

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction / Demolition Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed for approval by the Departmental Representative.
- .3 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .5 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.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .3 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 Colour coding chart.
- .4 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.
- .5 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 95 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
 - .1 Submit two (2) 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.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Departmental Representative will provide one (1) set of reproducible mechanical drawings or AutoCAD files. 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 for each service.

		.4	Make available for reference purposes and inspection.
		.9	As-built drawings: <ul style="list-style-type: none">.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 the 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.
		.10	Submit copies of as-built drawings for inclusion in final TAB report.
<u>1.3 QUALITY ASSURANCE</u>	.1		Quality Assurance: in accordance with Section 01 45 00 - Testing and Quality Control.
	.2		Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.
<u>1.4 MAINTENANCE</u>	.1		Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows: <ul style="list-style-type: none">.1 One (1) set of filter cartridges in addition to final operating set.
	.2		Provide one (1) set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
	.3		Furnish one (1) commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.
<u>1.5 DELIVERY, STORAGE, AND HANDLING</u>	.1		Waste Management and Disposal: <ul style="list-style-type: none">.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

- | | | |
|----------------------|----|--|
| <u>2.1 MATERIALS</u> | .1 | All materials used on this project shall be new and CSA approved unless noted otherwise. |
|----------------------|----|--|

PART 3 - EXECUTION

- | | | |
|--|----|---|
| <u>3.1 PAINTING,
REPAIRS AND
RESTORATION</u> | .1 | Prime and touch up marred finished paintwork to match original. |
| | .2 | Restore to new condition, finishes which have been damaged. |

- | | | |
|---------------------|----|---|
| <u>3.2 CLEANING</u> | .1 | Clean interior and exterior of all systems including strainers. Protect open ends of ducts, diffusers, grilles and registers during construction to prevent ingress of dust and dirt into interior of ducts. If dust or dirt is detected prior to startup, vacuum interior of all ducts and air handling units. Prior to vacuuming use video camera to record condition of ductwork. Also use video camera to record condition of ducts after cleaning. |
|---------------------|----|---|

- | | | |
|--------------------------------------|----|--|
| <u>3.3 FIELD QUALITY
CONTROL</u> | .1 | Site Tests: conduct following tests in accordance with Section 01 45 00 – Testing and Quality Control and submit report as described in PART 1 - SUBMITTALS.

.1 Submit tests as specified in other sections of this specification. |
| | .2 | Manufacturer's Field Services:

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

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE. |

- | | | |
|--------------------------|----|---|
| <u>3.4 DEMONSTRATION</u> | .1 | Departmental Representative will use equipment and systems for test purposes prior to acceptance. Contractor to supply labour, material, and instruments required for testing. |
| | .2 | Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all |

systems and equipment during regular work hours, prior to acceptance.

- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Departmental Representative may record these demonstrations on video tape for future reference.

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

<u>1.1 SUMMARY</u>	.1	This Section includes requirements for selective demolition and removal of heating, ventilation and air conditioning systems, controls and automated automation components, and related mechanical components and incidentals required to complete work described in this Section.
<u>1.2 RELATED SECTIONS</u>	.1	Section 01 74 11 – Cleaning.
	.2	Section 01 74 21 – Construction / Demolition Waste Management and Disposal
<u>1.3 DEFINITIONS</u>	.1	Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
	.2	Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
	.3	Remove and Salvage: Detach items from existing construction and deliver them to the Departmental Representative ready for reuse.
	.4	Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
	.5	Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.
	.6	Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.
<u>1.5 ADMINISTRATIVE REQUIREMENTS</u>	.1	Coordination: Coordinate work of this Section to avoid interference with work by other Sections.

- .2 Account for Owner's continued occupancy requirements during selective demolition and schedule staged occupancy and worksite activities.

1.6 SITE CONDITIONS

- .1 Condition of materials identified as being salvaged or demolished are based on their observed condition on date that tender is accepted.

1.7 SALVAGE AND
DEBRIS MATERIALS

- .1 Demolished items become Contractor's property and will be removed from Project site; except for items indicated as being reused, salvaged, or otherwise indicated to remain Owner's property.
- .2 Carefully remove materials and items designated for salvage and store in a manner to prevent damage or devaluation of materials

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Use only new materials required for completion or repair matching materials damaged during performance of work of this Section; new materials are required to meet assembly or system characteristics as existing systems indicated to remain and carry CSA approval labels required by the Authority Having Jurisdiction.
- .2 Use listed fire stopping materials compatible with existing fire stopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before tendering the Bid; the Departmental Representative will not consider claims for extras for work or materials necessary for proper execution and completion of the contract that could have been determined by a site visit.
- .2 Identify on-site removal of walls and ceiling to facilitate the work.
- .3 Identify on-site testing of ductwork and equipment to facilitate the Work.

3.2 PREPARATION

- .1 Protect systems and components indicated to remain in place during selective demolition operations and as follows:
 - .1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.
 - .2 Notify the Departmental Representative and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.
 - .3 Prevent debris from blocking drainage inlets.
 - .4 Protect mechanical systems that must remain in operation.
 - .5 Ensure hazardous materials are removed or abated prior to commencing demolition.
 - .6 For components intended for relocation and reuse, remove, store, protect, clean and reinstall and connect to HVAC systems, and recommission.
- .2 Sequence demolition work so that interference with the use of the building by the tenants is minimized and as follows:
 - .1 Prevent debris from endangering the safe access to and egress from occupied buildings.
 - .2 Notify the Departmental Representative and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

3.3 EXECUTION

- .1 Disconnect and cap electrical services in accordance with requirements of local Authority Having Jurisdiction.
- .2 Do not disrupt active or energized utilities without approval of the Departmental Representative.
- .3 Erect and maintain dust proof and weather tight partitions to prevent the spread of dust and fumes to occupied building areas; remove partitions when complete.
- .4 Demolish parts of existing building to accommodate new construction and remedial work as indicated.
- .5 At end of each work day, leave worksite in safe condition.
- .6 Perform demolition work in a neat and workmanlike manner:
 - .1 Remove any tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.

.2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.

.7 Conduct demolition of HVAC systems in accordance with local Authority Having Jurisdiction (AHT) including Service PE, Labour Division Inspections.

3.4 CLOSEOUT
ACTIVITIES

.1 Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre).

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section includes:
 - .1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

1.3 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1-20, Power Piping.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM A125-96(R2018), Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-14, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563-15, Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM)
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS).
 - .1 Safety Data Sheets (SDS).
- .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP-58-2018, Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation.

1.4 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by MSS SP58 or ASME B31.1.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP58.

.2 Performance Requirements

.1 Design supports, platforms, catwalks, hangers, to withstand seismic events for location as per the National Building Code

1.5 SUBMITTALS

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

.2 Shop drawings: submit drawings stamped and signed for approval by Departmental Representative.

.3 Submit shop drawings and product data for following items:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

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

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 Departmental Representative will make available one (1) copy of systems supplier's installation instructions.

.5 Closeout Submittals:

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

1.6 QUALITY
ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.7 DELIVERY,
STORAGE, AND
HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ASME B31.1 and MSS SP-58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized painted with zinc-rich paint after manufacture.
 - .2 Use electro-plating galvanizing process or hot dipped galvanizing process.
 - .3 Steel hangers in contact with copper piping to be copper plated or epoxy coated.
- .2 Upper attachment structural: Suspension from lower flange of I-Beam.
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .1 Rod: 9 mm UL listed, 13 mm FM approved.
- .3 Upper attachment structural: Suspension from upper flange of I-Beam.
 - .1 Cold piping NPS 2 maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed FM approved where required to MSS SP58.
- .4 Upper attachment to concrete.

- .1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed FM approved where required to MSS SP-58.
 - .5 Shop and field-fabricated assemblies.
 - .1 Trapeze hanger assemblies: MSS SP-58.
 - .2 Steel brackets: MSS SP-58.
 - .3 Sway braces for seismic restraint systems: to MSS SP-58.
 - .6 Hanger rods: threaded rod material to MSS SP-58.
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22 mm or 28 mm rod.
 - .7 Pipe attachments: material to MSS SP-58.
 - .1 Attachments for steel piping: carbon steel galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation saddles for hot pipework.
 - .4 Oversize pipe hangers and supports for insulated pipes.
 - .8 Adjustable clevis: material to MSS SP-58, UL listed FM approved, where required clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Confirm "U" has hole in bottom for rivetting to insulation shields.
- 2.3 EQUIPMENT
ANCHOR BOLTS AND
TEMPLATES
- .1 Provide templates to ensure accurate location of anchor bolts.
- 2.4 HOUSE-KEEPING
PADS
- .1 For base-mounted equipment: Concrete, at least 100 mm high, 50 mm larger all around than equipment, and with chamfered edges.

2.5 OTHER EQUIPMENT .1
SUPPORTS

Equipment supports supplied by equipment manufacturer:
specified elsewhere in Division 23.

- .2 Equipment Supports not supplied by equipment manufacturer:
fabricate from structural grade steel.

PART 3 - EXECUTION

3.1 MANUFACTURER'S .1
INSTRUCTIONS

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

3.2 INSTALLATION .1

Install in accordance with:

- .1 Manufacturer's instructions and recommendations.

- .3 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers,
cooling towers, elsewhere as indicated.

- .4 Clevis plates:

.1 Attach to concrete with four (4) minimum concrete
inserts, one(1) at each corner.

- .5 Provide supplementary structural steelwork where structural
bearings do not exist or where concrete inserts are not in correct
locations.

3.3 HANGER SPACING .1

Plumbing piping: most stringent requirements of Canadian
Plumbing Code

- .6 Within 300 mm of each elbow.

- .7 Pipework greater than NPS 12: to MSS SP58.

3.4 HANGER .1
INSTALLATION

Install hanger so that rod is vertical under operating conditions.

- .2 Adjust hangers to equalize load.

- .3 Support from structural members. Where structural bearing does
not exist or inserts are not in suitable locations, provide
supplementary structural steel members, comprised of angel iron
or c-channel.

3.5 HORIZONTAL
MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL
ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

END OF SECTION

PART 1 - GENERAL

- | | | |
|-----------------------------|----|---|
| <u>1.1 RELATED SECTIONS</u> | .1 | Section 01 33 00 - Submittal Procedures. |
| <u>1.2 REFERENCES</u> | .1 | National Fire Protection Association (NFPA): |
| | .1 | NFPA 13-2018, Installation of Sprinkler Systems. |
| | .2 | National Building Code of Canada (NBC) - 2015. |
| <u>1.3 SHOP DRAWINGS</u> | .1 | Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures. |
| | .2 | Provide separate shop drawings for each isolated system shop drawings complete with performance and product data. |

PART 2 - PRODUCTS

- | | | |
|--------------------------------|----|---|
| <u>2.1 GENERAL</u> | .1 | Size and shape of bases type and performance of vibration isolation to be as indicated. |
| <u>2.2 ELASTROMERIC PADS</u> | .1 | Type EP1 neoprene waffle or ribbed; 9mm minimum thick; 50 durometer; maximum loading 350 kPa. |
| | .2 | Type EP2 rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa. |
| | .3 | Type EP3 neoprene steel neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa. |
| | .4 | Type EP4 rubber steel rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa. |
| <u>2.3 ELASTROMERIC MOUNTS</u> | .1 | Type M1 colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt down holes; ribbed top and bottom surfaces. |
| <u>2.4 SPRINGS</u> | .1 | Design stable springs so that ratio of lateral to axial stiffness is equal to or greater than 1.2 times the ratio of static deflection to working height. Select for 50% travel beyond rated load. Units to be complete with levelling devices. |
| | .2 | Ratio of height when loaded to diameter of spring to be between 0.8 to 1.0. |
| | .3 | Cadmium plate for outdoor, 100% relative humidity. |

	.4	Colour code springs.
<u>2.5 SPRING MOUNT</u>	.1	Zinc or cadmium plated hardware; housings coated with rust resistant paint.
	.2	Type M2 stable open spring: support on bonded 6mm minimum thick ribbed neoprene or rubber friction and acoustic pad.
	.3	Type M3 stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.
	.4	Type M4 restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.
	.5	Type M5 enclosed spring mounts with snubbers for isolation up to 950 kg maximum.
<u>2.6 HANGERS</u>	.1	Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30° arc without metal to metal contact.
	.2	Type H1 neoprene inshear, moulded with rod isolation bushing which passes through hanger box.
	.3	Type H2 stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.
	.4	Type H3 stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.
<u>2.7 ACOUSTIC BARRIERS FOR ANCHOR AND GUIDES</u>	.1	Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy-duty duck and neoprene isolation material.
<u>2.8 STRUCTURAL BASES</u>	.1	Type B1 Prefabricated steel base: integrally welded on sizes up to 2400 mm on smallest dimension, split for field welding on sizes over 2400 mm on smallest dimension and reinforced for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; predrilled holes to receive equipment anchor bolts; and complete with adjustable built-in motor slide rail where indicated.

- .2 Type B2 Steel rail base: structural steel, positioned for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; and predrilled holes to receive equipment anchor bolts.
- .3 Bases to clear housekeeping pads by 25 mm minimum.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.

END OF SECTION

PART 1 - GENERAL

<u>1.1 SUMMARY</u>	.1	Section includes: .1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems. .2 Sustainable requirements for construction and verification.
<u>1.2 RELATED SECTIONS</u>	.1	Section 01 33 00 - Submittal Procedures.
	.2	Section 01 74 21 – Construction/Demolition Waste Management and Disposal
<u>1.3 REFERENCES</u>	.1	Canadian General Standards Board (CGSB) .1 CAN/CGSB-24.3, Identification of Piping Systems.
<u>1.4 SUBMITTALS</u>	.1	Product data: .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures. .2 Product data to include paint colour chips, other products specified in this section. .3 Samples: .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures. .2 Samples to include nameplates, labels, tags, lists of proposed legends.
<u>1.5 QUALITY ASSURANCE</u>	.1	Quality assurance submittals: submit following in accordance with section 01 33 00 – Submittal Procedures.
	.2	Health and Safety: .1 Do construction occupational health and safety in accordance with Section 01 35 29 – Health and Safety Requirements.
<u>1.6 DELIVERY, STORAGE, AND HANDLING</u>	.1	Packing, shipping, handling and unloading: .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements. .2 Deliver, store and handle materials in accordance with manufacturer’s written instructions.

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

PART 2 - PRODUCTS

2.1 MANUFACTURER'S .1 Metal or plastic laminate nameplate mechanically fastened to
EQUIPMENT each piece of equipment by manufacturer.
NAMEPLATES

- .2 Lettering and numbers to be raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: Manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM .1 Colours:
NAMEPLATES

- .1 Hazardous: red letters, white background.
- .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

- .2 Construction:
 - .1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

- .3 Sizes:
 - .1 Conform to following table:

<u>Size # mm</u>	<u>Sizes (mm)</u>	<u>No. of Lines</u>	<u>Height of Letters (mm)</u>
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5

<u>Size # mm</u>	<u>Sizes (mm)</u>	<u>No. of Lines</u>	<u>Height of Letters (mm)</u>
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: Use size # 5.

.2 Equipment in Mechanical Rooms: Use size # 9.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from the Departmental Representative.

2.4 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:

.1 Where required, to Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

- .1 Pipes and tubing 20 mm and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.
- .2 All other pipes: Pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100%RH and continuous operating temperature of 150°C and intermittent temperature of 200°C.

.7 Colours and Legends:

- .1 Where not listed, obtain direction from Departmental Representative.
- .2 Colours for legends, arrows, to following table:

Background colour	Legend, arrows
Yellow	BLACK
Green	WHITE
Red	WHITE

- .3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
** Add design temperature		
++ Add design temperature and pressure		
Compressed air (<700kPa)	Green	COMP. AIR ____ kPa
Compressed air (>700kPa)	Yellow	COMP. AIR ____ kPa

2.6 IDENTIFICATION
DUCTWORK SYSTEMS

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.
- .3 Identify system: e.g. Supply AHU-1, Exhaust F-7.

2.7 VALVES,
CONTROLLERS

- .1 Brass tags 12 mm diameter with stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

- 2.8 CONTROLS COMPONENTS IDENTIFICATION
- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in section 25 05 01 – EMCS: General Requirements. If no EMCS included in project, identification as per this section.
 - .2 Inscriptions to include function and (where appropriate) fail-safe position, component ID name.

- 2.9 LANGUAGE
- .1 Identification to be in English.

PART 3 - EXECUTION

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

- 3.2 INSTALLATION
- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
 - .2 Provide ULC and/or CSA registration plates as required by respective agency.

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

- 3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS
- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: At not more than 17 m intervals and more frequently if required to ensure that at least one (1) is visible from any one (1) viewpoint in operating areas and walking aisles.
 - .2 Adjacent to each change in direction.
 - .3 At least once in each small room through which piping or ductwork passes.

- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification to be easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 VALVES, CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by the Departmental Representative. Provide one (1) copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

- | | | |
|-----------------------------|----|--|
| <u>1.1 SUMMARY</u> | .1 | Section Includes:
.1 Materials and methods for pressure testing ducts over 5m in length, forming part of a supply, return or exhaust ductwork system directly or indirectly connected to air handling equipment. |
| <u>1.2 RELATED SECTIONS</u> | .1 | Section 01 33 00 - Submittal Procedures. |
| | .2 | Section 01 35 29 - Health and Safety Requirements. |
| | .3 | Section 01 45 00 – Testing and Quality Control. |
| | .4 | Section 01 74 21 - Construction/Demolition Waste Management and Disposal. |
| | .5 | Section 01 78 00 - Closeout Submittals. |
| | .6 | Section 01 91 13 – General Commissioning Requirements. |
| <u>1.3 REFERENCES</u> | .1 | Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Safety Data Sheets (SDS). |
| | .2 | Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
.1 SMACNA HVAC Air Duct Leakage Test Manual. |
| <u>1.4 SUBMITTALS</u> | .1 | Make submittals in accordance with Section 01 33 00 - Submittal Procedures. |
| | .2 | Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:
.1 Submit proposed report form and test report format to the Departmental Representative for approval at least three (3) months before proposed date of first series of tests. Do not start tests until approval received in writing from the Departmental Representative.
.2 Prepare report of results and submit to the Departmental Representative within two (2) working days of completion of |

tests. Include:

- .1 Schematic of entire system.
- .2 Schematic of section under test showing test site.
- .3 Required and achieved static pressures.
- .4 Orifice differential pressure at test sites.
- .5 Permissible and actual leakage flow rate (L/s) for test sites.
- .6 Witnessed certification of results.
- .3 Include test reports in final TAB report.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturer's field reports specified.

1.5 QUALITY
ASSURANCE

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting one (1) week prior to beginning work of this Section and on-site installations.
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

PART 2 - PRODUCTS

2.1 TEST
INSTRUMENTS

- .1 Test apparatus to include:
 - .1 Fan capable of producing required static pressure.
 - .2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.
 - .3 Flow measuring instrument compatible with the orifice plate.
 - .4 Calibration curves for orifice plates used.
 - .5 Flexible duct for connecting to ductwork under test.
 - .6 Smoke bombs for visual inspections.
- .2 Test apparatus: accurate to within +/- 3 % of flow rate and

pressure.

- .3 Submit details of test instruments to be used to Departmental Representative at least three months before anticipated start date.
- .4 Test instruments: calibrated and certificate of calibration deposited with Departmental Representative no more than 28 days before start of tests.
- .5 Re-calibrated every six(6) months thereafter.

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 TEST PROCEDURES

- .1 Maximum lengths of ducts to be tested consistent with capacity of test equipment.
- .2 Section of duct to be tested to include:
 - .1 Fittings, branch ducts, tap-ins.
- .3 Repeat tests until specified pressures are attained. Bear costs for repairs and repetition to tests.
- .4 Base partial system leakage calculations on SMACNA HVAC Air Duct Leakage Test Manual.
- .5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

3.3 SITE TOLERANCES

- .1 System leakage tolerances specified are stated as percentage of total flow rate handled by system. Pro-rate specified system leakage tolerances. Leakage for sections of duct systems: not to exceed total allowable leakage.
- .2 Dust collection ductwork to be pressure tested. Leakage tests on following systems not to exceed specified leakage rates.
 - .1 Small duct systems up to 250 Pa: leakage 2 %.
 - .2 HP duct systems up to 1000 Pa pressure classification: leakage 1%.
- .3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.4 TESTING

- .1 Test ducts before installation of insulation or other forms of concealment.
- .2 Test after seals have cured.
- .3 Test when ambient temperature will not affect effectiveness of seals, and gaskets.

3.5 FIELD QUALITY
CONTROL

- .1 Manufacturer's Field Services:
 - .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
 - .2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of the Work, after cleaning is carried out.
 - .4 Obtain reports, within three (3) days of review, and submit, immediately, to Departmental Representative.
- .4 Performance Verification:
 - .1 Departmental Representative to witness tests and verify reported results.
 - .2 To be certified by same TAB agency approved by the Departmental Representative to undertake TAB on this project.

3.6 CLEANING

- .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Tab is used throughout this section to describe the process, methods and requirements of testing, adjusting and balancing for hvac.
- .2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this Section.
- .3 TAB agency will be responsible for measuring airflows at the dust collector and grille.

1.2 QUALIFICATIONS
OF TAB PERSONNEL

- .1 Submit names of personnel certified to AABC or NEBB to perform tab to Departmental Representative within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience. TAB contractor shall have a minimum of five (5) years' experience to AABC, NEBB or SMACNA.
- .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.
 - .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 the 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 SMACNA), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

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

1.4 EXCEPTIONS

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

1.5 CO-ORDINATION

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

1.6 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 all proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

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

<u>1.8 OPERATION OF SYSTEMS DURING TAB</u>	.1	Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.
<u>1.9 START OF TAB</u>	.1	Notify Departmental Representative seven (7) days prior to start of TAB.
	.2	Start TAB when building is essentially completed, including: <ul style="list-style-type: none">.1 Installation of ceilings, doors, windows, other construction affecting TAB..2 Application of weather-stripping, sealing, caulking..3 Pressure, leakage, other tests specified elsewhere in other Divisions..4 Provisions for TAB installed and operational.
	.3	Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to: <ul style="list-style-type: none">.1 Proper thermal overload protection in place for electrical equipment..2 Air systems:<ul style="list-style-type: none">.1 Filters in place, clean..2 Duct systems clean..3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances..4 Correct fan rotation..5 Fire, smoke, volume control dampers installed and open..6 Coil fins combed, clean..7 Access doors, installed, closed..8 Outlets installed, volume control dampers open.
<u>1.10 APPLICATION TOLERANCES</u>	.1	Do TAB to following tolerances of design values: <ul style="list-style-type: none">.1 HVAC systems: plus 5%, minus 5%.
<u>1.11 ACCURACY TOLERANCES</u>	.1	Measured values to be accurate to within plus or minus 2% of actual values.
<u>1.12 INSTRUMENTS</u>	.1	Prior to TAB, submit to Departmental Representative list of instruments to be used together with serial numbers.

	.2	Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
	.3	Calibrate within three (3) months of TAB. Provide certificate of calibration to Departmental Representative.
<u>1.13 SUBMITTALS</u>	.1	Submit, prior to commencement of TAB: .1 Proposed methodology and procedures for performing TAB if different from referenced standard.
<u>1.14 PRELIMINARY TAB REPORT</u>	.1	Submit for checking and approval of Departmental Representative prior to submission of formal TAB report, sample of rough TAB sheets. Include:
	.2	Details of instruments used.
	.3	Details of TAB procedures employed.
	.4	Calculations procedures.
	.5	Summaries.
<u>1.15 TAB REPORT</u>	.1	Format to be 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 three (3) copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs. Submit electronic copy that includes the same information.
<u>1.16 VERIFICATION</u>	.1	Reported results subject to verification by Departmental Representative.
	.2	Provide manpower and instrumentation to verify up to 100% of reported results.
	.3	Number and location of verified results to be at discretion of Departmental Representative.
	.4	Bear costs to repeat TAB as required to satisfaction of Departmental Representative.

<u>1.17 SETTINGS</u>	.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. Markings not to be eradicated or covered in any way.
<u>1.18 COMPLETION OF TAB</u>	.1	TAB to be considered complete when final TAB Report received and approved by Departmental Representative.
<u>1.19 AIR SYSTEMS</u>	.1	Standard: TAB to be to most stringent of this section or TAB standards of AABC or NEBB.
	.2	Do TAB of systems, equipment, components, controls specified in other Divisions.
	.3	Qualifications: personnel performing TAB to be qualified to standards of AABC or NEBB.
	.4	Quality assurance: Perform TAB under direction of supervisor qualified to standards of AABC or NEBB.
	.5	Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration, amperage and volts for each stage of electrical heating coils.
	.6	Locations of equipment measurements: To include, but not be limited to, following as appropriate: .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions. .2 At controllers, controlled device.
	.7	Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).
<u>PART 2- MATERIALS</u>		
<u>2.1 NOT USED</u>	.1	Not Applicable.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Applicable.

END OF SECTION

PART 1 - GENERAL

<u>1.1 RELATED SECTIONS</u>	.1	Section 23 05 53.01 - Mechanical Identification.
<u>1.2 REFERENCES</u>	.1	American Society for Testing and Materials
	.1	ASTM C335/C335M-17, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
	.2	ASTM C534/C534M-2020, Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
	.2	Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
	.3	Underwriters Laboratories of Canada (ULC)
	.1	CAN/ULC S102-19, Surface Burning Characteristics of Building Materials and Assemblies.
<u>1.3 DEFINITIONS</u>	.1	For purposes of this section:
	.1	"CONCEALED" insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
	.2	"EXPOSED" will mean "not concealed" as defined herein.
	.3	Insulation systems insulation material, fasteners, jackets, and other accessories.
<u>1.4 SHOP DRAWINGS</u>	.1	Submit shop drawings in accordance with Section 01 33 00.
	.2	Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.
<u>1.5 SAMPLES</u>	.1	Submit samples in accordance with Section 01 33 00.
<u>1.6 MANUFACTURERS' INSTRUCTIONS</u>	.1	Submit manufacturer's installation instructions in accordance with Section 01 33 00.
	.2	Installation instructions to include procedures used and installation standards achieved.

1.7 QUALIFICATIONS .1 Installer: specialist in performing work of this section who has at least five (5) years successful experience in this size and type of project, qualified to standards of TIAC.

1.8 DELIVERY, STORAGE AND HANDLING .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
.2 Protect from weather and construction traffic.
.3 Protect against damage from any source.
.4 Store at temperatures and conditions recommended by manufacturer.

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE RATING .1 In accordance with CAN/ULC S102:
.1 Maximum flame spread rating: 25.
.2 Maximum smoke developed rating: 450.

2.2 INSULATION / JACKET .1 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335/C335M.
.2 Insulation code D-1: Flexible Elastomeric Insulation. Closed-cell, sponge-or expanded-rubber materials with a self-adhering backing and factory applied 17.5 mil aluminum cladding and white laminate finish. Comply with ASTM C534/C534M, Grade 1, Type II for sheet materials.

2.3 ACCESSORIES .1 Adhesives:
.1 Materials to be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
.2 Flexible elastomeric and polyolefin adhesive.
.2 Tape:
.1 Seam tape to match factory applied jacket finish.

PART 3 - EXECUTION

3.1 PREINSTALLATION REQUIREMENTS .1 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

- .1 Apply materials in accordance with manufacturer's instructions and as indicated.
- .2 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be outside vapour retarder jacket.
- .3 Supports, Hangers as follows:
 - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

3.3 DUCTWORK
INSULATION
SCHEDULE

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

Duct Insulation	Thickness (mm)	Code
Exterior Ductwork	50	D-1

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section includes:
 - .1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

1.2 RELATED
SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 35 29 – Health and Safety Requirements
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .4 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .5 Section 07 84 00 – Firestopping and Smoke Seals.
- .6 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.
- .7 Section 23 05 94 – Pressure Testing of Ducted Air Systems.

1.3 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-20a, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A635/A635M-15, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
 - .3 ASTM A 653/A653M-20, 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).
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Safety Data Sheets (SDS).
- .5 National Fire Protection Association (NFPA).

		<ul style="list-style-type: none">.1 NFPA 90A-2018, Standard for the Installation of Air-Conditioning and Ventilating Systems..2 NFPA 90B-2018, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
	.6	Sheet Metal and Air Conditioning Contractors' National Association (SMACNA). <ul style="list-style-type: none">.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, 1st Edition.
	.7	Transport Canada (TC). <ul style="list-style-type: none">.1 Transportation of Dangerous Goods Act (TDGA).
<u>1.4 SUBMITTALS</u>	.1	Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
	.2	Product data: submit WHMIS SDS - Safety Data for the following: <ul style="list-style-type: none">.1 Sealants..2 Tape..3 Proprietary Joints.
<u>1.5 QUALITY ASSURANCE</u>	.1	Certification of Ratings: <ul style="list-style-type: none">.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
	.2	Health and Safety: <ul style="list-style-type: none">.1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements..2 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction..3 Installers to be certified to journeyman level in sheet metal work.
<u>1.6 DELIVERY, STORAGE AND HANDLING</u>	.1	Protect on site stored or installed absorptive material from moisture damage.

- .2 Waste Management and Disposal:
- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .4 Separate for reuse and recycling and place in designated containers steel, metal, plastic waste in accordance with Waste Management Plan.
 - .5 Place materials defined as hazardous or toxic in designated containers.
 - .6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
 - .7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 SEAL CLASSIFICATION

- .1 Classification as follows:
- | <u>Maximum Pressure Pa</u> | <u>SMACNA Seal Class</u> |
|----------------------------|--------------------------|
| > 1000 | A |
| 750 | B |
| 500 | C |
| 250 | C |
| 125 | C |
- .2 Seal classification:
- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
 - .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant tape or combination thereof.
 - .3 Class C: transverse joints and connections made air tight with gaskets, sealant tape or combination thereof. Longitudinal seams unsealed.

2.2 SEALANT

- .1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30°C to plus 93°C.

<u>2.3</u>	<u>TAPE</u>	.1	Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.
<u>2.4</u>	<u>DUCT LEAKAGE</u>	.1	In accordance with SMACNA HVAC Duct Leakage Test Manual.
<u>2.5</u>	<u>FITTINGS</u>	.1	Fabrication: to SMACNA.
		.1	Radiused elbows:
		.1	Rectangular: Centreline radius: 1.5 times width of duct.
		.2	Round: smooth radius or five piece. Centreline radius: 1.5 times diameter.
		.2	Mitred elbows, rectangular:
		.1	To 400 mm: with single thickness turning vanes.
		.2	Over 400 mm: with double thickness turning vanes.
		.3	Branches:
		.1	Rectangular main and branch: with radius on branch 1.5 times width of duct or 45° entry on branch.
		.2	Round main and branch: enter main duct at 45° with conical connection.
		.3	Provide volume control damper in branch duct near connection to main duct.
		.4	Main duct branches: with volume control damper.
		.4	Transitions:
		.1	Diverging: 20° maximum included angle.
		.2	Converging: 30° maximum included angle.
		.5	Offsets:
		.1	Full short radiused elbows as indicated.
		.6	Obstruction deflectors: maintain full cross-sectional area. Maximum included angles: as for transitions.
<u>2.6</u>	<u>FIRESTOPPING</u>	.1	Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 – Firestopping and Smoke Seals.
		.2	Firestopping material and installation must not distort duct.
<u>2.7</u>	<u>GALVANIZED STEEL</u>	.1	Lock forming quality: to ASTM A653, G90 zinc coating.
		.2	Thickness, fabrication and reinforcement: to SMACNA.

- .3 Joints: to SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

2.8 STAINLESS STEEL

- .1 To ASTM A480/A480M, Type 304.
- .2 Finish: No 4. finish on exposed side of duct in finished area's, No. 3 finish or lower where concealed.
- .3 Thickness, fabrication and reinforcement: to SMACNA.
- .4 Joints: to SMACNA and be continuous inert gas welded.

2.9 ALUMINUM

- .1 To SMACNA. Aluminum type: 3003-H-14.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA and be continuous weld.

2.10 BLACK STEEL

- .1 To ASTM A635/A635M.
- .2 Thickness: 1.2 mm
- .3 Fabrication: ducts and fittings or SMACNA.
- .4 Reinforcement: to SMACNA.
- .5 Joints: continuous weld.

2.12 HANGERS AND SUPPORTS

- .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500 mm.
- .2 Hanger configuration: to SMACNA.
- .3 Hangers: galvanized steel angle with black steel rods to ASHRAE or SMACNA following table:

<u>Duct Size (mm)</u>	<u>Angle Size (mm)</u>	<u>Rod Size (mm)</u>
up to 750	25x25x3	6
751 to 1050	40x40x3	6
1051 to 1500	40x40x3	10
1501 to 2100	50x50x3	10
2101 to 2400	50x50x5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:

- .1 For concrete: manufactured concrete inserts.
- .2 For steel joist: manufactured joist clamp steel plate washer.
- .3 For steel beams: manufactured beam clamps:

PART 3 - EXECUTION

3.1 GENERAL

- .1 Do work in accordance with NFPA 90A, NFPA 90B, and SMACNA.
- .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 SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation. Do not place fire stopping material in expansion space between damper sleeve and fire partition.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.2 HANGERS

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

<u>Duct Size (mm)</u>	<u>Spacing (mm)</u>
to 1500	3000
1501 and over	2500

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. Sealant and tape to be applied to full perimeter of duct.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation of high-pressure metallic ductwork, joints and accessories.
- .2 Related Sections:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 Section 01 35 29 - Health and Safety Requirements
 - .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
 - .4 Section 23 05 29 -Hangers and Supports for HVAC Piping and Equipment
 - .5 Section 23 05 94 - Pressure Testing of Ducted Air System
 - .6 Section 23 33 01 - Dust Collection Air Duct Accessories
 - .7 Section 23 35 13 - Dust Collection

1.2 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials (ASTM).
 - .1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process. (Metric).
- .3 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .2 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Safety Data Sheets (SDS).
- .5 Sheet Metal Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible, latest edition.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, latest edition.
 - .3 SMACNA IAQ Guideline for Occupied Buildings under Construction, latest edition.

1.3 SUBMITTALS

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

- | | | |
|--|----|---|
| | .2 | Refer to section 23 33 01 for submittal requirements for the dust collection duct system. |
| <u>1.4 QUALITY ASSURANCE</u> | .1 | Certification of Ratings:
.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards. |
| | .2 | Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements. |
| <u>1.5 DELIVERY, STORAGE, AND HANDLING</u> | .1 | Protect on site stored or installed absorptive material from moisture damage. |
| | .2 | Waste Management and Disposal:
.1 Separate waste materials for recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material for recycling in accordance with Waste Management Plan.
.4 Place materials defined as hazardous or toxic in designated containers.
.5 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
.6 Seal emptied containers and store safely.
.7 Fold up metal and plastic banding, flatten and place in designated area for recycling. |

PART 2 - PRODUCTS

- | | | |
|---|----|---|
| <u>2.1 DUST COLLECTION SYSTEM DUCTWORK & ENCLOSURES</u> | .1 | Material:
.1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.
.2 Thickness: to SMACNA |
| | .2 | Construction – round:
.1 Ducts: SMACNA Class 2 duct, class A seal; smooth interior for material transport.
.2 Fittings:
.1 Elbows: smooth radius or minimum five -piece (for 90 degrees), three-piece (for 45 degrees). Centreline radius: 2 x diameter. |

- .2 Branches: conical transition with conical branch at 30 degrees and 60 degrees elbow.
 - .3 Enclosure:
 - .1 Wall thickness to be 16 gauge.
 - .2 Seams to be welded.
 - .3 Transition angles to be 45 degrees.
 - .3 Ductwork between the explosion isolation valve and the dust collector to be designed to match the design pressure class of the dust collection system.
 - .1 Material, thickness, joints and reinforcement to be as required to meet this design pressure.
 - .2 Provide submittals indicating the duct design standards and performance for this pressure class.
 - .3 Refer to section 23 35 13 for dust collection unit design pressure class.
- 2.2 DUST COLLECTION SYSTEM HANGERS AND SUPPORTS
- .1 Hangers and Supports:
 - .1 Band hangers: of same material as duct but next sheet metal thickness heavier than duct.
 - .2 Upper hanger attachments: no drilling or welding of structural members to be permitted.
 - .1 For concrete: manufactured concrete inserts.
 - .2 For steel joist: manufactured joist clamp or steel plate washer.
 - .3 For steel beams: manufactured beam clamps.
- PART 3 - EXECUTION
- 3.1 GENERAL
- .1 Do work in accordance with ASHRAE and SMACNA and as indicated on the drawings.
 - .2 Do not break continuity of insulation vapour barrier with hangers or rods.
 - .3 Contractor to erect mock-up of enclosure #7 for AAFC approval prior to construction of all enclosures.
- 3.2 HANGERS
- .1 Band hangers: install in accordance with SMACNA.
 - .2 Hanger spacing: in accordance with ASHRAE, SMACNA and as indicated on the drawings.
- 3.3 SEALING AND TAPING
- .1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.

3.4 LEAKAGE TESTS
/COMMISSIONING

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .2 Do leakage test on sample section of ductwork.
- .3 Make trial leakage tests as instructed to demonstrate workmanship.
- .4 Install no additional ductwork until trial test has been passed.
- .5 Test section minimum of 15 m long with not less than three branch takeoffs and two 90° elbows.
- .6 Complete test before insulation or concealment.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for duct accessories including flexible ductwork, access doors, blast gates and system bonding.
- .2 Related Sections:
 - .1 Section 01 33 00 - Submittal Procedures.
 - .2 Section 01 35 29 - Health and Safety Requirements.
 - .3 Section 01 45 00 – Testing and Quality Control.
 - .4 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
 - .5 Section 01 78 00 –Closeout Submittals.

1.2 REFERENCES

- .1 National Fire Protection Association (NFPA).
 - .1 NFPA 69-2019, Standard on Explosion Prevention Systems.
 - .2 NFPA 77-2019, Recommended Practice on Static Electricity.
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, latest edition.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:
 - .1 Flexible ducting.
 - .2 Duct access doors.
 - .3 Blast Gates
- .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
 - .1 Certification of ratings: catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturer's Field Reports: submit manufacturer's field reports.
- .7 Closeout submittals: submit maintenance and consulting data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.
- .9 Provide detailed shop drawings for the complete dust collection duct system.
 - .1 Coordinate shop drawings with the requirements for connection of the dust collection system.
 - .2 Determine the general dust collection system layout and containment enclosure dimensions are indicated on the drawings, final duct routing and connection details by coordinating with the duct system supplier.
 - .3 Provide custom duct fittings (or coordinate with the project sheet metal supplier for provision of hoods/connection fittings) for connection to each hood/equipment as required. Provide all necessary interconnection adaptors and fittings for a fully functioning system.
 - .4 Coordinate with other trades and the tool/equipment shop drawings/supplier.
 - .5 Install dust collection system ductwork as high as possible in the space (coordinating with other trades) in order to maximise head clearance in the room.

1.4 QUALITY
ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.5 DELIVERY,
STORAGE, AND
HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material for recycling in accordance with Waste Management Plan (WMP).
 - .4 Separate for recycling and place in designated containers Metal and Plastic waste in accordance with Waste Management Plan (WMP).
 - .5 Divert unused metal materials from landfill to metal recycling facility as approved by the Departmental Representative.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.
- .2 Supply the dust collection duct system and accessories from a single manufacturer familiar and experienced with the installation codes and standards associated with industrial dust collection duct systems.
 - .1 Coordinate the with the manufacturer's representative the requirements of the wood shop tools specified for use in this facility and have them visit the site prior to the manufacture of any duct system components.
 - .2 Take field measurements as required to ensure coordination of the duct system with the tools, equipment and other systems being installed in this room.

2.2 FLEXIBLE
DUCTING

- .1 Industrial grade, bonded hose.
- .2 Wire ring enforced.
- .3 Smooth interior for material transport.
- .4 Bonding as indicated on drawings.

2.3 ACCESS DOOR IN
DUCTS

- .1 As required by applicable codes, standards, the duct manufacturer's recommendations, and for proper inspection and cleaning of the duct system.
- .2 Gaskets: neoprene.
- .3 Hardware:
 - .1 Hold open devices.
 - .2 300 x 300 mm glass viewing panels.
 - .3 Up to 300 x 300 mm: two sash locks complete with safety chain.
 - .4 301 to 450 mm: four sash locks complete with safety chain.
 - .5 451 to 1000 mm: piano hinge and minimum two sash locks.
 - .6 Doors over 1000 mm: piano hinge and two handles operable from both sides.
 - .1 Hold open devices.
 - .2 300 X 300 mm glass viewing panels.

2.4 BLAST GATES

- .1 Factory built.

- | | | |
|--------------------------------------|----|--|
| | .2 | Full collar of cast aluminum or steel, with galvanized steel slide, set screw and integral locking device. |
| | .3 | Provide blast gates c/w accessories, components and duct taps on all duct branches and as required to operate each dust collection point and as indicated. |
| <u>2.5 SYSTEM BONDING</u> | .1 | To NFPA 77. |
| | .2 | Entire system to be electrically bonded for static dissipation. |
| | .3 | All bonding wire shall be #6AWG bare copper or with green insulation. |
| <u>2.6 EXPLOSION ISOLATION VALVE</u> | .1 | Provide NFPA 69 compliant and ATEX certified no-return explosion isolation valve in the duct system. |
| | .2 | This device shall be supplied by the dust collection system supplier/manufacturer and include all options for NFPA 69 compliance. |
| | .3 | Install a damper in the duct system as required for the NFPA listing, ensure that the maximum and minimum distances from the dust collector are complied with. |
| | .4 | Design the ductwork between this device and the dust collector with the same pressure rating as the dust collector. |
| | .5 | Provide device control panel, micro switch for system shut down and dust level sensor. |
| <u>2.7 HIGH SPEED ABORT GATE</u> | .1 | Provide NFPA 664 compliant high speed abort gate installed on collector discharge ductwork to building. |
| | .2 | Unit to be complete with: |
| | .1 | Round unit inlet and outlet. Diameter to match ductwork size. |
| | .2 | Heavy-duty welded and bolted steel design. |
| | .3 | Electro-magnetic 110 VDC gate-locking system |
| | .4 | Spring-action gate with an opening time of less than 500 milliseconds. |
| | .5 | High-temperature seal on gate. |
| | .6 | Gate relocking system activated by an electric cylinder. |

- .7 Directional air output housing complete with birdscreen.
 - .8 Electrical control panel prewired mounted on the side of the valve.
 - .9 Reversible manual reset handle.
 - .10 Support tower with maintenance platform and access ladder.
 - .3 Provide spark detection system including primary and secondary spark detectors and associated control panel.
- 2.8 ARTICULATING
EXTRACTION ARMS
- .1 Provide articulating extraction arms suitable for dust collection application.
 - .2 Unit to be complete with painted aluminum tubes, ball bearing external middle hinge, PVC hose, rotating inlet hood and mesh, volumetric damper, and wall mounting bracket.
 - .3 Physical dimensions and performance:
 - .1 Tube diameter: min 150mm
 - .2 Reach: min 1800mm
 - .3 Flowrate: 280 L/s at 450 Pa pressure drop

PART 3 - EXECUTION

- 3.1 MANUFACTURER'S
INSTRUCTIONS
- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.
- 3.2 INSTALLATION
- .1 Flexible Ducting:
 - .1 Install in following locations:
 - .1 As indicated, as recommended by the duct system manufacturer's standards and as required for the proper connection to each tool, allowing for swing doors and other adjustable parts.
 - .2 Install in accordance with recommendations of SMACNA.
 - .3 When system is operating:
 - .1 Ducting on sides of flexible ducting to be in alignment where possible.
 - .2 Install so there is slack material in flexible ducting.

- .2 Access Doors:
 - .1 Size:
 - .1 As required by applicable codes, standards, the duct manufacturer's recommendations, and for proper inspection and cleaning of the duct system.
 - .2 As shown on the drawings.
 - .2 Locations:
 - .1 To facilitate cleaning of ductwork and cereal processing equipment.
 - .2 As required by applicable codes, standards, the duct manufacturer's recommendations, and for proper inspection and cleaning of the duct system.
 - .3 Elsewhere as indicated.
- .3 Instrument Test Ports:
 - .1 General:
 - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
 - .2 Locate to permit easy manipulation of instruments.
 - .3 Locations:
 - .1 For traverse readings:
 - .1 Main and sub-main ducts.
 - .2 And as indicated.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
- .2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
 - .2 Upon completion of the Work, after cleaning is carried out.
- .4 Obtain reports, within three (3) days of review and submit, immediately to the Departmental Representative.

3.4 CLEANING

- .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

- | | | |
|-----------------------------|--|---|
| <u>1.1 SUMMARY</u> | .1 | Section Includes:
.1 Operating dampers for mechanical forced air ventilation and air conditioning systems. |
| <u>1.2 RELATED SECTIONS</u> | .1
.2
.3
.4
.5 | Section 01 33 00 – Submittal Procedures.
Section 01 35 29 – Health and Safety Requirements.
Section 01 45 00 – Testing and Quality Control.
Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
Section 01 78 00 – Closeout Submittals. |
| <u>1.3 REFERENCES</u> | .1
.1
.2
.1 | American Society for Testing and Materials International (ASTM)
ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
Health Canada/Workplace Hazardous Materials Information System (WHMIS)
Safety Data Sheets (SDS). |
| <u>1.4 SUBMITTALS</u> | .1
.1
.2
.3
.1
.2
.2 | Product Data:
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.
Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.
Indicate the following:
Performance data.
Specifications
Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures. |

		<ul style="list-style-type: none">.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties..2 Instructions: submit manufacturer's installation instructions.
	.3	Closeout Submittals: <ul style="list-style-type: none">.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals
<u>1.5 QUALITY ASSURANCE</u>	.1	Health and Safety Requirements: Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.
	.2	Certificates: <ul style="list-style-type: none">.1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency.
<u>1.6 DELIVERY, STORAGE, AND HANDLING</u>	.1	Packing, shipping, handling and unloading: <ul style="list-style-type: none">.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements..2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
	.2	Waste Management and Disposal: <ul style="list-style-type: none">.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
<u>PART 2 - PRODUCTS</u>		
<u>2.1 MULTI-LEAF DAMPERS</u>	.1	Opposed or parallel blade type as indicated.
	.2	Structurally formed steel or extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, structurally formed and welded galvanized steel or extruded aluminum frame.
	.3	Pressure fit self-lubricated bronze bearings.
	.4	Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

	.5	Performance: <ul style="list-style-type: none">.1 Leakage: in closed position to be less than 2% of rated air flow at 500 Pa differential across damper..2 Pressure drop: at full open position to be less than 25 Pa differential across damper at 10 m/s.
	.6	Insulated aluminum dampers: <ul style="list-style-type: none">.1 Frames: insulated with extruded polystyrene foam with RSI factor of 5.0..2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI factor of 5.0.
2.2 <u>DISC TYPE DAMPERS</u>	.1	Frame: insulated brake formed, welded, 1.6 mm thick, galvanized steel to ASTM A653M.
	.2	Disc: insulated spin formed, 1.6 mm thick, galvanized steel to ASTM A 653M.
	.3	Gasket: extruded neoprene, field replaceable, with 10-year warranty.
	.4	Bearings: roller self lubricated and sealed.
	.5	Operator: compatible with damper, linear stroke operator, spring loaded actuator, zinc-aluminum foundry alloy casting cam follower.
	.6	Performance: <ul style="list-style-type: none">.1 Leakage: in closed position to be less than 2 % of rated air flow at 500 Pa pressure differential across damper..2 Pressure drop: at full open position to be less than 25 Pa differential across damper at 10 m/s.
2.3 <u>BACK DRAFT DAMPERS</u>	.1	Automatic gravity operated, multi leaf, aluminum or steel construction with nylon bearings, centre pivoted, spring assisted or counterweighted.
2.4 <u>RELIEF DAMPERS</u>	.1	Automatic multi-leaf steel or aluminum dampers with ball bearing centre pivoted and counter-weights set to open as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant.
- .4 Install access door adjacent to each damper. See Section 23 33 01 – Dust Collection Air Duct Accessories.
- .5 Ensure dampers are observable and accessible.

3.2 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

<u>1.1 SUMMARY</u>	.1	Section Includes: .1 Wall exhausters.
<u>1.2 RELATED SECTIONS</u>	.1	Section 01 33 00 – Submittal Procedures.
	.2	Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
	.3	Section 01 78 00 – Closeout Submittals.
	.4	Section 23 33 15 – Dampers – Operating.
<u>1.3 REFERENCES</u>	.1	American Bearing Manufacturers Association (ABMA)
	.2	Air Movement and Control Association (AMCA) .1 AMCA Publication 99-16, Standards Handbook. .2 AMCA 300-14, Reverberant Room Method for Sound Testing of Fans. .3 AMCA 301-14, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
	.3	American National Standards Institute (ANSI) .1 ANSI/AMCA 210-16, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
	.4	Health Canada/Workplace Hazardous Materials Information System (WHMIS) .1 Safety Data Sheets (SDS).
<u>1.4 SYSTEM DESCRIPTION</u>	.1	Performance Requirements: .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force. Provide confirmation of testing. .2 Capacity: flow rate, total static pressure Pa, r/min, bhp W, model and size and sound ratings as indicated on schedule.
	.2	Statically and dynamically balanced. Constructed to AMCA 99.

- .3 Sound ratings: comply with AMCA 301, tested to AMCA 300. Unit shall bear AMCA certified sound rating seal.
- .4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, unit to bear AMCA certified rating seal.
- .5 Bearings: sealed lifetime oolite ball bearings, heavy duty grease lubricated ball or roller bearings of self-aligning type with oil retaining, dust excluding seals and a certified minimum rated L10 life of 100,000 hours.

1.5 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Include:
 - .1 Fan performance curves showing specified point of operation.
 - .2 Sound rating data.
 - .3 Installation procedures.
- .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
- .4 Closeout Submittals
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29- Health and Safety Requirements.

- | | | |
|--|----|---|
| <u>1.7 DELIVERY,
STORAGE,
AND HANDLING</u> | .1 | Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions. |
| | .2 | Waste Management and Disposal:
.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal. |
| <u>1.8 MAINTENANCE</u> | .1 | Extra Materials:
.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals. |
| | .2 | Furnish list of individual manufacturer's recommended spare parts for equipment, include:
.1 Bearings and seals.
.2 Addresses of suppliers.
.3 List of specialized tools necessary for adjusting, repairing or replacing. |
|
<u>PART 2 - PRODUCTS</u> | | |
| <u>2.1 FANS GENERAL</u> | .1 | Capacity: flow rate, static pressure Pa, r/min, bhp, model and size and sound ratings as indicated on schedule. |
| | .2 | Statically and dynamically balanced. Constructed in conformity with AMCA 99. |
| | .3 | Sound ratings to comply with AMCA 301, tested to AMCA 300. |
| | .4 | Performance ratings: based on tests performed in accordance with ANSI/ASHRAE 51/AMCA 210. |
| | .5 | Bearings: sealed lifetime ball bearings or heavy duty grease lubricated ball or roller bearings of self aligning type with oil retaining, dust excluding seals and a certified minimum rated life to ABMA L10 of 100,000 h. |
| <u>2.3 WALL
EXHAUSTERS</u> | .1 | Centrifugal backward inclined fan units, direct driven.
.1 Spun aluminum housings, complete with resilient mounted motor and fan.
.2 12 mm mesh 2.0 mm diameter aluminum birdscreen. |

- .3 Motorized gasketed insulation aluminum back draft dampers to Section 23 33 15 – Dampers - Operating.
- .4 Weatherproof disconnect switch within fan housing.
- .5 Cadmium plated or stainless steel securing bolts and screws.
- .2 Housings:
 - .1 Provide with rubber or neoprene grommets for wiring passages, integral attachment collar, or angle ring mounted to mating flanged wall sleeve with full gasketing.
 - .2 Discharge pattern: away from building.

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 manufacturer's instructions.
- 3.3 CLEANING
 - .1 Proceed in accordance with Section 01 74 11 - Cleaning.
 - .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- 3.4 COMMISSIONING
 - .1 Commissioning in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Provide dust collector per the drawings and general provisions of this contract.
- .2 Locate dust collection equipment as per drawings for this contract.

1.2 RELATED SECTIONS

- .1 Section 23 31 14 - Metal Ducts – High Pressure Class 2.
- .2 Section 23 33 01 - Dust Collection Air Duct Accessories
- .3 Section 23 05 48 - Vibration Isolation

1.3 REFERENCES

- .1 ACGIH-2019, Industrial Ventilation, A Manual of Recommended Practice.
- .2 ANSI/ASHRAE Standard 52.2-2017, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- .3 NFPA 91-2020, Exhaust Systems for Air Conveying or Vapours, Gases, Mists, and Non- combustible Particulate Solids.
- .4 NFPA Standard 68-2018, Standard on Explosion Protection by Deflagration Venting.
- .5 National Electrical Safety Code (NESC).

1.4 SUBMITTALS

- .1 Section 01 78 00 – Closeout Submittals.
- .2 Manufacturer's data sheets on each product to be used, including:
 1. Equipment Data.
 2. Design Data: Data to support compliance with Design Requirements.
 3. Preparation instructions and recommendations.
 4. Storage and handling requirements and recommendations.
 5. Installation methods.
- .3 Shop Drawings: Indicate dimensions, sizes, weights and point loadings, material thickness, and locations and sizes of field connections. Submit construction layout and details for inlet fittings.

- .4 Manufacturer's Installation Instructions.
- .5 Provide fan curves with specified operating point clearly plotted.
- .6 Submit sound power levels for both fan inlet and outlet at rated capacity.

PART 2 - PRODUCTS

2.1 EQUIPMENT COMPONENTS

- .1 Dust Collector:
 - .1 Furnish and install a complete pulse-jet dust collection system as shown on the plans to provide continuous duty cleaning. Dust-laden air to enter above the horizontally arranged filter elements and move in a true downward flow direction between the filters. The air stream to turn and pass through the filter media. The filter arrangement to be such that the heavier particles can drop out of the airstream before it turns to enter the filter media. The remaining dust to be collected on the filter media. The clean air to move through the tube sheet section and into a clean air plenum at the rear of the module.
 - .2 The Dust Collector to include high-efficiency cartridge filters. These filters to be MERV 15 rated when tested in accordance with ASHRAE 52.2. This MERV 15 filter efficiency rating to be obtained when testing new, unused filters, without pre-coating or without previously applied dust cake on the filter media. The filter surface layer fibers are to have 90% of its fibers sized less than 150 nanometers in diameter, continuously run filaments that are rated to be up to 99.9% efficient on 0.3 micron size particulate at operational efficiency.
 - .1 Provide full spare set of filters in addition to final operating set.
 - .3 Overall construction of the housing shall be 10 ga. steel construction for a rating of ± 4.98 kPa. Unit to be POWDER COATED, inside and outside. Maximum operating temperature shall be 82.2°C.
 - .4 Construct the cabinet using thread rolling screws with sealing material, creating a modular design. This design will allow for the addition of future modules at a later date, and thus providing future system flexibility.
 - .5 Inlet location to be through the front of the unit above the cartridge portholes. The inlet to be c/w with a single abrasive inlet section.
 - .6 Outlet location to be through the bottom of the clean air plenum located at the rear of the module.
 - .7 Cartridge access to be through the front of the unit via round portholes for each pair of cartridges. The filter access doors shall utilize a "quick release" type handle, which does not require any tools for cartridge filter replacement.

- .8 Automatic on-line cleaning system to be provided to allow for sequential cleaning of each set of filter cartridges. A timer to be provided to control the sequential activation of the solenoid valves in a cascading pattern. When the solenoid valves are activated, a burst of 620-760 kPa of compressed air is released via the diaphragm valves through the pulse pipe nozzle into the center of each cartridge set. The resulting shock wave and induced clean air to momentarily reverse the primary flow through the filter set and dislodge the accumulated dust cake. The downward airflow within the unit to help sweep the particulate past the filters to the bottom of the collector and into the hopper.
 - .9 Aerodynamic design to permit the free-fall of dislodged dust to the hopper and minimize direct impingement of dust particles on the media, which minimizes abrasion and dust build-up.
 - .10 Compressed air manifold and pulse valves to be mounted to the rear of the SFC with a 1" N.P.T. pipe coupling for compressed air connection. Each pulse pipe to be fitted with a 1" single diaphragm air valve. Pilot solenoid valve control box(es) to be rated NEMA 4 and be centrally mounted on the rear of the unit.
 - .11 Solid state printed circuit timer to be supplied in a NEMA 4 enclosure. The enclosure is shipped loose for field installation.
 - .12 Provide magnehelic differential pressure gage to monitor the status of the filter cartridges.
 - .13 Construct hopper(s) to have a 45° slope (60° optional) with a square flanged outlet. Design support legs to seismic zone 4, 160 km/h [100 MPH] wind loading specifications and provide a total of 1,118 mm [44"] clearance under the hopper discharge flange.
 - .14 Dust Collector Accessories.
- .2 Blower package:
Ground mounted blower c/w single width, single inlet, backwardly inclined fan with a non-overloading wheel. This ground mount blower package is c/w motor and adjustable motor base integral to the fan bearing support pedestal. Construction of this fan is of carbon steel and includes a continuously welded housing, flanged inlet and outlet connections, bolted access door, drain connection, belt and shaft guard and fixed pitch V-belt drive with 1.5 service factor. Include an opposed blade outlet damper for air volume control.
- .3 Drum Lid Kit:
Design the kit to provide the connection from a dust collector hopper outlet to a dust storage drum. Each kit includes a bolt-on slide gate and hose adaptor plate, factory mounted to the standard hopper outlet.
- .4 Solenoid Valve Thermal Kit:
.1 The Solenoid Valve Thermal Kit is designed to prevent

freezing of the pulse system solenoid valves due to moisture in the compressed air supply. This kit includes a temperature sensor and heater strip in each solenoid valve enclosure and is powered by a separate 115/1/60 power feed. The temperature sensor activates the heater strip when the ambient temperature drops to 10 degrees C 50 degrees F and deactivates the heater strip when the temperature reaches 24 degrees C 75 degrees F.

- .5 Explosion Vent:
 - .1 The venting of combustible gases and pressures resulting from a deflagration within an enclosure or dust collector to be in accordance with NFPA 68. Vent to be located on top of dust collector c/w weather cover. The dust control system to comply with the requirements of NFPA 91.
- .6 Bag out Collars:
 - .1 75mm wide steel collar designed to attach a standard disposable bag for removing of the cartridge from collector and for ease of disposal.
- .7 Photohelic ΔP Controller:
 - .1 Provide automatic on-line cleaning system to allow for sequential cleaning of each set of filter cartridges. A digital pressure and pulse control panel with NEMA 4 digital Photohelic gauges to be provided to control the sequential activation of the solenoid valves in a cascading pattern.
- .8 The solid-state control panel to have a precision to the nearest 3mm w.c. when setting the upper and lower pulse activation and deactivation points. The tamper resistant control panel to have the upper, lower and alarm set points located inside the control panel enclosure and factory mounting and wiring the pulse control board and pressure switch control board within the same enclosure.
- .9 The pulse controller to be integral to the collector starter panel enclosure with instructions to assist personnel when making operational adjustments.

PART 3 - EXECUTION

3.1 FIELD MEASUREMENTS

- .1 Verify field measurements are as indicated on shop drawings.

3.2 INSTALLATION

- .1 Install equipment to manufacturers written instructions. Manufacturer's installation instructions are indicated in the IOM provided with all equipment.
- .2 Install to NFPA 91 and Round Industrial Duct Construction Standard and ACGIH Industrial Ventilation Manual except as indicated.
- .3 Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.
- .4 Install fans with resilient mountings and flexible electrical leads. Refer to Section 23 05 48 - Vibration Isolation.
- .5 Install dust collector flat and level on concrete foundation.
- .6 Dust collector will be subject to the environmental conditions expected in Prince Edward Island including wind loads in excess of 75 MPH and deflagration loads. Securely fasten dust collector to concrete foundation.
- .7 Provide pitot tube opening where indicated for testing of system with plastic cap to ensure against air leakage.
- .8 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- .9 Provide factory trained representative to start-up the equipment and provide a complete written start-up report. Have the Departmental representative also provide a minimum of 2-hour operation and maintenance training for the building operators.

END OF SECTION

PART 1 - GENERAL

<u>1.1 SUMMARY</u>	.1	Section includes: .1 Supply, return and exhaust grilles and registers, diffusers and linear grilles, for commercial and residential use.
<u>1.2 RELATED SECTIONS</u>	.1	Section 01 33 00 - Submittal Procedures.
	.2	Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
	.3	Section 01 78 00 - Closeout Submittals.
<u>1.3 REFERENCES</u>	.1	American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE). .1 ASHRAE 70, Method of Testing for Rating the Performance of Air Outlets and Inlets.
<u>1.4 SYSTEM DESCRIPTION</u>	.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.
<u>1.5 SUBMITTALS</u>	.1	Product Data: .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations. .1 Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures. .2 Indicate following: .1 Capacity .2 Throw and terminal velocity .3 Noise criteria .4 Pressure drop .5 Neck velocity
	.2	Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures. .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance

characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

1.6 QUALITY
ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.7 DELIVERY,
STORAGE, AND
HANDLING

- .1 Packing, shipping, handling and unloading:
- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
- .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity.
- .2 Frames:
- .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board.
 - .3 Concealed fasteners.
- .3 Concealed manual volume control damper operators as indicated.
- .4 Colour: standard or as directed by Departmental Representative.

2.2 MANUFACTURED
UNITS

.1 Grilles, registers and diffusers of same generic type to be product of one (1) manufacturer.

2.3 SUPPLY GRILLES
AND REGISTERS

.1 See schedule on Drawing M03.

PART 3- EXECUTION

3.1 MANUFACTURER'S .1
INSTRUCTIONS

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 stainless steel or cadmium plated screws in countersunk holes where fastenings are visible.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION