1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Materials and procedures for the provision and installation of bronze valves for piping systems.

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements:

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

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).

.1 ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch).

.2 ANSI/ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ASTM International

.1 ASTM B 62, Standard Specification for Composition Bronze or Ounce Metal Castings.

.2 ASTM B 283, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).

.3 ASTM B 505/B 505M, Standard Specification for Copper-Base Alloy Continuous Castings.

.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

.1 MSS-SP-25, Standard Marking System for Valves, Fittings, Flanges and Unions.

.2 MSS-SP-110, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings

.1 Submit shop drawings to indicate materials, finishes, methods of anchorage, number of anchors, dimensions, construction and assembly details and accessories.

.4 Certificates:

.1 Submit certificates signed by the manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions:

.1 Submit manufacturer’s printed installation instructions.

.6 Manufacturer’s Field Reports:

.1 Manufacturer’s field reports specified.

1.6 Closeout Submittals

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.7 Delivery, Storage and Handling

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.9 Maintenance Material Submittals

.1 Extra Materials/Spare Parts:

.1 Furnish following spare parts:

.1 Bronze valves – 1 valve of each size.

.2 Valve handles: 2 of each size.

2. PRODUCTS

2.1 Materials

.1 Valves:

.1 Except for specialty valves, to be single manufacturer.

.2 Products to have CRN registration numbers.

.2 End Connections:

.1 Connection into adjacent piping/tubing:

.1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.

.2 Copper tube systems: solder ends to ANSI/ASME B16.18.

.3 Lockshield Keys:

.1 Where lockshield valves are specified, provide 3 keys of each size: malleable iron cadmium plated.

.4 Gate Valves:

.1 Requirements common to gate valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Bonnet: union with hexagonal shoulders.

.3 Connections: screwed with hexagonal shoulders.

.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.

.5 Packing: non-asbestos.

.6 Handwheel: non-ferrous.

.7 Handwheel Nut: bronze to ASTM B 62.

.2 NPS 2 and under, rising stem, split wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.

.2 Disc: split wedge, bronze to ASTM B 283, loosely secured to stem.

.3 Operator: handwheel.

.5 Globe Valves:

.1 Requirements common to globe valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Bonnet: union with hexagonal shoulders.

.3 Connections: screwed with hexagonal shoulders.

.4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.

.5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.

.6 Handwheel: non-ferrous.

.7 Handwheel Nut: bronze to ASTM B 62.

.2 NPS 2 and under, composition disc, Class 125:

.1 Body and bonnet: screwed bonnet.

.2 Disc and seat: renewable rotating PTFE disc, regrindable bronze seat, loosely secured to bronze stem to ASTM B 505.

.3 Operator: handwheel.

.6 Check Valves:

.1 Requirements common to check valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Connections: screwed with hexagonal shoulders.

.2 NPS 2 and under, swing type, bronze disc, Class 125:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.7 Ball Valves:

.1 NPS 2 and under:

.1 Body and cap: cast high tensile bronze to ASTM B 62.

.2 Pressure rating: 4140-kPa CWP, 860 kPa steam.

.3 Connections: crewed ends to ANSI B1.20.1 and with hexagonal shoulders.

.4 Stem: tamperproof ball drive.

.5 Stem packing nut: external to body.

.6 Ball and seat: replaceable stainless steel solid ball and Teflon seats.

.7 Stem seal: TFE with external packing nut.

.8 ULC listed for natural gas service.

.9 Operator: removable lever handle.

3. EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Installation

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.3 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Materials and procedures for the provision and installation of hangers and supports for mechanical pipework systems and equipment.

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements:

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

.2 Section 22 11 16 – Domestic Water Piping.

.3 Section 23 11 23 – Facility Gas Piping.

.4 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

.5 Section 23 34 00 – HVAC Fans.

.6 Section 23 35 16 – Engine Exhaust Systems.

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping.

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

.1 ASTM A 125, Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A 563, Specification for Carbon and Alloy Steel Nuts.

.4 Factory Mutual (FM).

.5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP 58, Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings

.1 Submit shop drawings to indicate materials, finishes, methods of anchorage, number of anchors, dimensions, construction and assembly details and accessories.

.2 Underwriter's Laboratories of Canada (ULC) Submittals

.1 Submit Shop Drawings and product data for following items:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.4 Instructions:

.1 Submit Manufacturer's installation instructions.

.4 Certificates:

.1 Submit certificates signed by the manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions:

.1 Submit manufacturer's printed installation instructions.

.6 Manufacturer's Field Reports:

.1 Manufacturer's field reports specified.

1.6 Closeout Submittals

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.7 Delivery, Storage and Handling

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.9 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 SP 58. 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 conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP 58.

2. PRODUCTS

2.1 General

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP 58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 Pipe Hangers

.1 Finishes:

.1 Pipe hangers and supports: galvanized after manufacture.

.2 Use electro-plating galvanizing process or hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.

.2 Upper attachment 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 to MSS SP 58.

.3 Accepted Shop and field-fabricated assemblies:

.1 Trapeze hanger assemblies.

.2 Steel brackets.

.4 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.

.5 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 shields for hot pipework.

.4 Oversize pipe hangers and supports.

.6 Adjustable clevis: material to MSS SP 58 UL listed FM approved, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.7 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP 58.

.8 U-bolts: carbon steel to MSS SP 58 with two (2) nuts at each end to ASTM A 563.

.1 Finishes for steel pipework: galvanized.

.2 Finishes for copper, glass, brass or aluminum pipework: galvanized, with formed portion plastic coated or epoxy coated.

.9 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP 58.

2.3 Riser Clamps

.1 Steel or cast iron pipe: galvanized carbon steel to MSS SP 58, type 42, UL listed FM approved.

.2 Copper pipe: carbon steel copper plated to MSS SP 58, type 42.

.3 Bolts: to ASTM A 307.

.4 Nuts: to ASTM A 563.

2.4 Insulation Protection Shields

.1 Insulated cold piping:

.1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP 58, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP 58.

2.5 Equipment Supports

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 50 00 - Metal Fabrications. Submit calculations with Shop Drawings.

2.6 Equipment Anchor Bolts and Templates

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

2.7 House-Keeping Pads

.1 Provide 150 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment in each direction; chamfer pad edges.

2.8 Other Equipment Supports

.1 Fabricate equipment supports from structural grade steel.

.2 Submit structural calculations with Shop Drawings.

3. EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Installation

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, and as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.4 Clevis plates:

.1 Attach to concrete with 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.

.6 Use approved constant support type hangers where:

.1 Vertical movement of pipework is 13 mm or more.

.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:

.1 Transfer of load to adjacent piping or to connected equipment is not critical.

.2 Variation in supporting effect does not exceed 25% of total load.

3.3 Hanger Spacing

.1 Plumbing piping: to Canadian Plumbing Code Provincial Code Authority Having Jurisdiction.

.2 Gas and fuel oil piping: up to 15mm: every 1.8 m.

.3 Copper piping: up to 15mm: every 1.5 m.

.4 Greater than 15mm in accordance with table below, but not less than one hanger at joints.

Maximum Pipe Size (mm)	Maximum Spacing Steel (m)	Maximum Spacing Copper (m)
up to 30	2.1	1.8
40	2.7	2.4
50	3.0	2.7
65	3.6	3.0
75	3.6	3.0
85	3.9	3.3
100	4.2	3.6
125	4.8	
150	5.1	
200	5.7	
250	6.6	
300	6.9	

.5 Within 300 mm of each elbow.

.6 Pipework greater than 300: to MSS SP 58.

3.4 Hanger Installation

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 Horizontal Movement

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 Final Adjustment

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow Manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

3.7 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Materials and procedures for the provision and installation of Vibration isolation materials and components, seismic control measures.

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements:

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

.2 Section 23 05 53.01 – Testing, Adjusting and Balancing for HVAC.

.3 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

.4 Section 23 34 00 – HVAC Fans.

.5 Section 23 34 25 – Packaged Roof and Wall Exhausters.

.6 Section 23 35 16 – Engine Exhaust Systems.

.7 Section 23 73 11 – Air Handling Units – Packaged.

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 Manitoba Workplace Safety and Health/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.3 National Building Code of Canada (NBC) – 2010 as amended by the Manitoba Building Code Regulation 31/2011.

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings

.1 Submit shop drawings to indicate materials, finishes, methods of anchorage, number of anchors, dimensions, construction and assembly details and accessories.

.4 Certificates:

.1 Submit certificates signed by the manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions:

.1 Submit manufacturer’s printed installation instructions.

.6 Manufacturer’s Field Reports:

.1 Manufacturer’s field reports specified

1.6 Closeout Submittals

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.7 Delivery, Storage and Handling

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2. PRODUCTS

2.1 General

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

2.2 Elastomeric Pads

.1 Type EP1 - neoprene waffle or ribbed; 9 mm minimum thick; 50 durometer; maximum loading 350 kPa.

.2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.

.3 Type EP3 - neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.

.4 Type EP4 - rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

2.3 Elastomeric Mounts

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

2.4 Springs

.1 Design stable springs: ratio of lateral to axial stiffness is equal to or greater than 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with levelling devices.

.2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.

.3 Cadmium plate for 100% relative humidity installations.

.4 Colour code springs.

2.5 Spring Mount

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

.2 Type M2 - stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.

.3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.

.4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.

.5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.

2.6 Hangers

.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.

.2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.

.3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.

.4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.

.5 Type H4 - stable spring, elastomeric element with precompression washer and nut.

2.7 Horizontal Thrust Restraint

.1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.

.2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

3. EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Installation

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

.2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:

.1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and Over: first 6 points of support.

.2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.

.4 Where isolation is bolted to floor use vibration isolation rubber washers.

.5 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.3 Field Quality Control

.1 Manufacturer's Field Services:

.1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.

.2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:

.1 After delivery and storage of products.

.2 After preparatory work is complete but before installation commences.

.3 Twice during the installation, at 25% and 60% completion stages.

.4 Upon completion of installation.

.3 Submit manufacturer's reports to the Contract Administrator within three (3) days of manufacturer representative's review.

.4 Make adjustments and corrections in accordance with written report.

.2 Inspection and Certification:

.1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.2 Take vibration measurements for equipment listed below.

.1 MAU-U-20.

.2 Exhaust Fan EF-U-23

.3 Provide Contract Administrator with notice 24 h in advance of commencement of tests.

.4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).

.5 Submit complete report of test results including sound curves.

3.4 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements:

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

.2 Section 22 11 16 – Domestic Water Piping.

.3 Section 23 07 15 – Thermal Insulation for Piping.

.4 Section 23 11 23 – Facility Gas Piping.

.5 Section 23 31 13.01 – Metal Ducts – Low pressure to 500 Pa.

.6 Section 23 34 00 – HVAC Fans.

.7 Section 23 34 25 – Packaged Roof and Wall Exhausters.

.8 Section 23 35 16 – Engine Exhaust Systems.

.9 Section 23 73 11 – Air Handling Units – Packaged.

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 Canadian Gas Association (CGA)

.1 CSA/CGA B149.1, Natural Gas and Propane Installation Code.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3, Identification of Piping Systems.

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings

.1 Submit shop drawings to indicate materials, finishes, methods of anchorage, number of anchors, dimensions, construction and assembly details and accessories.

.4 Samples:

.1 Submit for review by the Contract Administrator, one sample of each of the following:

.1 Size 5 system nameplate.

.2 Valve tag.

.5 Certificates:

.1 Submit certificates signed by the manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Instructions:

.1 Submit manufacturer’s printed installation instructions.

.7 Manufacturer’s Field Reports:

.1 Manufacturer’s field reports specified.

1.6 Closeout Submittals

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.7 Delivery, Storage and Handling

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2. PRODUCTS

2.1 Manufacturer's Equipment Nameplates

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed. Characters are to be mechanically engraved, stamped or embossed. Hand-written nameplates will not be accepted.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 System Nameplates

.1 Colours:

.1 Hazardous: red letters, white background.

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

.2 Construction:

.1 3 mm thick laminated plastic, semi-gloss finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size #	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5

3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

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

.4 Locations:

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

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

.3 Equipment elsewhere: sizes as appropriate.

2.3 Piping Systems Governed by Codes

.1 Identification:

.1 Natural gas: to CSA/CGA B149.1 and the authority having jurisdiction.

.2 Plumbing: to the requirements of the National Plumbing Code of Canada 2010 as amended by the Manitoba Plumbing Code Regulation 32/2011.

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: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

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

.4 Arrows showing direction of flow:

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

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

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

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

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

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

.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 Other pipes: pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from Contract Administrator.

.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 Marking
City water	Green	CITY WATER
Engine exhaust	Yellow	ENGINE EXHAUST
Natural gas	To Codes	

2.5 Identification Ductwork Systems

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high, identified as follows:

.1 Exhaust Air – Exh. Air.

.2 Relief Air – Relief Air

.3 Return Air – R.A.

.4 Supply Air – S.A.

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

2.6 Valves, Controllers

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

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.7 Controls Components Identification

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

3. EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Timing

.1 Provide identification only after painting specified Section 09 91 00 – Painting Buildings has been completed.

3.3 Installation

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and CSA registration plates as required by respective agency.

3.4 Nameplates

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.5 Location of Identification on Piping and Ductwork Systems

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 Valves, Controllers

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by the Contract Administrator. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

3.7 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

.5 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.6 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Process, methods and requirements of testing, adjusting and balancing for HVAC.

1.3 References

.1 National Research Council (NRC): National Building Code of Canada 2010 (NBC) as amended by the Manitoba Building Code Regulation 31/2011.

.2 ASTM International (ASTM)

.1 ASTM-E779-10, Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.

.2 ASTM-E1827-11, Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door.

.3 ASTM-E2357-11, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

1.4 Qualifications of Tab Personnel

.1 Submit names of personnel to perform TAB to the Contract Administrator within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.5 Purpose of Tab

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

.2 Adjust and regulate equipment and systems 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.

1.6 Exceptions

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

1.7 Application Tolerances

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus 10 %, minus 0 %.

1.8 Accuracy Tolerances

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

1.9 Instruments

.1 Prior to TAB, submit to the Contract Administrator list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to the Contract Administrator.

1.10 Action and Informational Submittals

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.11 Air Systems

.1 Standard: TAB to most stringent of this section or [AB standards of AABC.

.2 Do TAB of systems, equipment, components, controls specified Division 23 including but not limited to the following systems, equipment, components, controls:

.1 Building Airtightness Testing of Control Room.

.2 MAU-U-20.

.3 SF-U-21.

.4 SF-U-22.

.5 EF-U-23.

.3 Qualifications: personnel performing TAB current member in good standing of AABC/NEBB.

.4 Quality assurance: perform TAB under direction of supervisor qualified by AABC or NEBB.

.5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dew point), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.12 Other Tab Requirements

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

.2 Building Airtightness Testing of Control Room:

.1 Test the integrity and airtightness of the Control Room to the requirements of the National Building Code of Canada 2010 Part 5 and ULC Standards.

.2 Evaluate the structure during construction via tests to ASTM-E779, ASTM-E1827, and ASTM-E2357 at a minimum of 75 Pa positive pressure with respect to the outdoor ambient pressure (uncorrected for wind).

.3 Building pressure conditions:

.1 Adjust HVAC systems, equipment, controls to ensure specified minimum 25 Pa positive pressure conditions at all times in the Control Room. Airflow requirement through MAU-1 to permit this pressurization shall be no more than 150l/s with all doors in the closed condition.

.1 If the pressurization of the Control Room requires more than 150 l/s, coordinate with the following sections to have the leak sources located and corrected accordingly:

.1 Section 07 26 00 – Vapour Barrier.

.2 Section 07 92 00 – Joint Sealants.

.3 Section 08 71 00 – Door Hardware.

2. PRODUCTS

2.1 Not Used

.1 Not used.

3. EXECUTION

3.1 Co-ordination

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.1 Building leakage testing is to be scheduled at the point where actual doors and sealants or seals are in place, but at a point where repairs and improvements can still be made to correct defective work.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

3.2 Pre-Tab Review

.1 Review contract documents before project construction is started and confirm in writing to the Contract Administrator adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to the Contract Administrator in writing proposed procedures which vary from standard.

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

3.3 Start-Up

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

3.4 Operation of Systems During Tab

.1 Operate systems for length of time required for TAB and as required by the Contract Administrator for verification of TAB reports.

3.5 Preliminary Tab Report

.1 Submit for checking and approval of the Contract Administrator, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

3.6 Tab Report

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

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit 6 copies of TAB Report to the Contract Administrator for verification and approval, in English in D-ring binders, complete with index tabs.

3.7 Verification

.1 Reported results subject to verification by the Contract Administrator

.2 Provide personnel and instrumentation to verify up to 30 % of reported results.

.3 Number and location of verified results as directed by the Contract Administrator

.4 Pay costs to repeat TAB as required to satisfaction of the Contract Administrator.

3.8 Settings

.1 After TAB is completed to satisfaction of the Contract Administrator, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

3.9 Post-Occupancy Tab

.1 Measure air velocity, air flow patterns, NC levels in the Control Room. Make adjustments as directed.

.2 Participate in systems checks twice during Warranty Period:

.1 Approximately 3 months after acceptance and

.2 Within 1 month prior to the termination of Warranty Period.

3.10 Completion of Tab

.1 TAB considered complete when final TAB Report received and approved by the Contract Administrator.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Materials and procedures for the provision and installation of thermal insulation for ducted systems.

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements

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

.2 Section 23 05 53.01 – Mechanical Identification.

.3 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

.4 Section 23 33 00 – Duct Accessories.

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IESNA 90.1-04, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.3 ASTM International Inc.

.1 ASTM B 209M-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.2 ASTM C 335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.3 ASTM C 411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C 449/C 449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C 547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.

.6 ASTM C 553-02e1, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.7 ASTM C 612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.8 ASTM C 795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.9 ASTM C 921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.4 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.5 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

.6 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings

.1 Provide product data and installation recommendations from the manufacturer for each product.

.4 Samples:

.1 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.

.2 Mount sample on 12 mm plywood board.

.3 Affix typewritten label beneath sample indicating service.

.5 Certificates:

.1 Submit certificates signed by the manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Instructions:

.1 Submit manufacturer's printed installation instructions.

.7 Manufacturer's Field Reports:

.1 Manufacturer's field reports specified.

1.6 Closeout Submittals

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.7 Delivery, Storage and Handling

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.9 Definitions:

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - means "not concealed" as previously defined.

.3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:

.1 CRD: Code Round Ductwork.

.2 CRF: Code Rectangular Finish.

2. PRODUCTS

2.1 Fire and Smoke Rating

.1 To CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 Insulation

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C 335.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C 612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C 553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).

.1 Mineral fibre: to ASTM C 553.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to ASTM C 553.

2.3 Jackets

.1 Canvas:

.1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

.2 Lagging adhesive: compatible with insulation.

2.4 Accessories

.1 Vapour retarder lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.

.4 ULC Listed Canvas Jacket:

.1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921 untreated.

.5 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.6 Contact adhesive: quick-setting.

.7 Canvas adhesive: washable.

.8 Tie wire: 1.5 mm stainless steel.

.9 Banding: 12 mm wide, 0.5 mm thick stainless steel.

.10 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation.

.11 Fasteners: 2 mm diameter pins with 35 mm square clips, length to suit thickness of insulation.

3. EXECUTION

3.1 Application

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

3.2 Pre-Installation Requirements

.1 Pressure test ductwork systems complete, witness and certify.

.2 Ensure surfaces are clean, dry, and free from foreign material.

3.3 Installation

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer’s instructions and as indicated.

.3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Ensure hangers, and supports are outside vapour retarder jacket.

.5 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum [2] rows each side.

3.4 Ductwork Insulation Schedule

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

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	Yes	50
Round cold and dual temperature supply air ducts	C-2	Yes	50
Rectangular warm air ducts	C-1	No	25
Round warm air ducts	C-1	No	25
Supply, return and exhaust ducts exposed in space being served	None		
Outside air ducts to mixing plenum	C-1	Yes	25
Mixing plenum	C-1	Yes	25
Exhaust duct between dampers and louvers	C-1	No	25

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:
.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

.1 Finishes: conform to following table:

	TIAC Code	
	Rectangular	Round
Indoor, Concealed	None	None
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3

3.5 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Thermal insulation for piping and piping accessories in the following applications:

.1 Domestic Cold Water Piping.

.2 Engine Exhaust Piping and Silencer(s).

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements

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

.2 Section 22 11 16 – Domestic Water Piping.

.3 Section 23 05 53.01 – Mechanical Identification.

.4 Section 23 35 16 – Engine Exhaust Systems.

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).

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

.1 ASTM B 209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.

.2 ASTM C 335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C 411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C 449/C 449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C 533-2004, Calcium Silicate Block and Pipe Thermal Insulation.

.6 ASTM C 547-2003, Mineral Fiber Pipe Insulation.

.7 ASTM C 921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.4 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.5 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.6 Manitoba Workplace Safety and Health/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.7 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).

.8 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-07, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-05, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.3 CAN/ULC-S702-09, Thermal Insulation, Mineral Fibre, for Buildings .

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings

.1 Provide product data and installation recommendations from the manufacturer for each product.

.4 Samples:

.1 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.

.2 Mount sample on 12 mm plywood board.

.3 Affix typewritten label beneath sample indicating service.

.5 Certificates:

.1 Submit certificates signed by the manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Instructions:

.1 Submit manufacturer’s printed installation instructions.

.7 Manufacturer’s Field Reports:

.1 Manufacturer’s field reports specified.

1.6 Closeout Submittals

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.7 Delivery, Storage and Handling

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.9 Definitions

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC ss:

.1 CRF: Code Rectangular Finish.

.2 CPF: Code Piping Finish.

2. PRODUCTS

2.1 Fire and Smoke Rating

.1 In accordance with CAN/ULC-S102.

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 Insulation

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C 335.

.3 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702 ASTM C 547.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702 ASTM C 547.

.4 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.

.1 Insulation: to ASTM C 533.

.2 Maximum "k" factor: to CAN/ULC-S702 ASTM C 547.

.3 Design to permit periodic removal and re-installation.

2.3 Insulation Securement

.1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.2 Contact adhesive: quick setting.

.3 Canvas adhesive: washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: stainless steel, 19mm wide, 0.5 mm thick.

2.4 Cement

.1 Thermal insulating and finishing cement:

.1 Air drying on mineral wool, to ASTM C 449/C 449M.

2.5 Vapour Retarder Lap Adhesive

.1 Water based, fire retardant type, compatible with insulation.

2.6 Jackets

.1 Canvas:

.1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

.2 Lagging adhesive: compatible with insulation.

.2 Aluminum:

.1 To ASTM B 209.

.2 Thickness: 0.50 mm sheet.

.3 Finish: stucco embossed.

.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5mm thick at 300 mm spacing.

2.7 Weatherproof Caulking For Jackets Installed Outdoors

.1 Caulking to: Section 07 92 00 - Joint Sealants, suitable for elevated temperatures on engine exhaust pipe insulation.

3. EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Pre-Installation Requirement

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Ensure surfaces are clean, dry, and free from foreign material.

3.3 Installation

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer’s instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Install hangers, supports outside vapour retarder jacket.

.5 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 Piping Insulation Schedules

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: A-3.

.1 Securements: Tape at 300mm on center.

.2 Seals: VR lap seal adhesive, VR lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.3 TIAC Code: A-2.

.1 Insulation securements: Stainless steel banding at 300mm on center.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-H.

.4 Thickness of insulation as listed in following table.

.1 Run-outs to individual units and equipment not exceeding 4000 mm long.

.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp (°C)	TIAC Code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	To 1	1 ¼ to 2	2 ½ to 4	5 to 6	8 & over
Domestic CWS	to 20	A-3	25	25	25	25	25	25
Natural Gas generator exhaust system	to 450	A-2	38	65	75	100	100	100

.5 Finishes:

.1 Exposed indoors: canvas (CWS) or aluminum (Engine Exhaust).

.2 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.

.3 Outdoors: water-proof aluminum jacket.

.4 Finish attachments: SS at 300 mm on centre.

.5 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.5 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Materials and installation procedures for electric heating and cooling controls.

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements

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

.2 Section 23 33 15 - Dampers – Operating.

.3 Section 23 34 00 - HVAC Fans.

.4 Section 23 34 25 – Packaged Roof and Wall Exhausters.

.5 Section 23 73 11 – Air Handling Units – Packaged.

1.4 References

.1 Canadian Standards Association (CSA):

.1 CSA-C22.1-09, Canadian Electrical Code, Part 1.

.2 Manitoba Workplace Safety and Health/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.5 Action and Informational Submittals

.1 Refer to Section 21 05 01 – Common Work Results for Mechanical.

1.6 Quality Assurance

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Manitoba Workplace Safety and Health Requirements.

1.7 Delivery, Storage, and Handling

.1 Refer to Section 21 05 01 – Common Work Results for Mechanical.

2. PRODUCTS

2.1 Stand-Alone Floating Point Programmable Controller

.1 24 VAC input power, 5VA load, maximum 10A fuse.

.2 4 Universal inputs configurable as 200 Ω closed/50KΩ open dry contact digital inputs or analog of the following types:

.1 0 to 10VDC.

.2 0 to 1000Ω.

.3 1000 to 1175Ω.

.3 One additional permanently analog input as above for temperature sensor input.

.4 Two analog outputs, 0 to 10 VDC+/- 1mA current suitable for continuous short circuit.

.5 Two digital outputs with non-renewable slow-blow fuses rated for 10A.

.1 19 to 265 VAC switching voltage.

.2 4A resistive or 3Ainductive at 0.6 PF.

.3 Max inrush: 10A momentary (1 second).

.6 Integral LCD display and programming/diagnostic keys.

.7 Two control loops can be programmed into the same controller.

.1 Programming is accomplished through a push-button menu-driven system.

.2 Service tool connection (RJ45).

.8 C/w 0 to 1000 Ω temperature sensor.

.9 Integral terminal base.

.10 Acceptable Material: Siemens Synco 200 model RL222 or equivalent in accordance with B8.

2.2 Motorized Damper Operator – Two Position, for MD-U22-01 and MD-U70E-01A

.1 Direct shaft-mount damper operator with reversible mounting, spring return, mounting bracket, 0.9 m cable pigtail and the following attributes:

.1 Voltage: 24VAC.

.2 Torque: 18.0 NM.

.3 Power: 25 VA/18W.

.4 Full 90° stroke time: 90 seconds travel with motor, 15 seconds travel on spring return.

.5 Maximum stroke range: 90°.

.6 Acceptable Material: Siemens GCA 121.1E.

2.3 Motorized Damper Operator – Two Position, Hazardous Area Rated, MD-U23-01 and MD-U23-02.

.1 Direct shaft-mount damper operator with reversible mounting, spring return, suitable for Class 1 Zone 1 Hazardous Area, open and closed external end switches, switch enclosure, mounting bracket and 0.9 m cable pigtail and the following attributes:

.1 Voltage: 24VAC.

.2 Torque: 15.0 NM.

.3 Power: 25 VA/18W.

.4 Full 90° stroke time: 3 seconds opening with motor, 10 seconds closing on spring return.

.5 Maximum stroke range: 95°.

.6 Acceptable Material: Siemens ExMax-15-F with ExSwitch, ExBox, and MKK-S Mounting Brackets.

2.4 Motorized Damper Operator – Modulating, for MD-U20-03, MD-U70E-01B, MD-U70E-02A-D and MD-U70E-03

.1 Direct shaft-mount damper operator with reversible mounting, spring return, mounting bracket and 0.9 m cable pigtail and the following attributes:

.1 Voltage: 24VAC.

.2 Torque: 18.0 NM.

.3 Power: 7 VA/5 W.

.4 Positioning signal: 0 to 10VDC.

.5 Full 90° stroke time: 90 seconds opening with motor, 15 seconds closing on spring return.

.6 Maximum stroke range: 90°.

.7 Acceptable Material: Siemens GCA161.1E.

2.5 Control Panel

.1 NEMA 1 painted steel panel manufactured to meet the requirements of CSA-C22.1:

.1 Hinged Door with screw locks.

.2 Polycarbonate window in door to allow the display of the Stand-Alone Floating Point Controller to be seen through the door.

.3 Mounting rails and terminal strips as required for components.

2.6 Key-Operated Switch

.1 Manual key-operated two-position electric switch with:

.1 22 mm nominal diameter for installation.

.2 24 VAC 3A minimum contact capacity (resistive).

.3 Key removable in the off position only.

.4 50° operating angle, maintained contact type.

.5 Acceptable Material: Siemens Sirius 3SB3 Series, Order No. 3SB3000-4HD01 or equivalent in accordance with B8.

2.7 Relays

.1 Electric relay, 4 pole, plug-in, general purpose, c/w socket:

.1 Contacts rated to 250 VAC, 3A.

.2 Coil side voltage to be 24 VAC.

.3 Acceptable Material: Omron Series G2A with PyP-1 sockets or equivalent in accordance with B8.

2.8 Natural Gas Detector

.1 Catalytic bead combustion sensor:

.1 T60 <= 6s.

.2 Detection Range 0-100% LEL.

.3 Detected Gas – Natural Gas (Methane).

.4 Enclosure Material: Aluminium.

.5 NEMA 4X rated.

.6 Acceptable Material: Emerson Process model SC310-A-100-ASSY.

.2 Single Channel Transmitter

.1 Enclosure Material: Cast Aluminum.

.2 Outputs Standard: Analog 4–20 mA.

.3 Display Organic LED (OLED), Power/Status LED‘s.

.4 Certifications North American:

.1 Class I, Zone 1, AEX/Ex d IIB+H2 T5.

.2 NEMA Type 4X/IP67.

.5 Acceptable Material:Emerson Process model M21-AR-A.

3. EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Installation

.1 Install control devices.

.2 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.

.3 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

3.3 Sequence of Operation

.1 Supply Fan SF-U-21 for Generator Room Ventilation

.1 Supply Fan SF-U-21 will run continuously when there is normal power, and the standby generator is off. The fan will be off under standby power. The fan provides 100% outdoor air to meet ventilation requirements for the space as required in NFPA 37.

.2 Exhaust Fan EF-U-22 for Generator Room Free Cooling

.1 The fan will operate when there is normal power. The fan will be off under standby power.

.2 Exhaust Fan EF-U-22 will be energized when the Generator Room space temperature exceeds 30°C.

.3 When EF-U-22 is energized, Damper MD-U70E-01A will be de-energized to open on spring return, and will provide outdoor air to make-up for the exhaust rate.

.4 When EF-U-22 is energized, Damper MD-U22-01 will be energized to opened.

.5 When Exhaust Fan EF-U-22 is energized, Damper MD-U20-03 on the transfer opening from the Control Room will also be closed.

.6 The inlet of Exhaust Fan EF-U-22 will be fitted with a backdraft damper BDD-1 to prevent reverse air flow when the fan is de-energized, and will permit excess air from the Control Room and Supply Fan SF-U-21 to escape.

.7 When the Generator Room space temperature is below 25°C, Exhaust Fan EF-U-22 will be de-energized, and Damper MD-U70E-01A will close.

.3 Exhaust Fan EF-U-22 for Generator Room Venting

.1 Exhaust Fan EF-U-22 will be energized when the Generator Room natural gas detector records a level of 20% of the LEL.

.2 When EF-U-22 is energized, Damper MD-U70E-01A will be de-energized to open on spring return, and will provide outdoor air to make-up for the exhaust rate.

.3 When EF-U-22 is energized, Damper MD-U22-01 will be energized to opened.

.4 When Exhaust Fan EF-U-22 is energized, Damper MD-U20-03 on the transfer opening from the Control Room will also be closed.

.5 Supply Fan SF-U-21 will be de-energized.

.6 When the Generator Room natural gas detector records a level of 10% LEL, fan EF-U-22 will be de-energized, and Damper MD-U70E-01A will close, Fan SF-U-21 will start, and Damper MD-U20-03 will modulate to maintain a Control Room pressure of +30 Pa.

.4 Control Room Pressure Relief

.1 Motorized damper MD-U20-03 will modulate to maintain a positive pressure in the control room of +30 Pa.

.2 MD-U20-03 will close on the loss of normal power and remain closed under standby power.

.3 MD-U20-03 will close when Fan EF-U-22 is energized.

.4 The wall opening will also incorporate a fire damper (type A).

.5 Generator Cooling Control Operation

.1 When the generator is off, the outdoor air intake dampers MD-U70E-01A/b and Exhaust Air dampers MD-U70E-02A-D will be closed, and the recirculation damper MD-U70E-03 will be open.

.2 Upon loss of normal power or manual start-up of the generator, motorized damper MD-U70E-01A will be de-energized and will open on spring return to provide combustion air

for the generator. Damper open status to be confirmed. Once open status is confirmed the engine will start.

.3 Upon temperature rise in the space above 25°C, dampers MD-U70E-01B, and dampers MD-U70E-02A-D will modulate open to maintain the temperature in the space below 28°C, and damper MD-U70E-03 will modulate toward closed to reduce the generator discharge air that is recirculated.

.4 Upon the space temperature dropping below 25°C, dampers MD-U70E-01B, and dampers MD-U70E-02A-D will modulate closed to maintain the temperature in the space above 25°C, and damper MD-U70E-03 will modulate toward open to increase the generator discharge air that is recirculated.

.5 The floating point controller used to control the modulating dampers must be of the EEPROM memory type so it does not loose system setpoints and programming during a power outage.

.6 Exhaust Fan EF-U-23 in the Wet Well

.1 Exhaust Fan EF-U-23 in the Wet Well will normally be off and discharge motorized damper MD-U23-01 closed, and the corresponding outdoor air intake damper MD-U23-02a/b closed.

.2 Prior to staff entering the Wet Well, the operator will engage the ventilation using a key switch on the exterior of the Lift Station, which will energize discharge motorized damper MD-U23-01 and the outdoor air intake motorized damper MD-U23-02 will be and drive both dampers to the open position.

.1 The end switch on damper motors of MD-U23-01 and MD-U23-02 will both signal when the dampers are completely open, and EF-U-23 will then be energized on low speed.

.3 When the combustible/flammable gas detection (by process) indicates that levels are at 10% of the lower explosive limit, the detection system will annunciate an alarm that will engage the ventilation and will energize discharge motorized damper MD-U23-01 and the outdoor air intake motorized damper MD-U23-02 will be and drive both dampers to the open position.

.1 The end switch on damper motors of MD-U23-01 and MD-U23-02 will both signal when the dampers are completely open, and EF-U-23 will then be energized.

.4 Once the key switch is turned off, or the combustible/flammable gas alarm is cleared, the Wet Well Exhaust Fan EF-U-23 will be de-energized, and both MD-U23-01 on the intake dampers and MD-U23-02 on the discharge dampers will be de-energized and close under spring return force.

.7 Unit Heater UH- U70-01 – Control Room Heating

.1 Unit Heater UH- U70-01 will be provided by electrical and will have a built-in thermostat. The unit heater will cycle its coil and fan to maintain the space temperature at 15°C.

.8 Unit Heater UH- U70-02 – Generator Room Heating

.1 Unit Heater UH- U70-02 will be provided by electrical and will have a built-in thermostat. The unit heater will cycle its coil and fan to maintain the space temperature at 15°C.

.9 Unit Heater UH-U70-03 and UH- U70-04 – Wet Well Heating

.1 Unit Heater UH- U70-03 and UH- U70-04 will be provided by electrical, will have a built-in thermostats, and be Class 1 Zone 2 Hazardous Area Rated. The unit heaters will cycle their coils and fans to maintain the space temperature at 10°C.

3.4 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Steel pipe fittings and valve materials, components and installation for the outdoor and indoor distribution systems for natural gas.

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements

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

1.4 References

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/ASME B16.11-2011, Forged Fittings, Socket-Welding and Threaded.

.4 American Petroleum Institute (API)

.1 API 5L, Specification for Line Pipe.

.2 API 6D-R2002, Specification for Pipeline Valves (Gate, Ball, and Check Valves) 22nd Edition.

.3 ANSI/API 1104-01, Standard for Welding Pipeline and Related Facilities 19th Edition.

.5 ASTM International (ASTM)

.1 ASTM-A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Stainless.

.2 ASTM-A181/A181M-12, Specification for Carbon Steel Forgings, for General Purpose Piping.

.3 ASTM-A193/A193M-12b, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.

.4 ASTM-A194/A194M-12a, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

.5 ASTM-A216/A216M-12, Standard Specification for Steel Castings, Carbon, Suitable For Fusion Welding, for High-Temperature Service.

.6 Canadian Standards Association (CSA International)

.1 CSA-B149.1-05, Natural Gas and Propane Installation Code.

.2 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.3 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel Structures.

.4 CSA W48-01, Filler Metals and Allied Materials for Metal Arc Welding.

.5 CSA W178.2, Certification of Welding Inspectors.

.7 The National Fire Code of Canada 2010 as amended by the Manitoba Fire Code Regulation 155/2011.

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings

.1 Provide product data and installation recommendations from the manufacturer for each product.

1.6 Closeout Submittals

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.7 Delivery, Storage and Handling

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2. PRODUCTS

2.1 Steel Piping

.1 Pipe: to ASTM-A53/A53M or API 5L, schedule40. Pipe finish to be black, ends are to be threaded or plain for field threading.

.2 Fittings:

.1 Threaded type, malleable iron or steel to ASME B16.3. Class 150.

.2 Welding type, carbon steel, seamless or resistance weld. Wall thickness same as corresponding pipe size.

.3 Flanges: cast carbon steel, raised face, weld neck, to ASTM-A181/A181M, Grade II Class 150, 1 MPa.

.4 Bolting materials:

.1 Bolts: carbon steel to ASTM-A193/A193M.

.2 Nuts: carbon steel to ASTM-A194/A194M.

.3 Gasket: capable of chemically withstanding fluids and temperatures of 650°C.

.5 Joints:

.1 Aboveground: threaded joints using compound approved by Contract Administrator for product being handled.

.2 Welded joints: conform to provincial, federal and municipal regulations or requirements of CSA W47.1 and CSA W47.1S1.

.6 Corrosion and product protection:

.1 Protect piping against external corrosion by painting.

2.2 Flexible Connectors:

.1 Listed/approved and labelled for Natural Gas service.

.2 To match pipe size.

.3 Corrugated stainless steel hose.

.4 Stainless steel exterior braiding.

.5 NPT ends.

.6 Minimum working pressure: 345 kPa at 50°C.

2.3 Regulators

.1 Service Regulator: As provided by utility supplier.

.2 PRV-1 at the Standby Generator:

.1 Cast gray iron body with 50mm threaded inlet and outlet, internal relief valve, and calibrated spring driven by internal outlet pressure sensing.

.2 Maximum 1.2 kPa inlet pressure or 0.6 specific gravity natural gas.

.3 Setpoints and orifice sizes vary depending on manufacturer/model of standby generator, refer to schedule on drawing.

.4 Acceptable Material: Fisher Model CS800 regulator or equivalent in accordance with B8.

2.4 Valves

.1 50mm and smaller: ULC Listed ball valves, refer to Section 23 05 23.01 Valves - Bronze.

.2 Stem seals and valve seats: materials resistant to conveyed gas or fluid.

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 Handling

.1 Protect and shield pre-coated equipment and piping.

3.3 Coatings

.1 Clean surfaces to base metal. Store clean pipe for short time period in sheltered dry location.

.2 Shop application: prefabricated piping sections are limited to 15 m maximum length.

.3 Reprime mill primed pipe before coating.

3.4 Anchors and Guides

.1 Install anchors and guides as indicated and at following points:

.1 At changes of pipe sizes.

.2 At branch line take offs.

.3 At changes of piping directions.

.4 At terminal points.

.5 Elsewhere as indicated.

3.5 Provision for Expansion

.1 Install loops offsets as indicated.

3.6 Supports

.1 Above-ground piping: prevent excessive vibration and stress on adjacent equipment.

3.7 Protection

.1 Protect piping system from damage by vehicular traffic using guard devices, marked with fluorescent markers painted with warning colours.

3.8 Sleeves

.1 Install where pipes pass through walls or floors. Firestop around pipes.

3.9 Location of Pipework

.1 General: locate not to constitute hazard to personnel, buildings or equipment.

.2 Above-ground outdoor piping:

.1 Do not locate on exterior walls constructed of combustible material.

.2 Do not locate above windows, or door openings.

.3 Locate above roofs only if roof is accessible for pipe maintenance.

.3 Underground pipework: coordinate with utility to locate at least 300 mm away from foundations of building structure, and rise above grade for regulator and meter station before piping enters building.

3.10 Indoor Installation

.1 Install to CSA-B149.1 and the additional requirements of the authority having jurisdiction.

.2 Take most direct route possible or practicable.

.3 Support overhead or locate in trenches which contain no other services.

.4 Install overhead piping close to ceiling or beams or along walls, where possible. Support from building structure at least 2100 mm from floor.

.5 Hanger spacing:

.1 Up to 30mm, 3700 mm.

.2 40mm and over, 4600 mm.

.3 Design to prevent lateral movement.

.6 Exposed risers: protect against mechanical damage by installing:

.1 Adjacent to walls or pilasters.

.2 Between flanges of steel columns.

.3 Guards.

.7 Install loops or swing connections to compensate for pipe movement.

.8 Do not jeopardize fireproofing of structural elements or fire separations.

3.11 Valves

.1 Install valves to control flow and to isolate equipment at following locations:

.1 Branch lines at points of connection to main line;

.2 At equipment requiring periodic servicing such as pressure regulators and appliances.

3.12 Welding

.1 Do work in accordance with API 1104.

.2 Make joints in accordance with Manufacturer's recommendations.

.3 Use bevelling machine to produce bevel cuts.

.4 Electrodes: to CSA W48.

.5 Welds: full penetration. Provide split backing ring for field joints above 50mm or as indicated. Use welding sockets for joints 50mm or smaller, conforming to ANSI/ASME B16.11.

.6 Make branch connections with welding tees or forged branch outlet fittings.

.7 Leave welds uncovered until inspected and approved by Contract Administrator.

.8 Replace welds which fail to meet API 1104 requirements.

3.13 Pre-Assembly of Piping Systems

.1 Obtain Contract Administrator's approval for pre-assembly of sections of pipe systems. Seal pipes against infiltration of dirt and moisture.

3.14 Field Quality Control

.1 Testing:

.1 Test system in accordance with CAN/CSA B149.1 and requirements of authorities having jurisdiction.

.2 Pressure test with air, nitrogen or liquid approved by Contract Administrator to at least 1.5 times maximum operating pressure. Submit certificate of tests and test results to Engineer.

.3 Should there be loss of pressure, soap test each weld or use tracer gas with compressed air as directed by Contract Administrator.

3.15 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

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

1.3 Related Requirements

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements

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

.2 Section 23 05 53.01 – Mechanical Identification.

.3 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.4 Section 23 07 13 - Duct Insulation.

.5 Section 23 09 33 – Electric and Electronic Control System for HVAC.

.6 Section 23 33 00 – Air Duct Accessories.

.7 Section 23 33 15 - Dampers - Operating.

.8 Section 23 33 16 – Dampers – Fire and Smoke.

.9 Section 23 34 25 – Packaged Roof and Wall Exhausters.

.10 Section 23 37 20 – Louvers, Intakes and Vents.

.11 Section 23 73 11 – Air Handling Units – Packaged.

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.3 American Society for Testing and Materials International, (ASTM).

.1 ASTM-A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Stainless.

.2 ASTM-A635/A635M-09b, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.

.3 ASTM-A653/A653M-11, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM-B209M-10, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).

.4 Manitoba Workplace Safety and Health/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.5 National Fire Protection Association (NFPA).

.1 NFPA 90A-2012, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition [1995] and Addendum No. 1, 1997.

.2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.

.7 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations for the following:

.1 Sealants.

.2 Tape.

.3 Proprietary Joints.

1.6 Closeout Submittals

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.7 Delivery, Storage and Handling

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2. PRODUCTS

2.1 Seal Classification

.1 Classification as follows:

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

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant, tape or combination thereof.

.3 Class C: transverse joints and connections made air tight with sealant, tape or combination thereof. Longitudinal seams unsealed.

.4 Unsealed seams and joints.

2.2 Sealant

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 35 degrees C to plus 93 degrees C.

2.3 Tape

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

2.4 Duct Leakage

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

2.5 Fittings

.1 Fabrication: to SMACNA Standards and ASHRAE Guidelines.

.2 Radiused elbows.

.1 Rectangular: Centreline radius: 1.0 times width of duct.

.2 Round: smooth radius or five piece. Centreline radius: 1.0 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400 mm: with single thickness turning vanes.

.2 Over 400 mm: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with radius on branch 1.0 times width of duct.

.2 Round main and branch: enter main duct at 45 degrees with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.5 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.6 Offsets:

.1 Short radiused elbows as indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.

.1 Maximum included angles: as for transitions.

2.6 Fire Stopping

.1 Retaining angles around duct, on both sides of fire separation in accordance with Section 23 33 16 – Dampers – Fire and Smoke.

.2 Fire stopping material and installation must not distort duct or have direct fasteners to wall or floor.

2.7 Galvanized Steel Sheet

.1 Lock forming quality: to ASTM-A653/A653M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

2.8 Aluminum

.1 To ASTM-B209M. Aluminum type: 3003-H-14.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

2.9 Galvanized Steel Pipe

.1 To ASTM A53/A53M, grade b, ERW, hot-dipped galvanized.

.2 Thickness: Schedule 10.

.3 Fabrication: shop and field welded as shown.

.4 Embedment: as indicated.

.5 Joints: continuous weld.

2.10 Hangers and Supports

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500 mm.

.2 Hanger configuration: to SMACNA.

.3 Hangers: galvanized steel angle with galvanized steel rods to SMACNA and the following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6

1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For wood joist: manufactured joist clamp or steel plate washer.

.3 For steel beams: manufactured beam clamps.

3. EXECUTION

3.1 General

.1 Do work in accordance with ASHRAE and SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond insulated duct.

.3 Install breakaway joints in ductwork on sides of fire separation in conformance with teh listing of the fire damper.

.4 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

3.2 Hangers

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with SMACNA as follows:

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

3.3 Watertight Duct

.1 Provide watertight duct for:

.1 Fresh air intake.

.2 Plenums.

.3 As indicated.

.2 Form bottom of horizontal duct without longitudinal seams.

.1 Solder joints of bottom and side sheets.

.2 Seal other joints with duct sealer.

3.4 Sealing and Taping

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

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

3.5 Leakage Tests

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

.2 Do leakage tests in sections.

.3 Make trial leakage tests as instructed to demonstrate workmanship.

.4 Do not install additional ductwork until trial test has been passed.

.5 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.

.6 Complete test before performance insulation or concealment Work.

3.6 Duct Materials

.1 Make ductwork out of the materials as specified below in specific areas, or out of galvanized steel sheet elsewhere:

.1 Ductwork in the Wet Well on the intake and exhaust system shall be of aluminum materials.

.2 Ductwork (pipe) in the Discharge Chamber shall be of galvanized steel pipe up to and including the discharge above grade. Refer to the details on the drawings.

3.7 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Materials and installation for duct accessories including flexible connections, access doors, vanes and collars.

1.3 Related Requirements

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements

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

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 Manitoba Workplace Safety and Health/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations for the following:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings

.1 Provide product data and installation recommendations from the manufacturer for each product.

.4 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.

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

.6 Instructions: submit manufacturer's installation instructions.

.7 Manufacturer's Field Reports: manufacturer's field reports specified.

1.6 Closeout Submittals

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.7 Delivery, Storage and Handling

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2. PRODUCTS

2.1 General

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

2.2 Flexible Connections

.1 Frame: galvanized sheet metal frame 1.6 mm thick with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m².

2.3 Access Doors In Ducts

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: closed cell neoprene foam rubber.

.4 Hardware:

.1 Up to 300 x 300 mm: two sash locks complete with safety chain.

.2 301 to 450 mm: four sash locks complete with safety chain.

.3 451 to 1000 mm: piano hinge and minimum two sash locks.

.4 Doors over 1000 mm: piano hinge and two handles operable from both sides.

.5 Hold open devices.

2.4 Turning Vanes

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

2.5 Instrument Test

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.6 Spin-In Collars

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to corresponding round duct standards.

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 Connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Length of connection: 100mm.

.3 Minimum distance between metal parts when system in operation: 75 mm.

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access Doors and Viewing Panels:

.1 Size:

.1 900 x 900 mm for person size entry.

.2 600 x 600 mm for servicing entry.

.3 300 x 300 mm for viewing and hand/arm entry.

.4 As indicated.

.2 Locations:

.1 Fire and smoke dampers.

.2 Control dampers.

.3 Devices requiring maintenance.

.4 Required by code.

.5 Reheat coils.

.6 Elsewhere as indicated.

.3 Instrument Test Ports:

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations:

.1 For traverse readings:

.1 Ducted inlets to roof and wall exhausters.

.2 Inlets and outlets of other fan systems.

.3 Main and sub-main ducts.

.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.

.2 And as indicated.

.4 Turning vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Operating dampers for mechanical forced air ventilation and air conditioning systems.

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements

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

.2 Section 23 05 53.01 – Mechanical Identification.

.3 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.4 Section 23 09 33 – Electric and Electronic Control System for HVAC.

.5 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

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

.1 ASTM-A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 Manitoba Workplace Safety and Health/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings

.1 Provide product data and installation recommendations from the manufacturer for each product.

.2 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 21 05 01 - Common Work Results for Mechanical. Include product characteristics, performance criteria, and limitations.

.3 Indicate the following:

.1 Performance data.

.1 Pressure drop.

.2 Shaft torque requirements.

.2 Schedule of sizes by tag number.

.1 Type of mounting/fastening.

1.6 Closeout Submittals

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical,

1.7 Delivery, Storage and Handling

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2. PRODUCTS

2.1 Multi-Leaf Dampers

.1 Opposed or parallel blade type as indicated.

.2 2.0 mm thick extruded 6063-T5 aluminum alloy, interlocking airfoil blades with two-sided profile, center pivot, complete with extruded rubber blade tip and side frame seals, extruded 6063-T5 aluminum frame.

.3 Pressure fit self-lubricated Celcon bearings on shafts rotating within polycarbonate outer bearings pressed into the frame to prevent metal-to-metal or metal-to-plastic movement.

.4 Linkage: aluminum tie rods, brass pivots and zinc-plated steel fasteners within the damper frame, factory set for proper damper blade timing.

.5 101.6 mm thick frame to be complete with minimum 25mm wide flanges for flange-mounting to ductwork.

.6 Hexagonal 11.1mm aluminum drive rod with u-bolt fastener and hexagonal retaining nuts of zinc-plated steel extends out through the side of the damper frame for external mounting of actuator beyond duct wall and insulation.

.7 Operator: to Section 23 09 33 – Electric and Electronic Control System for HVAC.

.8 Performance:

.1 Leakage: in closed position less than 15.2 liters/second at 250 Pa differential across damper.

.2 Pressure drop: at full open position less than 25 Pa differential across damper at 3.5 m/s.

.9 Insulated aluminum dampers DM-4A/B, DM-5A-D, DM-7 and DM-8:

.1 Frames: insulated with duct insulation as specified in Section 23 07 13 – Duct Insulation. Leave sufficient room for linkage operation.

.2 Blades: thermally broken aluminum extrusions with internal hollows insulated with polyurethane foam, RSI 0.88.

.3 Blade tip and frame side seals are constructed of silicone rubber for -40°C to 100°C operation.

.4 Acceptable Material: Tamco Series 9000SC or equivalent in accordance with B8.

.10 Uninsulated dampers DM-3 and DM-6:

.1 Hollow one-piece aluminum blade extrusions.

.2 Blade tip and frame side seals are made of EPDM rubber for -40°C to 100°C operation.

.3 Acceptable Material: Tamco Series 1000 or equivalent in accordance with B8.

3. EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Installation

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Provide aluminum mullion framing where multiple dampers meet within ductwork.

.4 Seal single or multiple damper modules to duct flanges or structural mullions with silicon sealant.

.5 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.6 Ensure dampers are observable and accessible.

3.3 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Fire dampers.

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements

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

.2 Section 23 05 53.01 – Mechanical Identification.

.3 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.4 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

.5 Section 23 33 00 – Air Duct Accessories.

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)

.1 ANSI/NFPA 90A-2012, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.3 Manitoba Workplace Safety and Health/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN4-S112-M1990, Fire Test of Fire Damper Assemblies.

.2 ULC-S505-1974, Fusible Links for Fire Protection Service.

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings

.1 Provide product data and installation recommendations from the manufacturer for each product.

.2 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 21 05 01 – Common Work Results for Mechanical. Include product characteristics, performance criteria, and limitations.

.1 Design details of break-away joints.

1.6 Closeout Submittals

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.7 Delivery, Storage and Handling

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.9 Maintenance

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Contract Administrator's Requirements.

.2 Provide following:

.1 6 fusible links of each type.

2. PRODUCTS

2.1 Fire Dampers

.1 Fire dampers: arrangement Type A listed and bear label of ULC, UL, or Warnock Hersey, and meet requirements of ANSI/NFPA 90A and the authority having jurisdiction. Fire damper assemblies fire tested in accordance with CAN4-S112.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.1 Fire dampers: 1-1/2 hour fire rated unless otherwise indicated.

.2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.

.3 Top hinged: interlocking type, sized to maintain full duct cross section.

.4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type in horizontal position with vertical air flow.

.5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.

.7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.

.8 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition of floor slab depth or thickness.

.9 Unless otherwise indicated, the installation details given in SMACNA and in manufacturer's instructions on fire dampers' ULC listing shall be followed.

3. EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Installation

.1 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.

.2 Maintain integrity of fire separation.

.3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.4 Install access door adjacent to each damper. Refer to Section 23 33 00 - Air Duct Accessories.

.5 Co-ordinate with installer of concrete masonry units for proper opening size.

.6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.7 Install break-away joints of approved design on each side of fire separation.

3.3 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Fans, motors, accessories and hardware for commercial use.

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements

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

.2 Section 23 05 53.01 – Mechanical Identification.

.3 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.4 Section 23 09 33 - Electric and Electronic Control System for HVAC.

.5 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

.6 Section 23 33 00 – Air Duct Accessories.

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 Air Conditioning and Mechanical Contractors (AMCA)

.1 AMCA Publication 99-2003, Standards Handbook.

.2 AMCA 300-1996, Reverberant Room Method for Sound Testing of Fans.

.3 AMCA 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.3 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/AMCA 210-1999, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.5 Manitoba Workplace Safety and Health/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings:

.1 Submit shop drawings and product data in accordance with Section 21 05 01 – Common Work Results for Mechanical.

.1 Provide :

.1 Fan performance curves showing point of operation, W and efficiency.

.2 Sound rating data at point of operation.

.2 Indicate:

.1 Motors, bearings, accessories.

1.6 Closeout Submittals

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.7 Delivery, Storage and Handling

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.9 System Description

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.2 Capacity: flow rate, static pressure, W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.

.4 Sound ratings: comply with AMCA 301, tested to AMCA 300. Supply unit with AMCA certified sound rating seal.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210. Supply unit with AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

2. PRODUCTS

2.1 Fans General

.1 Motors:

.1 In accordance with CSA C22.1, Division 25 and as specified herein.

.2 Sizes as indicated in schedules on the drawings.

.2 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, inlet and outlet cones, discharge and inlet screens, backdraft dampers, and as listed in the schedules on the drawings and as indicated herein.

.3 Factory primed before assembly in colour standard to manufacturer.

.4 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

.5 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

2.2 Centrifugal Fans

.1 Fan wheels:

.1 Dual inlet welded steel, dynamically balanced, direct driven.

.2 Maximum operating speed of centrifugal fans not more than 50 % of first critical speed.

.3 Forward curved fan wheel.

.2 Bearings: integral to motor, permanently sealed and lubricated.

.3 Disconnect: integral plug-in disconnect.

.4 Overloads; Built-in.

.5 Scroll integrally fabricated with the cabinet.

2.3 Cabinet Fans – SF-U-21

.1 Fan characteristics and construction: as centrifugal fans.

.2 Cabinet hung single or multiple wheel with DWDI centrifugal fans in factory fabricated casing complete with vibration isolators and seismic control measures, motor, and insulated casing.

.3 Fabricate casing of zinc coated or phosphate treated steel of 1.0 mm thickness or thicker, reinforced and braced for rigidity. Provide removable panels for access to interior. Paint uncoated, steel parts with corrosion resistant paint to CAN/CGSB 1.181. Finish inside and out, over prime coat, with rust resistant enamel. Internally line cabinet with 25 mm thick rigid acoustic insulation, pinned and cemented, 56 kg/m^3 density.

.4 Integral backdraft damper on discharge, and TDA Inlet Duct Sleeve.

2.4 Axial Flow Fans (Tube-Axial) – EF-U-23

.1 Casings: welded steel with welded motor support, bolted access plates, streamlined inlet cone, streamlined discharge conel sections and heresite phenolic coating of all steel surfaces.

.2 Blade material: Cast T319 aluminum with 7 blades and integral hub.

.3 Supports:

.1 Wall Mounted unit: support brackets welded to side of casing. Extended grease lubrication lines to outside of casing.

.4 Bearings:

.1 Fan shaft: heavy duty grease lubricated ball or roller with extension tubes to outside of casing. Minimum average bearing life AFBMA L-50 in excess of 200,000 hours at maximum RPM.

.2 Motor: Greaseable ball bearing with grounding strap.

.5 Belt drive:

.1 Fixed blades driven by externally mounted motor through V-belt drive. Provide internal belt fairing, fixed sheave, external OSHA belt guard and adjustable motor mounts.

.2 Adjustable drive pulley mounted on the output shaft of the electric motor to allow balancing and adjusting of the fan speed.

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 Fan Installation

.1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.

.2 Provide sheaves and belts required for final air balance.

.3 Bearings and extension tubes to be easily accessible.

.4 Access doors and access panels to be easily accessible.

3.3 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Roof and wall exhausters.

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements

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

.2 Section 23 05 53.01 – Mechanical Identification.

.3 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.4 Section 23 09 33 – Electric and Electronic Control System for HVAC.

.5 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 Air Movement and Control Association (AAMC)

.1 AMCA Publication 99-2003, Standards Handbook (Revised 2003).

.2 AMCA 300-1996, Reverberant Room Method for Sound Testing of Fans.

.3 AMCA 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.3 American National Standards Institute (ANSI)

.1 ANSI/AMCA 210-99, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.4 Manitoba Workplace Safety and Health/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings:

.1 Submit shop drawings and product data in accordance with Section 21 05 01 – Common Work Results for Mechanical.

.1 Provide :

.1 Fan performance curves showing point of operation, W and efficiency.

.2 Sound rating data at point of operation.

.2 Indicate:

.1 Motors, bearings, accessories.

1.6 Closeout Submittals

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.7 Delivery, Storage and Handling

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.9 System Description

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force. Provide confirmation of testing.

.2 Capacity: flow rate, static pressure Pa, r/min, kW, 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 heavy duty ball bearings with oil-retaining, dust excluding seals and a certified minimum L50 rated life of 200,000 hours.

2. PRODUCTS

2.1 Wall Exhausters – SF-U-22

.1 Centrifugal backward inclined fan units, V bet driven.

.1 Spun aluminum housings, complete with resilient mounted motor and fan.

.2 12 mm mesh 2.0 mm diameter aluminum birdscreen.

.3 Automatic gasketted aluminum backdraft dampers, refer to Section 23 33 15 – Dampers - Operating.

.4 Disconnect switch within fan housing.

.5 Cadmium plated securing bolts and screws.

.2 Aluminum spark-resistant and non-overloading wheel for fume service with motor out of air stream.

.3 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 gasketting.

.2 Discharge pattern: away from building.

.4 Single speed motor: Single winding, continuous duty permanently lubricated ball bearing design with speed of approximately 1750 r/min. Motor to be mounted out of the main airstream, and provided with a cooling tube to the exterior of the fan.

.1 Refer to Division 25 for voltage, phase and frequency requirements.

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 Refer to Section 21 05 01 - Common Work Results for Mechanical.

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontrac shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Materials and procedures for the provision and installation of stationary engine exhaust systems.

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements

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

.2 Section 23 05 23.01 – Valves – Bronze.

.3 Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping.

.4 Section 23 05 53.01 – Mechanical Identification.

.5 Section 23 07 15 – Thermal Insulation for Piping.

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 American National Standards Institute (ANSI)

.1 ANSI/ASME-B16.3-2006, Malleable-Iron Threaded Fittings, Classes 150 and 300.

.2 ANSI/ASME-B16.5-2013, Pipe Flanges and Flanged Fittings: NPS ½ through NPS24 Metric/Inch Standard.

.3 ANSI/ASME-B16.20-2007, Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound, and Jacketed.

.3 ASTM International (ASTM)

.1 ASTM-A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.

.2 ASTM-A105/A105M-12, Standard Specification for Carbon Steel Forgings for Piping Applications.

.3 ASTM-A193/A193M-12b, Standard Specification for Alloy Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.

.4 ASTM-A758/A758M-10, Standard Specification for Wrought Carbon Steel Butt Welding Piping Fittings with Improved Notch Toughness.

.4 National Fire Protection Association (NFPA)

.1 NFPA 37-2006, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.

.2 NFPA 211-2006, Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances.

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings

.1 Provide product data and installation recommendations from the manufacturer for each product.

1.6 Closeout Submittals

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.7 Delivery, Storage and Handling

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.9 Extra Materials

.1 Provide maintenance materials in accordance with Section 21 05 01 – Common Work Results for Mechanical.

2. PRODUCTS

2.1 Flexible Piping Connectors

.1 Corrugated metal flexible connector(s) will be supplied with the generator package as specified by Division 26.

.2 Provide bolts, gaskets, and guard as specified to install the flexible connectors under this section.

2.2 Silencers

.1 Silencer(s) will be supplied with the generator package as specified by Division 26.

.2 Provide bolts, gaskets, piping, valves, supports and insulation as specified to install the silencer(s) under this section.

2.3 Pipe and Fittings

.1 Pipe shall conform to ASTM-A53 grade b, ERW with plain ends for welding, schedule 40 wall thickness.

.2 Fittings .

.1 Sizes 65 and larger: Fittings shall have butt-welding ends and be wrought of steel to schedule 40 ID according to ASTM-A758.

.2 Sizes 50 and smaller: Malleable iron Class 300 threaded pipe fittings according to ANSI/ASME-B16.3.

.3 Flanges are to be made in accordance with ASTM-A105 and ANSI/ASME-B16.5, Class 150 raised face.

2.4 Gaskets

.1 Spiral-wound AISI Type 347 stainless steel winding, centering and inner ring, with ceramic filler to ANSI/ASME-B16.20. Temperature rating to 925°C, for Class 150 flat and raised face flanges. Acceptable Material: Garlock Style RWI.

2.5 Fasteners

.1 AISI Type 347 Class I cap screws and nuts, minimum 413 MPa yield.

3. EXECUTION

3.1 Application

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

3.2 Installation

.1 Install in accordance with NFPA 37, and 211.

.2 Provide substantial supports and brace supports for seismic forces.

.3 Slope piping up towards the discharge outside so that condensate drains back to the low point drain in the silencer.

.1 Use eccentric reducers for size changes to promote drainage.

.4 Install piping from the low point drain to approximately 450 mm above the floor of the generator room.

.5 Install drain valve in piping from low point in drain between 1000 and 1500 mm above the floor.

.6 Make joints watertight and airtight when subjected to 15 kPa pressure.

.7 Install silencer supports to manufacturer's recommendations.

3.3 Testing

.1 Test assembled and sealed piping and silencer from silencer inlet to plugged discharges under 15 kPa positive pressure for 30 minutes using dry nitrogen gas.

.1 No leakage is permissible.

.2 Test apparatus to be isolated once test pressure is achieved, no topping up will be accepted.

3.4 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Supply, return and exhaust grilles and registers, diffusers and linear grilles, for commercial and residential use.

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements

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

.2 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 Air Movement and Control Association International Inc.(AMCA)

.1 Damper/Louver Application Manual.

.2 Standard 500-L-12, Laboratory Methods of Testing Louvers for Rating.

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

.1 ASTM E 90-04, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.4 Manitoba Health Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings

.1 Provide product data and installation recommendations from the manufacturer for each product. Indicate following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

.5 Neck velocity.

1.6 Closeout Submittals

.1 Refer to Section 21 05 01 – Common Work Results for Mechanical.

1.7 Delivery, Storage and Handling

.1 Refer to Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.9 Maintenance

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 21 05 01 – Common Work Results for Mechanical.

.2 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

1.10 System Description

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2. PRODUCTS

2.1 General

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as specified.

.2 Frames:

.1 Full perimeter gaskets.

.3 Concealed manual volume control damper operators.

.4 Colour: Aluminum.

2.2 Manufactured Units

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

2.3 Supply Grilles and Registers

.1 General: with opposed blade dampers.

.2 Type SA: steel 32 mm border, double deflection with airfoil shape, horizontal face and vertical rear bars. Finish: painted.

3. EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Installation

.1 Install in accordance with manufacturer's instructions.

.2 Install with oval head cadmium plated screws in countersunk holes where fastenings are visible.

3.3 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Mechanical louvers; intakes; vents; and reinforcement and bracing for air vents, intakes and gooseneck hoods.

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements

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

.2 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 Air Movement and Control Association International Inc.(AMCA)

.1 Damper/Louver Application Manual.

.2 Standard 500-L-12, Laboratory Methods of Testing Louvers for Rating.

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

.1 ASTM E 90-04, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.4 Manitoba Health Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.6 Society of Automotive Engineers (SAE)

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings

.1 Provide product data and installation recommendations from the manufacturer for each product. Indicate following:

.1 Pressure drop.

.2 Face area.

.3 Free area.

.4 Accessories.

.4 Instructions

.1 Submit manufacturer's installation instructions.

.5 Test Reports:

.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E 90.

1.6 Closeout Submittals

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.7 Delivery, Storage and Handling

.1 Refer to Section Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.9 System Description

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2. PRODUCTS

2.1 Gooseneck Hoods

.1 Thickness: to ASHRAE and SMACNA.

.2 Fabrication: to ASHRAE and SMACNA.

.3 Joints: continuously welded.

.4 Supports: self-supporting.

.5 Complete with integral birdscreen of 2.7 mm diameter aluminum wire. Use 12 mm x 12 mm mesh on exhaust.

2.2 Fixed Louvers - Aluminum

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T6.

.3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.

.4 Frame, head, sill and jamb: 150 mm deep one piece extruded aluminum, minimum 3 mm thick.

.5 Mullions: at 1500 mm maximum centres.

.6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 12 mm x 12 mm mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvers in formed U-frame.

.8 Finish: factory anodized. Colour: to the Contract Administrator’s approval.

.9 For sizes and performance data, refer to the drawings.

3. EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Installation

.1 In accordance with manufacturer's and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

3.3 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Filters and filter gauges for various types of mechanical air handling equipment.

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements

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

.2 Section 23 73 11 – Air Handling Units - Packaged.

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 52.1-1992, Gravimetric And Dust Spot for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter (ANSI Approved).

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-115.10-M90, Disposable Air Filters for the Removal of Particulate Matter from Ventilating Systems.

.2 CAN/CGSB-115.14-M91, High Efficiency Cartridge Type Supported Air Filters for the Removal of Particulate Matter from Ventilating Systems.

.3 CAN/CGSB-115.18-M85, Filter, Air, Extended Area Panel Type, Medium Efficiency.

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

.1 Material Safety Data Sheets (MSDS).

.5 Underwriters' Laboratories of Canada

.1 ULC -S111-95, Standard Method of Fire Tests for Air Filter Units.

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings:

.1 Provide product data and installation recommendations from the manufacturer for each product. Indicate following:

.1 Air flow resistance at the clean condition, recommended maximum dust loading, and maximum pressure differential the filter is designed for.

1.6 Closeout Submittals

.1 Refer to Section 21 05 01 – Common Work Results for Mechanical.

1.7 Delivery, Storage and Handling

.1 Refer to Section 21 05 01 – Common Work Results for Mechanical.

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.9 Maintenance

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 21 05 01 – Common Work Results for Mechanical.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as frames and filters, addresses of suppliers, list of specialized tools necessary for adjusting, repairing or replacing for inclusion in operating manual.

.3 Spare filters: in addition to filters installed immediately prior to acceptance by Contract Administrator, supply one (1) complete set of filters for each filter unit or filter bank in accordance with Section 21 05 01 – Common Work Results for Mechanical.

2. PRODUCTS

2.1 General

.1 Media: suitable for air at 100% RH and air temperatures between minus 35°C and 50°C.

.2 Number of units, size and thickness of panels, overall dimensions of filter bank, configuration and capacities: as indicated.

.3 Pressure drop when clean and dirty, sizes and thickness: as indicated on schedule.

2.2 Accessories

.1 Holding frames: permanent "T" section or channel section construction of galvanized steel or extruded aluminum, 1.6 mm thick, except where specified.

.2 Seals: to ensure leakproof operation.

.3 Blank-off plates: as required, to fit all openings and of same material as holding frames.

.4 Access and servicing: through doors/panels on each side.

2.3 Pleated Fibrous Panel Filters

.1 Disposable pleated fibrous synthetic media: to CAN/CGSB-115.10 with adhesive.

.2 Holding frame: 28 pt. minimum thick beverage carrier board.

.3 Performance: Minimum Efficiency Reporting Value (MERV) value for pre-filter: MERV 8A filtration media to ASHRAE 52.2.

.4 Fire rated: to ULC S111.

.5 Nominal thickness: 50 mm.

.6 Acceptable Material: American Air Filter (AAF) PerfectPleat HC 8 or equivalent in accordance with B8.

2.4 Cartridge Type Filters, 80-85 % Efficiency

.1 Media: deep pleated, disposable, high efficiency.

.2 Holding frame: thermoplastic frame, header and cell sides.

.3 Media support: ABS plastic.

.4 Final filter: Minimum Efficiency Reporting Value (MERV) of 13A in accordance with ASHRAE 52.2

.5 Fire rated: to ULC S111.

.6 Acceptable Material: American Air Filter (AAF) VariCel VXL or equivalent in accordance with B8.

2.5 Filter Gauges - Dial Type

.1 Diaphragm actuated, direct reading.

.2 Range: 0 to 2 times initial pressure, 0 to 250 Pa minimum.

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 General

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

3.3 Replacement Media

.1 Replace media with new upon acceptance.

.2 Filter media new and clean, as indicated by pressure gauge, at time of acceptance.

3.4 Filter Gauges

.1 Install type as indicated across each filter bank (pre-filter and final filter) in approved and easy readable location.

.2 Mark each filter gauge with value of pressure drop for clean condition and manufacturer's recommended replacement (dirty) value.

3.5 Cleaning

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

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 General

.1 For additional information, refer to Section 21 05 01 – Common Work Results for Mechanical and Division 1 - General Conditions of the Contract.

.2 For a list of applicable codes and standards, refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 The mechanical Subcontractor shall be responsible for coordinating all aspects of this work.

.4 Locations of equipment, ductwork, pipework, and all associated appurtenances indicated on the Drawings are approximate only. The Contractor is responsible for checking and coordinating the locations of equipment, ductwork, pipework, and all associated appurtenances and shall make any necessary adjustments in positions to conform with the architectural features, other services, symmetry and lighting arrangements.

1.2 Scope of Work

.1 The scope of work for this section includes, but is not limited to, the following:

.1 Materials and procedures for the provision and installation of packaged custom air handling equipment.

1.3 Related Work

.1 This Section may not contain all materials, equipment and requirements required for the completion of this project. This Section is to be read in conjunction with the remaining Sections of Division 21, 22 and 23 any and all related works.

.2 Division 1 forms an integral part of Division 10, 21, 22 and 23.

.3 Related Requirements

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

.2 Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

.3 Section 23 05 53.01 – Mechanical Identification.

.4 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.5 Section 23 07 13 – Duct Insulation.

.6 Section 23 09 33 – Electric and Electronic Control System for HVAC.

.7 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

.8 Section 23 33 15 – Dampers – Operating.

.9 Section 23 44 00 – HVAC Air Filtration.

1.4 References

.1 Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

.2 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)

.1 ANSI/ARI 430-99(R2002), Central-Station Air-Handling Units.

.3 American Society of Heating, Refrigeration and Air Condition Engineers (ASHRAE)

.1 ANSI/ASHRAE 90.1-2007, (I-P) Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ANSI/ASHRAE 52.2-2007, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.4 Master Painters Institute (MPI)

.1 MPI-INT 5.3-2007, Galvanized Metal.

1.5 Action and Informational Submittals

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings:

.1 Provide drawings stamped, dated and signed by the general contractor to indicate acceptance, and stamped by a professional engineer registered or licensed in Manitoba, Canada where indicated in these specifications.

.2 Indicate following: fan fan curves showing point/range of operation, motor drive, bearings, filters, mixing box, dampers, heating coils, include performance data.

1.6 Closeout Submittals

.1 Refer to Section 21 05 01 – Common Work Results for Mechanical,

1.7 Delivery, Storage and Handling

.1 Refer to Section 21 05 01 – Common Work Results for Mechanical,

1.8 Quality Assurance

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.9 Maintenance Material Submittals

.1 Provide maintenance materials in accordance with Section 21 05 01 – Common Work Results for Mechanical.

.2 Provide one (1) spare set of filters.

.3 Provide list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

.4 Spare filters: in addition to filters installed immediately prior to acceptance Contract Administrator, supply one (1) complete set of filters for each filter unit or filter bank.

2. PRODUCTS

2.1 General – MAU-U-20

.1 Factory assembled components to form indoor unit supplying air at designed conditions, to maintain constant pressure as indicated.

.2 Certify ratings: to ANSI/ARI 430 with ARI seal.

.3 Horizontal type, as indicated, having air tight modular components, consisting of casing, fan section with motor and drive, filter section, dampers, bypass section, heating coils, mixing box and integral controls/electrical cabinet.

.1 Discharge plenum on top of unit with integral aluminum diffusers on three sides sized for 1.3 m/s discharge velocity

.4 Configuration as shown on drawings.

2.2 Casings

.1 G-90 galvanized steel double wall construction with reinforcement and bracing for rigidity.

.1 Outer casing wall and roof: 1.3 mm thickness.

.2 Inner casing liner: 0.85mm thickness.

.3 Inner floor: 1.3 mm thickness.

.4 Outer floor: 0.85mm thickness.

.2 Hinged inspection doors: provide access for maintenance of internal parts.

.3 Integral 100 mm welded black iron channel base, painted.

.4 Paint steel parts, where not galvanized, with corrosion resistant paint.

.5 Finish unit, inside and out, with rust resistant enamel.

.2 Line casing with solid galvanized steel liner.

2.3 Cabinet Insulation

.1 Do not use expanded polystyrene and polyurethane insulation materials in this unit.

.2 Insulate between outer and inner surface of panels with 50mm high density mineral wool insulation of 56 kg/m³ density.

.1 No fibrous insulation to be exposed to the airstream.

2.4 Fan

.1 Cabinet hung, direct drive plenum fan with heavy duty 200,000 hours service self-aligning bearings.

.1 Provide AMCA-rated for sound and performance tested centrifugal fans with backward inclined SWSI wheel, selected to operate in stable part of performance curve at all times.

.2 Motor: TEFC to ASHRAE 90.1, 2.24 kW, 1725 r/min maximum.

.2 Maximum sound power levels, as indicated.

.3 Internally mounted motor and fan.

2.5 Vibration Isolation

.1 Vibration isolators on fan frame within fan section: neoprene rubber pads in accordance with Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

2.6 Variable Volume Devices

.1 Variable speed drives: 6 to 60 Hz range,

2.7 Filter Box

.1 Material to match casing. For flat panel pre-filter and cartridge type final filter arrangement:.

.1 Provide access to filter through hinged door with suitable hardware.

.2 Provide blank-off plates and gaskets to prevent air bypass.

.3 Filters: in accordance with Section 23 44 00 - HVAC Air Filtration.

.1 Minimum Efficiency Reporting Value (MERV) value for pre-filter: MERV 8A filtration media to ASHRAE 52.2.

.2 Final filter: Minimum Efficiency Reporting Value (MERV) of 13A in accordance with ASHRAE 52.2.

2.8 Mixing Box

.1 Material to match casing and produce uniformly mixed air temperature within plus or minus 5°C of design across face of outlet.

2.9 Dampers:

.1 Dampers for mixing boxes: in accordance with Section 23 33 15 - Dampers - Operating.

.2 Hollow airfoil aluminum extrusions for blades with low leakage silicon rubber blade tip seals and side seal vanes.

.1 Acceptable material: Tamco 1000.

2.10 Coils

.1 Capacity: as indicated in schedules on drawings.

.2 Voltage: 575V 3 phase.

.3 Construction:

.1 Casings: 1.5 mm thick galvanized sheet steel.

.1 Supports of galvanized steel double angle frames.

.2 Blank-off plates. Insulated sandwich construction.

.3 Elements: 80% nickel, 20% chrome open wire resistance type..

.4 Control: Full modulation SCR.

.5 Accessories:.

.1 Discharge air temperature sensor.

.2 Airflow sensor.

.3 High limit sensor.

.4 Phase ad burn-out protection.

.5 Digital input for coil shut-down on generator operation for coil EHC-U20-02.

2.11 Power and Controls.

.1 Single point of power supply.

.1 Incoming power: 575 Volt 3phase, 60 Hz.

.2 Non-fused NEMA 3R main electrical disconnect switch.

.3 VFD with integrated starter and overloads.

.4 Internal transformation for control voltages as required.

.2 Control panel complete with:

.1 Unit Summer/Off/Winter Switch.

.2 Unit in function light.

.3 Main heating coil EHC-U20-01 in function light.

.4 Bypass coil EHC-U20-02 in function light.

.5 Clogged filter alarm light.

.6 Discharge temperature selector.

.7 Bypass heater EHC-U20-02 temperature selector.

.8 Internal terminal strips for the following output and input signals:

.1 Unit shut-down alarm dry contact.

.2 Low Limit alarm dry contact.

.3 Clogged filter alarm dry contact.

.4 Airflow proving dry contact

.9 Room thermostat for unit control in summer mode.

.10 Pressure sensor with 0 – 10VDC signal feedback to drive the VFD to maintain 25 Pa positive space pressure referenced to outdoor air pressure.

.11 Adjustable inlet temperature thermostat for heat cut-off in mild weather, and to enable EHC-U20-02 in cold weather.

.12 Adjustable inlet temperature thermostat to switch unit between summer and winter modes based on outdoor air temperature entering the unit.

.13 Discharge temperature thermostat with 300 second timed delay to annunciate the low-limit alarm when air below 4°C is leaving the unit.

.14 All wiring to be tagged, main electrical components to be labeled and all terminal strips are to be numbered.

2.12 Acceptable Material:

.1 Bousquet custom air handling unit as per schedule on drawings, or equivalent in accordance with B8.

3. EXECUTION

3.1 Application

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

3.2 Installation

.1 Provide appropriate protection during handling and installation.

.2 Install units in accordance with manufacturer's instructions and as indicated.

.3 Ensure adequate clearance for servicing and maintenance.

.4 Provide signage on the control panel door of the unit to indicate "**Danger – This Equipment Has More Than One Power Source**"

3.3 Fans

.1 Remove any shipping blocking and ensure that the fan wheel rotates smoothly and without binding.

3.4 Filters

.1 Ship filters separate from unit in original packaging.

.2 Provide one set of clean filters for commissioning and balancing and one set of filters to be installed at acceptance.

3.5 Sequence of Operation

.1 The controls of this unit are included in the scope of supply from the factory, prewired, tested and with site support for start-up and verification.

.1 The fan of MAU-U-20 shall run continuously, and its speed be controlled by a variable frequency drive to maintain a positive pressure of +25 – 28 Pa in the Control Room referenced to the outdoors. When the fan of MAU-U-20 is energized, the inlet damper MD-U20-01 from outdoors shall be driven fully open. Upon the pressure in the Control Room exceeding +28 Pa when referenced to the outdoors, the fan control shall ramp down the VFD speed until the pressure is below +28 Pa within 5 seconds. When the pressure in the Control Room is less than +25 Pa, when referenced to the outdoors, the fan control shall ramp up the VFD speed until the pressure is above +25 Pa within 5 seconds.

.2 When the Control Room space pressure drops below +25 Pa, the pressure sensor PS-U20-01 will trigger an alarm contact to change state and will be monitored by the Process Control Panel. The Programmable Logic Controller (PLC) in the Process Control Panel will use the security monitoring features to determine if the pressure drop is due to doors being open, and if this is true, the PLC will just display the alarm locally. If no doors are open, then an alarm condition will be annunciated to the monitoring control room at the McPhillips Street Pumping Station.

.3 When the pressure drop through the filter bank exceeds a programmed setting (250 Pa, field adjustable) then an alarm contact will become energized for a future alarm output to the Process PLC, and illuminating an LED alarm light on the unit control panel.

.4 If the discharge air temperature sensor detects a leaving air temperature below +4°C, the unit shall continue to operate and an alarm contact will become energized for a future alarm output to the Process PLC, and illuminating an LED alarm light on the unit control panel.

.5 In WINTER mode: The outdoor air temperature sensor in the intake duct will sense when the outdoor air temperature is less than 15°C, and will permit damper MD-U20-02 to modulate to recirculate discharge air and maintain a minimum +4°C mixed air temperature as sensed by an averaging element at the inlet to the filters. Should the door(s) to the Control Room be opened, the pressure sensor PS-U20-01 will sense the rapid space pressure loss, the supply fan will ramp up and damper MD-U20-02 will close within 5 seconds to bring in 100% outdoor air. EHC-U20-01 in the main air stream of MAU-U-20 will modulate its output using an SCR controller to maintain a constant 15°C supply air temperature. The electric heating coil EHC-U20-01 will be protected by a flow sensor and hi-limit thermostat to avoid damage to the coil from fluctuating air flow and temperature.

.1 Should the mixed air temperature sensed by the averaging element at the inlet to the filters, and the damper MD-U20-02 be fully open, EHC-U20-02 in the bypass airstream will be energized and will modulate the output to maintain +4°C mixed air temperature as sensed by an averaging element at the inlet to the filters.

.2 The electric heating coil EHC-U20-02 will be protected by a flow sensor and hi-limit thermostat to avoid damage to the coil from fluctuating air flow and temperature.

.3 When normal power is available, the ”loss of normal power input terminals” will receive a 120 VAC signal from the MCC provided by Division 26 that permits EHC-U20-02 to operate when required. When normal power is not available, the “loss of normal power input terminals” will not receive a signal from the MCC indicating that normal power is not available and the generator will soon start. When normal power is not available, MAU-U-20 internal controls will de-energize the by-pass heating coil EHC-U20-02 before the diesel generator is connected to the load, and will close the by-pass damper DM-2 within 90 seconds.

.6 In SUMMER mode: The outdoor air temperature sensor in the intake duct will sense when the outdoor air temperature is more than 15°C, and will signal damper MD-U20-02 to modulate to closed to bring in 100% outdoor air. Should the door(s) to the Control Room be opened, the pressure sensor PS-U20-01 will sense the rapid space pressure loss, the supply fan will ramp up to 1835l/s airflow (by field measurement and calibration of VFD drive) and will remain there until the space pressure rises above +25 Pa relative to the outdoors. EHC-U20-01 in the main air stream and EHC-U20-02 in the bypass of MAU-U-20 will remain off.

.1 During SUMMER mode operation, the supply fan speed can be increased independently from the space pressure controls in response to a modulating signal corresponding to the space temperature as measured by a space temperature sensor. The supply air delivery can be increased above the discharge air required to meet the pressurization control, but the discharge air volume required to meet the space pressurization will form the minimum fan speed control. The space temperature setpoint that will initiate the discharge air increase is 30°C.

3.6 Cleaning

.1 Clean in accordance with the Contract Administrator's instructions.

END OF SECTION