 Required by Code.
 - .3 Elsewhere as indicated.
- .3 Handhole location:
 - .1 Located to give access to the smoke evacuation dampers and fire dampers
 - .2 Located to give access to balancing dampers.
 - .3 Located to give access to devices requiring periodical maintenance.
 - .4 Located as required by standards.
 - .5 Located where indicated.
- .2 Turning vanes.
 - .1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 CLEANING

- .1 Once installation work is completed, clear the job site of all surplus material, waste, tools and safety barriers.

END OF SECTION

PART 1 - GENERAL**1.1 REFERENCES**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .2 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .4 National Fire Protection Association (NFPA).
 - .1 NFPA 90A-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B-02, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.
- .5 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 95 (Addendum No.1, November 1997).
 - .2 SMACNA IAQ Guideline for Occupied Buildings under Construction, 1st Edition, 1995.
- .6 Underwriters' Laboratories Inc. (UL).
 - .1 UL 181-96, Standard for Factory-Made Air Ducts and Air Connectors.
- .7 Underwriters' Laboratories of Canada (ULC).
 - .1 CAN/ULC-S110-1986 (R2001), Fire Tests for Air Ducts.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- .1 Certification of Ratings:
 - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to Codes and Standards.
- .2 Health and Safety:
 - .1 Apply pertinent measures in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Protect on site stored or installed absorptive material from moisture damage.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Factory fabricated to CAN/ULC-S110-07.
- .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 - INSULATED

- .1 Spiral wound flexible aluminum with glass fibre thermal insulation with vapour barrier and vinyl reinforced jacket, as indicated.
 - .1 Aluminum sheet thickness: Not less than 0.15 mm.
 - .2 Insulation thickness: Not less than 25 mm.
- .2 Performance.
 - .1 Factory tested to 3 kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.
 - .3 Leakage: 0%.

FLEXIBLE DUCTS

- .4 Thermal loss/gain: 1.03 W/m²/°C.
- .5 ULC approved Class 1.
- .6 Acceptable products: Flex Master, T/L-A Model or equivalent.

PART 3 - EXECUTION**3.1 INSTALLATION OF FLEXIBLE DUCT**

- .1 Install flexible air ducts where specified in compliance with SMACNA recommendations, ANSI/NFPA 90A, 90B, and UL 181 Standards.
- .2 Flexible ductwork must be supported in accordance with SMACNA.
- .3 Flexible duct length connected to diffuser must not be greater than 1,200 mm.
- .4 Flexible duct length connected to boxes must not be greater than 900 mm.

END OF SECTION

PART 1 - GENERAL**1.1 SYSTEM DESCRIPTION**

- .1 Performance Requirements.
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to Codes and Standards.

1.2 SUBMITTALS

- .1 Product Data.
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .2 Indicate following:
 - .1 Capacity;
 - .2 Throw and terminal velocity;
 - .3 Noise criteria;
 - .4 Pressure drop;
 - .5 Neck velocity.
- .2 Quality Assurance: Submit the following in accordance with section 01 33 00 - Submittal Procedures.
 - .1 Certificate: Submit catalogued or published ratings obtained from tests carried out by the manufacturer or those ordered by the manufacturer from an independent testing agency demonstrating adherence to codes and standards.
 - .2 Instructions: Submit manufacturer's installation instructions:

1.3 QUALITY ASSURANCE

- .1 Health and Safety: Apply pertinent measures in accordance to Section 01 35 29.06 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

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

1.5 MAINTENANCE

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

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Standard products meeting requirements regarding following items: air flow, pressure loss, air terminal velocity, range, noise level and velocity at maximum narrowing point (clamp).
- .2 Casing.
 - .1 Aluminum casing: extruded aluminum, satin finish, with mechanical fasteners and miter joints at the angles.
 - .2 Sealing trim surrounding casing.
 - .3 Assembling frame, coated for casing mounted within coated wall or partition, or made from plaster plates, as prescript.
 - .4 Hidden attach system.
- .3 Acceptable products: E.H. Price model LBP 25C/1000 Anodise Aluminium, type C fastening (concealed bracket); Titus; Nailor.
- .4 Characteristics: See note on drawing.

PART 3 - EXECUTION**3.1 MANUFACTURER'S INSTRUCTIONS**

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

3.2 INSTALLATION

- .1 Install in accordance with manufacturers instructions.
- .2 Install with flat head cadmium plated screws in countersunk holes, where fastenings are visible.
- .3 Install balancing dampers with each grid and diffuser.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 This Section includes requirements common to various sections of Division 26, and in addition to general requirements of Division 01.
- .2 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA C22.1-15, Canadian Electrical Code.
 - .2 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 Manufacturers Association of Electrical and Electronic Equipment of Canada (EEMAC).
 - .1 EEMAC 2Y-1, Light Gray Colour for Indoor Switch Gear.
- .3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC).
 - .1 IEEE SP1122, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 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.

1.4 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 control items in English and French.

- .4 Use one nameplate or label for both languages.

1.5 SUBMITTALS

- .1 Provide to the Departmental Representative product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
 - .2 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.
 - .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
 - .5 Submit ten copies of drawings of at least 216 mm x 280 mm, and sheets, to the competent authority inspection.
 - .6 If changes are required, notify Departmental Representative of these changes before they are made.
- .3 Quality Control:
 - .1 Provide CSA certified equipment and material.
 - .2 Submit test results of installed electrical systems and instrumentation.
 - .3 Permits and fees: in accordance with General Conditions of contract.
 - .4 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
 - .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .4 Reports of spot checks by the manufacturer: Departmental Representative to submit, not later than three days after execution of inspections and tests the installation and electric instruments prescribed in Article CONTROL FIELD QUALITY PART 3, a written report of the manufacturer showing that the work complies with specified criteria.

1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
 - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Site visits with the Departmental Representative shall be provided. The cost of these visits is an integral part of the Contract.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within two weeks after award of Contract.

1.8 OPERATING INSTRUCTIONS

- .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 The operating instructions should be exposed to the weather-resistant material or shall be placed in a weatherproof enclosure.

- .6 Ensure that the operating instructions will not fade when exposed to sunlight.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Control panels and components shall be assembled in the factory. Material and equipment to be CSA certified.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Control wiring and conduit there for must be provided under Division 26, except ducts, wiring and connections operating at a voltage below 50 V, and related control systems prescribed by the supplier mechanical equipment and included in his drawings.

2.3 WARNING SIGNS

- .1 Warning Signs: Complying with the requirements of the Departmental Representative.

2.4 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for copper conductors.
- .2 All wiring terminals must be the correct size for compression.

2.5 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, faced white and black soul mechanically attached with self tapping screws. For devices connected to the emergency, the plates must have a red face and a white soul.
- .2 Sizes as follows:

NAMEPLATE SIZES

Size	Dimensions	Number of Lines	Letters (height)
Size 1	10 x 50 mm	1 line	3 mm high
Size 2	12 x 70 mm	1 line	5 mm high

Size	Dimensions	Number of Lines	Letters (height)
Size 3	12 x 70 mm	2 lines	3 mm high
Size 4	20 x 90 mm	1 line	8 mm high
Size 5	20 x 90 mm	2 lines	5 mm high
Size 6	25 x 100 mm	1 line	12 mm high
Size 7	25 x 100 mm	2 lines	6 mm high

- .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.
- .4 Allow for minimum of twenty-five (25) letters per nameplate.
- .5 Nameplates for terminal cabinets, pull boxes and junction boxes to indicate system and/or voltage characteristics.
- .6 Disconnects, starters and contactors: indicate equipment being controlled, the number of the disconnect, starter or contactor, the number of the feeding panel with the respective circuits.
- .7 Transformers: indicate capacity, primary and secondary voltages.
- .8 Identify the receptacles and lighting switches with plastic pressure sensitive label (Brother P-touch), indicating the number of the feeding panel with the respective circuits. The labels must be whites with black letters or as per building standards. Also, the receptacles for maintenance only must also be identified with: "POUR ENTRETIEN SEULEMENT/FOR MAINTENANCE ONLY".
- .9 Make the identification of each circuit in the modified panels and new panels in new dactylographic tables. Panel dactylographic tables to be approved by Departmental Representative prior to manufacture and/or installation.

2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered plastic tapes, 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.

2.7 CONDUIT AND CABLE IDENTIFICATION

- .1 Assign a color code to the ductwork and metal sheathed cables.
 - .1 Each and every wire leads must wear a band-reference (≥ 20 mm wide) color as shown in the table below, except for conduits "alarms" that are wholly "RED" and "Communication" fully "BLUE" with the movie references required.
 - .1 Departure and arrival of the duct.
 - .1 Indicate also the origin (panel, circuit, etc.).
 - .2 All 15 m.
 - .3 At each change of direction.
 - .4 Each input/output, wall, or floor box.
 - .1 When passing through walls and floors, also include the source (panel, circuit, etc.).
 - .2 Assign a color code to the boxes:
 - .1 Paint all sides of the junction boxes by color code, described below, but not the cover. Using a large permanent marker, identified on the cover of the junction box or pull the source (the panel) and (s) number (s) of any circuit wiring through junction boxes and draw, when in a space only or unfinished in a between ceiling.
 - .2 Indicate also the use of wiring (see table below).

Note:

- Normal: Network from Hydro-Quebec

USE OF WIRING IN THE DUCT	PRIMARY COLOR	SUPPLEMENTARY COLOR
Grounding (Ground)	GREEN	"__"
Electricity - Normal/0 - 250 V	YELLOW	"__"
Electricity - Normal/251 - 600 V	YELLOW	GREEN
Telephone	GREEN	"__"
Emergency Communication	RED	BLUE
Fire Alarm	RED	"__"
Other Security Systems	RED	YELLOW
Other Communication Networks	GREEN	BLUE

2.8 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 2Y-1.
- .2 Clean and touch up the painted surfaces in the workshop have been scratched or damaged during shipment and installation, use a paint harmony to the original painting.
- .3 Clean and prime the hooks, brackets, fasteners and other fasteners apparent, not galvanized to protect against rust.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Do complete installation in accordance with Construction Code of Quebec, CSA C22.10 (current edition in the works).

3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduits and sleeves before the pouring of concrete.
 - .1 Thimble concrete structures: steel pipe, schedule 40, in diameter allowing free passage of the conduit and above the concrete surface of 53 mm per side.
- .2 When using plastic sleeves for penetrations of walls or floors with a degree of fire resistance, remove them before installing the pipes.
- .3 Install cables, pipes and fittings to be embedded or plastered, placing them neatly against the building structure so as to minimize the thickness of fur.

3.4 DRILLING AND CUT

- .1 All openings, each opening or cutouts all required wiring and electrical equipment shall be performed by:
 - .1 The Contractor General, when they must be made on any finish material or any material appearance of the building. The Electrical Contractor should indicate the location of any opening.

- .2 The Electrical Contractor in all other cases.
- .2 Any drilling or cutting in any structural member must be under the control of the structural engineer must give approval.
- .3 Perform any drilling into the concrete using a rotary drill.
- .4 When the work is performed in an existing building, take appropriate means to detect the presence of ducts in the slabs. Any damage to existing pipes must be repaired by the Contractor at his expense in accordance with existing finishes.
- .5 It must also maintain the fire integrity of the floors, ceilings and walls, filling the entire wool insulation between the hole in the concrete and pipe, and seal with caulk firewall (HILTI FS-ONE or 3M), the two sides of floors, ceilings and walls.

3.5 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .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 3,000 mm and that information is given prior 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 with the Departmental Representative before proceeding with installation.

3.7 UNIFORMITY

- .1 The Contractor shall comply with a perfect homogeneity between the different systems for each specialty.
- .2 The Departmental Representative may at any time before the installation, if deemed necessary, to move within 3 m of ancillary devices such as fans, light fixtures, switches, sockets, fuses circuits, transformers, lighting, and without any additional charges if the Notice was given prior to installation. It is incumbent upon the Contractor to coordinate with other trades and contractors, and obtain the necessary approvals from Departmental Representative.
- .3 No lighting fixture shall not be placed above the pipes, ducts or other obstructions.

- .4 The pull boxes and junction boxes must be selected according to the requirements of CSA C22.10-07, taking into account the number and the conductor and conduit in question.
- .5 The pull boxes and junction boxes must be located in protected areas and easily accessible. They must remain accessible after installation finishes and appliances.
- .6 The Contractor shall note that his plans are provided as a guide and are sometimes reduced to scale and may not have ratings. It must use common sense and ensure that these systems accessories fit well with the structure and architecture of the building.

3.8 FIELD QUALITY CONTROL

- .1 Before closing the wall, the Contractor shall notify, verbally and in writing, the Departmental Representative. The Departmental Representative, if desired, will inspect the installations.
- .2 The Contractor shall ensure the presence of skilled personnel and availability of measuring devices and testing to perform the tests requested by the Departmental Representative to his satisfaction. In addition, any test requested by the Departmental Representative shall be executed at no additional charge. The Departmental Representative shall be notified verbally and in writing two weeks in advance of the proposed tests and may, if desired, inspect the facility and attend trials.
- .3 All tests should take place with the permission of the Departmental Representative and other Contractors involved. Any imperfection or defects discovered during testing must be corrected to the satisfaction of the Departmental Representative.
- .4 Provide measuring devices, equipment and personnel needed to carry out testing during the installation and completion.
- .5 Perform the following tests:
 - .1 Circuits from panels.
 - .2 Lighting system and controls/regulation.
 - .3 Motors, heaters and controls/regulation related, including operating controls sequential systems as appropriate.
 - .4 Fire alarm system and communication network. Obtain a certificate of operation issued by a recognized authority.
 - .5 Measurement of insulation resistance.
 - .1 Measure, using a 500 V megger, the value of isolation circuits, cables and distribution equipment with a rated voltage not exceeding 350 V.
 - .2 Measure, using a megger 1,000 V, the value of isolation circuits, arteries and appliances with a rated voltage between 350 V and 600 V.

COMMON WORK RESULTS - ELECTRICAL

- .3 Verify the value of earth resistance before powering up.
- .6 Check continuity of the grounding.
- .6 Perform tests in presence of Departmental Representative.
- .7 Provide equipment, gauges and personnel required for carrying out the tests during the construction work and the completion thereof.
- .8 Spot checks by the manufacturer.
 - .1 Obtain a written report from the manufacturer confirming that the work conforms to the criteria specified in regard to handling, implementation, application products and the protection and cleaning of the book then submit this report pursuant to Article DOCUMENTS/ITEMS TO SUBMIT PART 1.
 - .2 The manufacturer shall make recommendations regarding the use of the product, and make periodic visits to check if the implementation was carried out according to its recommendations.
 - .3 Provide site visits in accordance with section QUALITY ASSURANCE PART 1.
- .9 Submit test results to the Departmental Representative.

3.9 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
- .3 Clean the inside and top of the distribution panels, motor starters, and any other electrical enclosures.

END OF SECTION

PART 1 - GENERAL**1.1 DEMOLITION**

- .1 Remove all existing electrical equipment indicated on the plans. This equipment must be removed in due course.

1.2 EQUIPMENT EXISTING

- .1 Means all existing equipment or components existing materials relevant to the existing electrical installations at the time of signing the contract associated with this estimate and plans related thereto.
- .2 All existing equipment to remove:
 - .1 To be completely removed from its supply point to its point of use, unless indicated on drawing.
 - .2 The Contractor must offer all equipment removed to Departmental Representative. These elements become the property of the Contractor if Departmental Representative does not wish to recover them. The Contractor shall dispose of it promptly.
- .3 All existing equipment to remove and relocate temporarily and to reinstall:
 - .1 Must be removed and relocated to the location indicated in the temporary construction plans for the duration of the work. The temporary installations will be of new equipment and material.
 - .2 Retain all conductors and conduits associated with the equipment to be relocated in order to reinstall the equipment in its original location.
 - .3 Where indicated on drawings, wiring of an existing unit to remove and relocate may be reused in whole or in part if the wiring is in excellent condition. However, it must respect the existing function of the wiring by allocating the same function.
 - .4 Must be reinstalled in its original location after the work.
- .4 All existing to remove, to store and to reinstall:
 - .1 Must be removed and stored, he must protect the conductors in the outlet boxe and install a cover plate.
 - .2 Must be reinstalled in its original location after the work.
- .5 All the temporary equipment used during the work must be recovered by the Contractor at the end of the work.

WORK EXISTING INSTALLATION

- .6 Where existing fixtures are removed and reinstalled, the Contractor must supply and install new lamps or tubes, any fixture having defective ballasts, broken lenses or any other damage must be returned in perfect condition with the appearance of a new fixture.

1.3 CONTINUITY OF ELECTRIC SERVICE

- .1 Ensure the full continuity of electrical services to building occupants during and after construction.
- .2 Where changes to the existing electrical installation affect areas adjacent to works, supply and install conduits, conductors, equipment and accessories necessary for the permanent redistribution of services.

1.4 POWER INTERRUPTION

- .1 Interruptions of power supply should be minimized and shall be implemented in close coordination with the Departmental Representative, who must be notified at least fifteen (15) working days in advance and recalled forty-eight (48) hours before Work begins.
- .2 Interruptions of power supply must be planned and documented. The Contractor shall submit for approval a detailed description explaining the actions and work in each step. The duration of each operation must be adequately prepared to enable the Departmental Representative to decide to proceed with the Work.
- .3 In the event of a cons order from the Departmental Representative, the Contractor shall provide the opportunity to restore power supply in operation in less than twenty (20) minutes.

PART 2 - PRODUCTS

- .1 Not Used.

PART 3 - EXECUTION

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2No.65, Wire Connectors.
 - .1 CSA C22.2 n° 41, Equipment Grounding and Bonding.
- .2 Manufacturers Association of Electrical and Electronic Equipment of Canada (EEMAC).
 - .1 EEMAC 1Y 2, Connectors and Terminals Crossing Aluminum Adapters (rated 1,200 A).
- .3 National Electrical Manufacturers Association (NEMA).

PART 2 - PRODUCTS**2.1 MATERIALS**

- .1 Pressure type wire connectors to: CSA C22.2 No. 65, with current carrying parts of copper sized to fit copper conductors according to the requirements of this project.
- .2 Fixture type splicing connectors conform to CSA C22.2 No. 65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Clamps or connectors for armoured cable.flexible conduit, as required, in accordance with standard CAN/CSA C22.2 No. 18.

PART 3 - EXECUTION**3.1 INSTALLATION**

- .1 Remove insulation carefully from ends of conductors 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. Replace insulating cap.
 - .3 Install bushing stud connectors in accordance with EEMAC 1Y 2.
 - .4 If needed, make the grounding and bonding in accordance with CSA C22.2 No. 41.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 26 05 00 - Common Work Results - Electrical.
- .2 Section 26 05 20 - Wire and Box Connectors (0-1,000 V).
- .3 Section 26 05 34 - Conduits, Conduits Fastening and Conduits Fittings.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA C22.2, No. 0.3, Test Methods for Electrical Wires and Cables.
 - .2 CAN/CSA-C22.2, No. 131, Type TECK 90 Cable.
- .2 Underwriters Laboratories of Canada (ULC).
 - .1 ULC-S139-00, Method of Fire Test for Evaluation of Integrity of Electrical Cables.

1.3 PRODUCT DATA

- .1 Produce product data in accordance with Section 01 33 00 - Submittals Procedures.

1.4 DRAWINGS

- .1 Conductors numbers and sizes are indicated on drawings. If not indicated, the Contractor must never take class lower than Construction Code of Quebec, Chapter V - Electricity requirements with a minimum acceptable size of 12 AWG for copper conductors.
- .2 Not all cabling is indicated on drawings. Indicated cabling is represented schematically and is used to identify circuit number to use. Provide and install all required cabling. The Contractor shall apply correction factors required by the Electrical Code.

PART 2 - PRODUCTS**2.1 BUILDING WIRES**

- .1 Conductors twisted if they are size 10 AWG or more; minimum size: 12 AWG.

- .2 Copper conductors: size as indicated, with 600 or 1,000 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE or RWU90 XLPE.
- .3 Each circuit must have a bonding wire (Green Wire). EMT conduit is not acceptable for bonding.
- .4 Each single phase circuit must have dedicated neutral conductor.

2.2 TECK 90 CABLE

- .1 Cables conform to CAN/CSA C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated in drawing.
- .3 Insulation:
 - .1 Cross-linked polyethylene RW XLPE, 1,000 V.
- .4 Inner Jacket: polyvinyl chloride (PVC) material.
- .5 Armor: galvanized steel.
- .6 Overall covering: PVC, compliant to FT-4 flammability standards.
- .7 Fastenings:
 - .1 One hole aluminum straps to secure surface cables 53 mm and smaller. Two holes galvanised steel straps for cables larger than 53 mm.
 - .2 Stands "U" for groups of two or more cables, placed at 1,000 mm centers
 - .3 Threaded rods: 6 mm diameter to support suspended channels in a "U".
- .8 Connectors:
 - .1 Watertight, approved for TECK cable.

2.3 ARMOURED CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.

- .4 Connectors: anti-short circuit and not waterproof.

2.4 CONTROL CABLES

- .1 Type: LVT: 2 or more soft annealed copper conductors, sized as indicated in drawing, as insulation: thermoplastic sheath: thermoplastic jacket, and armour of closely wound aluminum wire.
- .2 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated in drawing, insulation: PVC, TW 40 degrees C, or polyethylene, overall covering: PVC jackets FT-4 or protected with armour steel strip.

PART 3 - EXECUTION

3.1 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduits Fastening and Conduits Fittings.

3.2 INSTALLATION OF TECK 90 CABLE (0 -1,000 V)

- .1 Install cables:
 - .1 Where possible, group the cables on supports "U".
- .2 Finish the ends of cables in accordance with Section 26 05 20 - Wire and Box Connectors (0-1,000 V).
- .3 Use TECK cable only when indicated on drawings.

3.3 INSTALLATION OF ARMOURED CABLES

- .1 In general, all wiring is in conduit. However, the following options are allowed in the following special cases:
 - .1 Where the ceilings are open (removable tiles) the basic frame of the lighting circuits must be in conduit with junction boxes anchored to the building structure and spread evenly over the entire surface of the facility. From junction boxes distributed, it is possible to connect each fixture individually with AC-90 armored cable. However, it should not be more than four fixtures individually connected to each junction box and the maximum allowable cable length is 3 m.

WIRES AND CABLES (0-1,000 V)

- .2 The AC-90 armored cable can also be used in the same manner and under the same conditions as for luminaries in paragraph 3.3.1.1 for vertical descents in the walls and/or walls covered with gypsum board to connect the wiring devices to a junction box in between ceiling. The maximum allowable cable length is 3 m.
- .3 Ac-90 armoured cable can also be used in the same manner and under the same conditions as in paragraphs 3.3.1.1 and 3.3.1.2 for temporary installations of the electrical equipment.
- .4 "Daisy Chain" type connection is not allowed.
- .2 Group cables wherever possible.
- .3 Finish the ends of cables in accordance with Section 26 05 20 - Wire and Box Connectors (0-1,000 V).
- .4 Unless otherwise indicated, all wiring is hidden in the architectural elements. Unless otherwise specified, no surface installation is permitted without prior approval of the Engineer.

3.4 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit.
- .2 Ground control cable shield.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 26 05 00 - Common Work Results - Electrical.

PART 2 - PRODUCTS**2.1 SUPPORT CHANNELS**

- .1 "U" shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, suspended or set in poured concrete walls and ceilings.
- .2 Supports of equipments must be in galvanised steel.
- .3 Supply all the supports for all equipments in order to have a complete installation. For example, the supports for junction boxes, receptacles, conduits etc., are not shown in drawings but they must be supplied and installed. Supply and install support channels in galvanised steel on vertical between the wall and the panel for all new panel installed on the wall. For precast supports, follow the installation recommendations from the manufacturer.
- .4 Fixation fasteners must be metallic. Plastic fasteners are not permitted.

PART 3 - EXECUTION**3.1 INSTALLATION**

- .1 Secure equipment to masonry, tile and plaster surfaces with lead anchors.
- .2 Secure equipment to poured concrete with expandable anchors.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole galvanized steel clamps to secure surface conduits and cables 53 mm and smaller.
 - .2 Two-hole galvanized steel clamps for conduits and cables larger than 53 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

- .6 Suspended support systems:
 - .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
 - .2 Support two or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .7 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support, unless it has obtained permission from the latter and the approval of the Departmental Representative.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA C22.1-15, Canadian Electrical Code.

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: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 Provide at least three terminals provided for each series of pods splitting boxes with a current rating less than 400 A.

2.2 JUNCTION AND PULL BOXES

- .1 Construction: welded steel enclosure, with lids screwed flat for mounting.
- .2 Lids, with an edge of at least 25 mm, adapted to pull boxes and junction mounted outcrop.

2.3 CABINETS

- .1 E-type cabinet, sheet steel, surface mount, fitted with a hinged door with sides folded over the sides, a handle and a latch.

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, 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 in order to avoid more than 30 m distance and three elbows with a right angle or equivalent between boxes for the electrical distribution and two elbows with a right angle for other conduit networks or empty conduits.
- .4 All pull and junction boxes must have the appropriate size depending of the numbers and size of conductors.

3.3 IDENTIFICATION

- .1 Supply and install identification tags of equipment in accordance with Section 26 05 00 - Common Work Results - Electrical for the results of the Work.
- .2 Install a Type 2 label indicating the name of the network, voltage and number of phases.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

- .1 CSA C22.2 No.18, Outlet Boxes, Conduit Boxes, Fittings, and Associated Hardware.

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.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 OUTLET BOXES STEEL PLATE

- .1 Boxes, electro-galvanized steel, for single and multi-gang flush device boxes for flush installation, minimum size 102 mm x 102 mm x 65 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 Square outlet boxes of 102 mm side with extension and plaster rings for flush mounting devices in finished plaster or ceramic tile.

OUTLET BOXES, CONDUIT BOXES AND FITTINGS

2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.4 CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface mounting of switches and receptacles, when installed in locations that are not protected from weather.

2.5 FITTINGS - GENERAL

- .1 Sleeves and collar connectors with nylon insulation.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 - EXECUTION**3.1 INSTALLATION**

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of Work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armored cable connections. Do not install reducing washers.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA C22.2, No. 18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2, No. 45, Rigid Metal Conduit.
 - .3 CSA C22.2, No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2, No. 83, Electrical Metallic Tubing.
 - .5 CSA C22.2, No. 211.2 M1984 (R2003), Rigid PVC (Unplasticized) Conduit.

1.3 SUBMITTALS

- .1 Provide product data 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.

1.4 GENERAL

- .1 Conduits are not fully indicated on drawings. Indicated conduits are schematic.
- .2 All conduit must have 21 mm diameter or larger.
- .3 Paint completely the conduits for fire alarm system and communication/ phone systems as indicated in the section 26 05 00 - Common Work Results - Electrical.

PART 2 - PRODUCTS**2.1 CABLES AND REEL**

- .1 The cables should be supplied on reels. Each cable or cable winding drum shall be marked or labeled to indicate the length of cable, voltage rating, conductor size, number and batch number of the reel.
- .2 Each reel or coil should be continued without a cable connection.
- .3 Identify cables used exclusively for DC applications.

2.2 CONDUITS

- .1 Rigid metal conduit: conform to CSA C22.2 No. 45, hot dipped galvanized steel threaded.
- .2 Electrical metallic tubing (EMT) according to CSA C22.2 No. 83, with couplings with expanded ends and a green wire to bonding.
- .3 Flexible metal conduit in accordance with CSA C22.2 No. 56, and steel liquid-tight flexible metal.
- .4 All conduit to have 21 mm diameter or larger.

2.3 CONDUIT FASTENINGS

- .1 One hole galvanized steel straps to secure surface conduits 53 mm and smaller. Brides two holes steel straps for conduits larger than 53 mm.
- .2 Beam clamps to secure conduits to exposed steel work. Stirrups "U" to support more conduits arranged to 1,500 mm wheelbase.
- .3 Channel type supports in galvanized steel for two or more conduits.
- .4 Threaded rods in galvanized steel, 6 mm diameter, to support suspended channels.
- .5 Fixation fasteners must be metallic. Plastic fasteners are not permitted.

2.4 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90° bends for 27 mm and larger conduits.

.3 Steel watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings for linear expansion of 100 mm.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 21 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

.1 Polypropylene twisted of 6 mm from a tensile strength of 5 kN.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with the requirements, recommendations and manufacturer's written specifications, including all technical bulletin available, instructions for handling, storage and installation of products, and Data Sheets

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 except in mechanical and electrical service rooms and in unfinished areas.

.3 Use rigid hot dipped galvanized steel threaded conduit for exterior installations if subject to mechanical damage (ex.: electrical room, mechanical room, corridor, etc.).

.4 Use electrical metallic tubing (EMT) except in cast concrete, and when they are not subject to mechanical damage.

.5 Use flexible metal conduit in case of installation of removable metallic partition. Use flexible metal conduits for connections to motors and other equipment subject to vibrations in dry areas.

.6 Use flexible metal and watertight conduits for connections to motors and other equipment subject to vibrations in damp and wet areas.

- .7 Use conduits with a diameter that meets the requirements of the Electrical Code. These conduits must be 21 mm of diameter minimum.
- .8 Bend the conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .9 Mechanically bend steel conduit over 21 mm diameter.
- .10 Field threads on rigid conduit must be of sufficient length to allow tight joints to be made.
- .11 Install fish cord in empty conduits.
- .12 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .13 Dry conduits out before installing wire.
- .14 Install a metal support in the ceiling "T" for installation of exit signs and fire detectors.
- .15 Install an expansion fitting for all conduits which pass through a building expansion joint.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Group conduits wherever possible on suspended or surface channels.
- .3 Locate conduits behind heat sources with 1.5 m clearance.
- .4 Do not pass conduits through structural members except as indicated.
- .5 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
- .6 Pass ducts along the beams of concrete to minimize the visual impact.

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 It is forbidden to drown in books ducts terrazzo or concrete copings.
- .4 Solidly anchor all the concealed conduit, including those installed above the suspended ceilings.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 26 05 00 - Common Works Results - Electrical.

1.2 REFERENCES

- .1 CSA International.
 - .1 CAN/CSA-Z809-08, Sustainable Forest Management.
- .2 Forest Stewardship Council (FSC).
 - .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
- .3 Insulated Cable Engineers Association, Inc. (ICEA).
- .4 Sustainable Forestry Initiative (SFI).
 - .1 SFI-2010-2014 Standard.

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 cables and include product characteristics, performance criteria, physical size, finish, and limitations.

PART 2 - PRODUCTS**2.1 CABLE PROTECTION**

- .1 38 x 140 mm planks treated with clear, copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

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

3.2 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts.
- .2 Do not pull spliced cables inside ducts.
- .3 Install multiple cables in duct simultaneously.
- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables are properly terminated, seal ends of cables with moisture seal tape.
- .7 After installation of cables, seal duct ends with duct sealing compound.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Perform tests using qualified personnel.
 - .1 Include necessary instruments and equipment.
- .3 Verify phase rotation and identify each phase conductor of each feeder.

- .4 Verify each feeder for continuity, short circuits, and grounds.
 - .1 Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-Acceptance Tests:
 - .1 After installing cable, but before splicing and terminating, perform insulation resistance test with 1,000 V megger on each phase conductor.
 - .2 Verify insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.
- .7 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 11 - Cleaning.

3.5 PROTECTION

- .1 Repair damage to adjacent materials caused by cables installation.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-C22.2 No. 42, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.2, No. 42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA-C22.2, No. 55, Special Use Switches.
 - .4 CSA-C22.2, No. 42, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .5 CSA-C22.2, No. 111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

PART 2 - PRODUCTS**2.1 RECEPTACLES**

- .1 Duplex receptacles, "Specification Grade" type, 125 V, 15 A, "U" ground, according to CSA C22.2 No. 42, Grade Heavy Duty Specification Grade with the following characteristics:
 - .1 Urea moulded housing ivory for normal network, red for the emergency network and receptacles with isolated grounding to be colour orange.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.

WIRING DEVICES

- .2 Outlets simple type CSA 5 15 R, 125 V, 15 A, socket grounding "U", with the following characteristics.
 - .1 Molded resin urea ivory.
 - .2 For connection side or rear son size 10 AWG.
 - .3 Four rear connection ports, two screw terminals for connection side.
- .3 Other receptacles with ampacity and voltage as indicated in drawing.
- .4 Receptacles for cleaning, designed for 15 A and 20 A must be 5-20R configuration.
- .5 Receptacles of one manufacturer throughout project.

2.2 GROUND RECEPTACLE (GFI)

- .1 Double protected receptacle for 15 A circuit, 120 V, including:
 - .1 Leak detector land, semi-conductors.
 - .2 Test device and reset.
 - .3 CSA approved enclosure, mounted flush with stainless steel faceplate.

2.3 COVER PLATES

- .1 Provide cover plates for wiring devices according to CSA C22.2 No. 42.1.
- .2 Cover plates from one manufacturer throughout project.
- .3 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .4 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.
- .5 Cover plate: plate for wiring devices mounted in boxes for conduit type FS or FD, mounted projection.
- .6 Weatherproof metallic while-in-use covers, NEMA 3R, held in place by at least 4 screws.

PART 3 - EXECUTION**3.1 INSTALLATION**

- .1 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 - Electrical or as indicated.
 - .3 Do not connect wiring only with screws.
- .2 Ground Receptacle (GFI):
 - .1 The neutral must not be grounded on the load side of relay ground fault.
 - .2 The phase conductors including the neutral must pass through transformers homopolar field.
 - .3 Install receptacle at the height prescribed in Section 26 05 00 - Common Work Results - Electrical for the results of Work or as directed by the drawings.
 - .4 Connect the power wiring and load the appropriate equipment, as indicated, following the manufacturer's instructions.
- .3 Cover Plates:
 - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
- .4 All the receptacles installed at less than 1 m from a wash basin or a sink must be protected by a GFI breaker at the panelboard or GFI receptacle.
- .5 Do not install back to back outlets. A minimum 150 mm horizontal space must be left between boxes.

3.2 TESTS

- .1 Demonstrate for receptacle ground (GFI) by simulating grounded fault.

END OF SECTION

PART 1 - GENERAL**1.1 REFERENCES**

- .1 CSA C22.1-15, Canadian Electrical Code.

1.2 WORK RESTRICTIONS

- .1 Perform the work in accordance with the requirements of Section 01 14 00 - Work Restrictions.
- .2 Retain the services of the accredited specialist for the door and window surveillance system and video surveillance system at the time of the work. Request the contact information of the accredited specialist to the Departmental Representative.

1.3 DESIGN REQUIREMENTS

- .1 All cables/wires must be suited to the conditions of use, in accordance with Table 19 of the Quebec Construction Code, Chapter V, even if the type of equipment being connected is not governed by the Code.
- .2 Unless otherwise indicated, cables/wires must meet the following requirements:
 - .1 Manufacturer's requirements for use.
 - .2 When installed indoors, they must be covered with FT4 sheathing and installed in conduits.
 - .3 When installed outside underground, they must be covered by a sheath suited for use in damp conditions.
 - .4 If one section of a cable/wire is installed underground and the other in a building, the cable/wire must be FT4 rated and suited for use in damp conditions.
 - .5 18 AWG minimum for all voltage under 24V.
 - .6 A higher cable/wire gauge must be used if the drop in voltage exceeds 5%.
 - .7 No splices.
 - .8 Of sufficient length and with enough reserve to redo a minimum of five (5) connections to the component in the event of accidental breakage.
 - .9 Stranded conductors must be used for supervision and power cables (no single-conductor cables).

1.4 SUBMITTAL PROCEDURES

- .1 Submit documents and samples required in accordance with Section 01 33 00 - Submittal Procedures.
- .2 The product data to be submitted are:
 - .1 Product data for all cable/wire types.
 - .2 Product data for the equipment to be supplied in this section.
 - .3 Manufacturer's instructions concerning installation of its equipment.
- .3 Shop drawings to be submitted are:
 - .1 Cable/wiring diagrams and installation details for devices showing the proposed location, placement, route and layout, control panels, accessories, piping, conduits and any other item required for a coordinated installation.
 - .2 Cable/wiring diagrams showing circuit terminals, internal wiring of each device and interconnections between devices.
 - .3 Drawings indicating clearances required for operation, maintenance and replacement of devices.
 - .4 If changes are required, notify the Departmental Representative before proceeding.

1.5 HEALTH AND SAFETY

- .1 Take the necessary occupational health and safety measures for the construction industry in accordance with Province of Quebec regulations. The Specialized Contractor must perform health and safety-related tasks on the construction sites.
- .2 Comply with all requirements identified in Section 01 35 29.06 - Health and Safety Requirements.

1.6 SYSTEM START-UP

- .1 The accredited specialist retained must conduct the start-up, check, adjust, balance and calibrate, the different components.
- .2 Provide these services for such period and for as many visits as necessary to put equipment in operation.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- .1 Where required by the Quebec Construction Code - Chapter V, equipment must be certified for installation in Quebec. Where certified materials or equipment is not available, or where an assembly requiring certification is to be connected to an electrical installation, submit for approval by a competent authority and obtain the necessary authorizations before delivery to the site or before system start-up.
- .2 Stranded conductors must be used for security cables (no solid conductors).

2.2 CABLE/WIRING TERMINATIONS

- .1 Ensure lugs, terminals and screws for cable/wire terminations are suitable for both copper and aluminum conductors.
- .2 Use compression connectors (wire-to-wire) with anti-corrosion and damp-proofing gel.
- .3 Use compression terminations when making wire-to-wire connections.
- .4 Use ring terminal lugs when connecting to a bolt (e.g., grounding a piece of equipment). Fork-type terminals are prohibited.
- .5 When connecting to a terminal block, strip the cable/wire to the appropriate length. The stripped portion must not extend beyond the face of the terminal block. When a stranded conductor with a gauge lower than 22 is used, the conductor must be stripped over a length representing twice that usually required, folded over on itself and twisted before being inserted into the terminal block.
- .6 Cover wire-to-wire connections with heat-shrink sheathing when the joint is exposed to weather or when the joint is outside a heated building.

2.3 CABLE/WIRING LABELLING

- .1 Both cable/wire ends must be labelled using permanent, indelible ink on BRADY SELF-LAMINATING vinyl tape or equivalent.
- .2 Labelling must be logical and follow the numbering of doors, rooms or reference points, including a component code to facilitate identification. Labelling must be submitted to the Departmental Representative for comment.
- .3 Labelling must be uniform for the entire installation.
- .4 Use communication cables composed of a sheath and conductors with uniform colour-coding throughout the network.

- .5 Unless otherwise agreed by the Departmental Representative, colour-coding of sheaths for wires/cables and conductors must be consistent for every installation of the same type of component.

2.4 CONDUIT LABELLING

- .1 See Division 26 Electricity.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Unless otherwise indicated, install in accordance with CSA C22.1.

3.2 LABELS, NAMEPLATES AND IDENTIFICATION PLATES

- .1 Ensure that CSA labels, nameplates and identification plates are visible and legible once equipment is installed.

3.3 CABLE/WIRING INSTALLATION

- .1 Comply with manufacturer's requirements.
- .2 If a lubricant is required to facilitate cable pulling, use a product that is safe for human contact and the environment. It must also be compatible with all sheath types and CSA approved. Submit product data and obtain prior authorization.
- .3 All cables/wires must be installed in conduits; connection to components should be in the closest equipment room, unless otherwise indicated in the safety and security plans in Division 28 and the conduit routing plans in Division 26. If the conduits are not shown in the Division 26 plans, the Contractor shall assume that the conduits are installed along the axis line of the building and corridors.

3.4 CONDUIT INSTALLATION

- .1 See Division 26 Electricity.
- .2 Conduit sizing was based on a fill ratio not exceeding 40% using standard cables such as those listed below:
 - .1 Low voltage stranded 2 x 18 Belden 5300UE power cable.
 - .2 Low voltage stranded 6 x 18 Belden 5304UE power cable.
 - .3 Stranded 4 x 22 Belden 5502UE monitoring cable.

COMMON WORK RESULTS - SECURITY

- .4 Low voltage stranded 6 x 16 Belden 8621 power cable.
- .5 Low voltage stranded 4 x 14 Belden 8627 power cable
- .3 The Security Contractor is responsible for ensuring that conduit sizes indicated in the plans and specifications meet the safety requirements of the cables/wires and equipment proposed. If the Security Contractor deems that the size is inadequate, it must notify the Departmental Representative and explain the sizing problem well before the Division 26 Contractor carries out the work.
- .4 Submit for review the plans showing the cable/wiring distribution in all conduits.
- .5 To minimize the impact of lightning, cables/wires for outdoor cameras installed on the building must be installed in conduits designated for this purpose. Cables/wires serving equipment installed indoors must not be placed in these conduits.

3.5 MOUNTING HEIGHT

- .1 Unless otherwise indicated or specified, mounting height measure for equipment is from finished floor to the equipment centre line.
- .2 If mounting height is not given, verify prior to installation.
- .3 Comply with the manufacturer's recommended mounting heights and those indicated on the plans. Coordinate placement of components based on expected results and coordinate with the Division 26 Contractor for conduit installation.

3.6 CLEANING

- .1 Clean and touch up shop painted surfaces scratched or damaged during transport or installation; use paint of the same type and colour as the original.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED SECTIONS**

- .1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

- .1 CSA C22.1-15, Canadian Electrical Code.
- .2 Government of Canada.
 - .1 TB OSH Chapter 3-03, 1997-01-28, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire protection Electronic Data Processing Equipment.
 - .2 TB OSH Chapter 3-04, 1994-12-22, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.
- .3 Underwriter's Laboratories of Canada (ULC).
 - .1 CAN/ULC-S524-06, Installation of Fire Alarm Systems.
 - .2 ULC-S525-07, Audible Signal Devices for Fire Alarm Systems, including Accessories.
 - .3 CAN/ULC-S527-99, Control Units for Alarm Systems.
 - .4 CAN/ULC-S528-05, Manual Stations for Alarm Systems, including Accessories.
 - .5 CAN/ULC-S531-02, Smoke Alarms.
 - .6 CAN/ULC-S536-04, Inspection and Testing of Fire Alarm Systems.
 - .7 CAN/ULC-S537-04, Verification of Fire Alarm Systems.

1.3 DESCRIPTION OF PROJECT

- .1 This specification is intended to describe the work to be carried out under the project.
- .2 Temporarily move the equipment indicated on the drawing. Intercept in the outlet box, add a terminal block and extend to the temporary location.
- .3 Retain the services of the fire alarm specialist under contract at the time of the work. Request the contact information of the specialist to the Departmental Representative.

FIRE ALARM SYSTEMS

1.4 DESCRIPTION OF SYSTEM

- .1 The existing system is Simplex, model 4100U.

1.5 CLOSEOUT SUBMITTALS

- .1 Upon completion of verification of the moved fire alarm equipment, submit a copy of verification certificate and report to the Departmental Representative.
- .2 The moved fire alarm equipment shall be subject to an inspection and test performed by the installer and witnessed by Departmental Representative for final acceptance. The electrical contractor must be available at time of testing by Departmental Representative.

PART 2 - PRODUCTS

- .1 Not Used.

PART 3 - EXECUTION**3.1 INSTALLATION**

- .1 Install the equipment as per the fire alarm system manufacturer's written instructions.
- .2 Locate and install audible signal devices and connect to signalling circuits.
- .3 Connect signalling circuits to main control panel.
- .4 Install end-of-line devices at end of signalling circuits.
- .5 Wiring for initiating device circuits and signalling line circuits shall be #16 gauge minimum. Wiring used for the multiplex communication loop shall be twisted and shielded.
- .6 Wiring for signals shall be minimum #14 gauge, THHN, 600 V, solid copper. Signal circuit conductors shall be red and black in colour.
- .7 All fire alarm system wiring shall be contained in conduit.
- .8 All fire alarm conductors shall be free of splices and t-taps and shall be installed continuous between devices.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and CAN/ULC-S537.
- .2 Fire Alarm System:
 - .1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors, flow switch transmit alarm to control panel and actuate presignals and general alarms.
 - .2 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.

END OF SECTION