

PART 1 - GENERAL

1.1 Intent

- .1 Provide complete, fully tested and operational mechanical systems to meet the requirements described herein and in complete accord with applicable codes and ordinances.
- .2 In general, work in this Division includes:
 - .1 Supply and installation of process and sump pumps.
 - .2 Supply and installation of discharge pipe drain, wetwell air vent, and clean out suction piping
 - .3 Supply and installation heating and ventilation systems.
- .3 Drawings are diagrammatic. They establish scope, material and installation quality and are not detailed installation instructions.
- .4 Follow Manufacturers' recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents.
- .5 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors. Uncrate equipment, move in place, install complete; start-up and test.
- .6 'Provide' shall mean; "supply and install".

1.2 Co-ordination of Work

- .1 Make reference to electrical, mechanical, structural and architectural drawings when setting out Work. Consult with respective Divisions in setting out locations for ductwork, equipment, and piping, so that conflicts are avoided. Jointly resolve all conflicts on-site before fabricating or installing any materials or equipment.
- .2 Where dimensional details are required, coordinate with the applicable architectural and structural drawings.

1.3 Quality of Work

- .1 All Work shall be by qualified tradesmen with valid Provincial Trade Qualification Certificates.
- .2 Work which does not conform to standards accepted by the Contract Administrator and the trade may be rejected.

~End~

PART 1 - GENERAL

1.1 Scope

- .1 The scope of this section includes the design, supply, delivery, installation assistance and commissioning of all equipment and appurtenances required for the pumps and monitoring process.
- .2 Scope of supply consists of the following major items:
 - .1 Process pumps, complete with power and control cables.
 - .2 Pump monitoring equipment.
 - .3 Provide installation training.
 - .4 Supervise the installation of the equipment.
 - .5 Supervise equipment performance testing and commissioning.
 - .6 Provide As-Built mark-up drawings documenting all changes made.
 - .7 Provide technical support and remedy defects during the Warranty Period.
- .3 The supplied equipment shall include all accessories required to ensure the supplied equipment safely and satisfactorily operates as an integral system as required by the Bid Opportunity.
- .4 Provide any appurtenances or services not specifically mentioned or included in the Contract Documents but which are necessary as part of the Work to ensure that the equipment is fully operational when installed.

1.2 Shop Drawings

- .1 Provide shop drawings showing pumps, monitoring equipment, power and control cable system, etc.
- .2 Provide discharge pipe shop drawings, stamped by a Professional Engineer as being suitable for this application.

1.3 Operating And Maintenance Manuals

- .1 Prior to the time of Equipment Performance Testing, submit to the Contract Administrator for review two (2) draft copies of Operating and Maintenance (O&M) manuals containing information required by the Specifications. All instructions in these manuals shall be in simple language to guide the City in the proper operation and maintenance of the installation.
- .2 Submit O & M manuals in paper format.
- .3 Furnish four (4) complete O & M. Provide information as specified in this Section for installation check-out, operation, maintenance, and lubrication requirements for each unit of mechanical, electrical, and instrumentation equipment or system and each instrument.
- .4 Customize the O&M manuals to describe the equipment actually furnished. Do not include extraneous data for models, options, or sizes not furnished. When more than one (1) model or size of equipment type is furnished, show the information pertaining to each model, option or size.

- .5 In addition to information called for in the Specifications, include the following:
 - .1 Title sheet, labeled "Operating and Maintenance Instructions", and containing project name and date.
 - .2 List of contents.
 - .3 Record Shop Drawings of all mechanical and electrical systems.
 - .4 Full description of entire mechanical and electrical system and operation.
 - .5 Address and telephone number of the Contractor and the nearest Contractor's Representative, including distributors for parts, servicing, and repairs.
 - .6 Detailed Specification and O&M instructions for all items of equipment provided including a preventative maintenance program.
 - .7 Process control/operating instructions for each component and the entire system as a whole. This shall include, but not necessarily be limited to:
 - .1 The Contractor's recommended step-by-step procedures for starting and stopping under normal and emergency operation. Include all specified modes of operation including recommended operation after the assembly or equipment has been in long-term storage.
 - .2 Control diagrams with data and information to explain operation and control of systems and specific equipment.
 - .3 Technical information on all alarms and monitoring devices provided with the equipment.
 - .4 Routine maintenance requirements including procedures and specific description of consumable items such as lubricants, filter, seals, etc. and listing Canadian sources of supply.
 - .5 Complete disassembly, inspection, repair and re-assembly instructions including required tolerances, fastener pre-loads, specialty tools and any other information necessary to restore equipment to correct operation.
 - .8 List of spare and replacement parts and consumables.
 - .9 List of special tools.
 - .10 Nameplate information including equipment number, make, size, capacity, model number, serial number and equipment tag number.
- .6 Submit separately originals of all warranties and guarantees. Arrange to conform to same sequence as project Specifications.

1.4 Definitions

- .1 Contractor's Representative: A Contractor's Representative is a trained serviceman empowered by the Contractor to provide:
 - .1 Witnessing of delivery
 - .2 Witnessing of equipment installation
 - .3 Assistance in equipment commissioning
 - .4 Confirmation of satisfactory equipment operation

- .5 Participation in the performance testing.

1.5 Equipment Delivery

- .1 Pack and crate each component to provide protection during transport, handling, and storage. The Contractor shall identify each component with durable labels or tags securely attached to each piece of equipment, crate or container.
- .2 Protect polished and machined metal surfaces from corrosion and damage during shipment and storage. Protect threaded connections with threaded plugs or caps and protect open plain end pipes with caps. Pack electrical equipment and control panels to prevent scratching, access by dirt, moisture, or dust or damage to insulation, and shall cover equipment having exposed bearings and glands to exclude foreign matter. All openings in the equipment shall be covered before shipment. Sufficient lifting hooks shall be supplied for handling all crates or boxes and heavy pieces

1.6 Installation Support

- .1 Provide instructions regarding the installation of the equipment. If it is found necessary, or if so directed by the Contract Administrator, attend the site to provide assistance during installation.
- .2 Prior to completing installation, the Contract Administrator will inform the Contractor and arrange for the attendance at the Site of the Contractor to verify successful installation.
- .3 Conduct a detailed inspection of the installation including, wiring, electrical connections, controls and instrumentation, rotation direction, running clearances, lubrication, workmanship, and all other items as required to ensure successful operation of the equipment.
- .4 Identify any outstanding deficiencies in the installation and provide a written report to the Contract Administrator describing such deficiencies.
- .5 Deficiencies shall be rectified and the Contractor's Representative shall then re-inspect.
- .6 Demonstration Test: Given the limited amount of water available for testing prior to March 31, 2009, each pump shall operate for 5 minutes to confirm pumps and related controls are functioning. If water is not available from the wetwell inlet pipe, close the wetwell gate valve and fill the wetwell with water 3 times, once for each pump, to provide water for this demonstration test.
- .7 Performance Test: Run each pump for up to 4 hours without operating problems to confirm its electrical and control systems are operating satisfactorily. During this test period, pumps will be run one, two and three at a time to verify electrical systems are working as intended. This test will be performed as soon as a sufficient amount of water has accumulated in the deep pond due to natural land drainage in the Spring of 2009.
- .8 Should the initial demonstration, and performance test reveal any defects, then those defects shall be promptly rectified and the tests repeated.

1.7 Quality Assurance

- .1 Build motors in accordance with Canadian Standards Association (CSA) C22.2 No. 100, CSA C22.2 No. 145, National Electrical Manufacturer's Association (NEMA) Standard MG1, and to the requirements specified.

1.8 Shipment, Protection And Storage

- .1 Ship, protect, and store equipment in a manner that prevents damage or premature aging.

- .2 Handle motors with suitable lifting equipment.
- .3 Store motors in heated, dry, weather-protected enclosure.

PART 2 - PRODUCTS

2.1 Acceptable Pump and Motor Manufacturers

- .1 Flygt
- .2 KSB
- .3 ABS
- .4 Ebara

2.2 Pump Motors

- .1 Heavy duty service.
- .2 Squirrel cage induction type with non-hygroscopic windings. Insulation temperature rise not to exceed Class F. Insulation to be moisture resistant.
- .3 For starting and torque characteristics, conform to Electrical and Electronic Manufacturers Association of Canada (EEMAC) Design B.
- .4 Provide motor nameplate rated for 600 V, 60 Hz, 3-phase service unless otherwise noted.
- .5 Design motors for full voltage starting and capable of running successfully when terminal voltage is from +10% to -10% of nameplate voltage. Motors with a service factor of 1.0 shall run at not more than 90% of nameplate current rating and motors with a service factor of 1.15 shall operate at not more than 100% of nameplate current rating.
- .6 Provide motors capable of ten (10) evenly spaced starts per hour on a continuous basis without temperature rises which would harm insulation and windings.
- .7 Design motors for semi-continuous immersion in liquid with an ambient temperature of 40°C unless higher temperatures are noted. Design casing for adequate heat rejection. Designs utilizing the circulation of the pumping liquid are not permitted.
- .8 Design the pump control / monitoring system with solid modules for monitoring motor stator high temperature, high bearing temperature and moisture sensing / water intrusion into the stator housing and seal chamber.
- .9 Provide sealed ball bearing type bearings with an Anti-Friction Bearings Manufacturers Association (AFBMA) B10 life of 100,000 hours.
- .10 Provide 304 or 316 stainless steel hardware.

2.3 Motor Cable

- .1 Supply submersible motors with cable, of a minimum length to reach the pump's control panel/starter. The motor and cable to be capable of continuous submergence under water without loss of watertight integrity to a depth of 20 m.
- .2 Provide cable that contains power and ground wires, copper, of sufficient size for the service and in compliance with applicable codes.
- .3 Provide cable that contains instrument leads, shielded as necessary to prevent electrical interference.

- .4 Provide heavy duty cable, water tight and capable of withstanding operating loads.
- .5 Seal end of cable prior to shipping to prevent ingress of moisture.

2.4 Pump and Discharge Pipe System Description

- .1 Mount pumps onto seats at the bottom of vertical discharge pipes in a wet pit. The pumps are held in place by their own weight and the pumping head.
- .2 Make pumps completely removable from the discharge columns from above so that entry into the wet pit is not required for inspection or service.
- .3 Close-couple pump and motor to form one integrated direct drive unit.
- .4 Provide the discharge pipes complete with seats and support flanges, as required to provide a long term, reliable operating interface with the pumps.
- .5 Provide a stainless aircraft cable guide system that will engage a lifting chain with the pump to lift it out of the station. The guide cable shall include a turnbuckle or similar system for pulling the cable tight. Fasten the lifting chain guide cable to the support bar/beam located just below the pump access hatch

2.5 Pump Capacity and Performance

- .1 Provide 3 pumps.
 - .1 Drive: Constant Speed
 - .2 Design Point – Flow: 0.6 m³/s
 - .3 Design Point – Head: 10 m
 - .4 Peak Operating Head Range: 8 to 12 m

2.6 Pump Detailed Specifications

- .1 Cast iron pump casing and impeller.
- .2 Fabricate all exposed nuts and bolts of 304 stainless steel.
- .3 Cast iron A48, impeller.
- .4 Use single piece shaft.
- .5 Completely isolate the shaft from the pumped liquid.
- .6 Provide bearings with a minimum Anti-Friction Bearings Manufacturers Association (AFBMA) B10 bearing life of 100,000 hours minimum.
- .7 For the lower bearing include a thermal sensor (RTD) of the platinum - 100 type to monitor the temperature of the thrust bearing outer race during operation.
- .8 Provide 2 sets of tungsten carbide shaft seals between the impeller and the motor.
- .9 Design each pump and motor to be cooled by the passage of the pumped fluid up, about, and past the motor housing.
- .10 Provide adequate length of cable to reach the junction box without splices, situated outside the pump chamber.
- .11 Make outer jacket of oil resistant chloroprene rubber and insulate the copper conductors with ethylene-propylene rubber. Make the cable UV protected and abrasion resistant.
- .12 Use cable rated for 750V and 90°C.

- .13 Design the cable entry to be 100% watertight during immersion of up to 20 m depth, while providing sufficient strain relief to prevent the cable from pulling out when handling, installing or operating the pump.
- .14 Design the junction box with two (2) separate terminal boards, one for connecting the signal wires and signal cable, and one (1) for connecting the stator leads and power cables.
- .15 Seal the lower terminal board from the motor by an elastomer compression seal (O-ring) so that it is leakproof.
- .16 In the junction box, provide a collection cavity placed so that any leakage into the junction box terminates in the cavity. Separately wire a sensor in the cavity to provide an alarm in the event of water intrusion into the cable junction box.
- .17 Provide a pump control status monitoring system for each pump. The motor starters, disconnect switches, and other power ancillaries will be provided by the installation contractor.
- .18 Design the pump control/monitoring system with solid state modules for monitoring motor stator high temperature, high bearing temperature and moisture sensing/water intrusion into the stator housing and cable connection housing.
- .19 Control system shall have capabilities equal to the Flygt 'MAS' system.
- .20 For each pump control/monitoring system provide sufficient wiring to connect between the pump and the control enclosure.
- .21 Provide an O-ring seal at the bottom of the pump inlet so that the weight of the pump unit effectively forms a seal between pump and discharge column.

2.7 Factory Tests & Factory Performance Testing

- .1 Perform the following inspections and tests on each pump before shipment from the factory. Include the test results in the O&M Manuals.
- .2 Test motor and cable insulation for defects.
- .3 Submerge the pump and run for thirty (30) minutes.
- .4 Simulate the head conditions at 8 m and at 12 m.
- .5 Develop a certified test curve (per Hydraulic Institute Class A standards) showing the performance of the pump.
- .6 Repeat the insulation tests after the operational test.
- .7 Document the tests and submit the results.

2.8 Pump Discharge Pipes

- .1 Within one week of Contract award submit for review detailed pump discharge pipe fabrication drawings and welding procedures stamped by a Professional Engineer as being suitable for this application for review.

PART 3 - MEASUREMENT AND PAYMENT

3.1 Method of Measurement and Payment

.1 Propeller Pumps and Discharge Pipes

- .1 The supply, installation and testing of propeller pumps and discharge pipes will be measured and paid for at the Contract Lump Sum Price for "Supply, Installation and Field Testing of Propeller Pumps and Discharge Pipes", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

~End~

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Supply and delivery of Sump Pump as specified herein.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.2 Shop Drawings.

.1 Submit shop drawings to indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

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

.4 Instructions: submit manufacturer's installation instructions.

Part 2 Products

2.1 SUMP PUMP

.1 Submersible sump pump shall be rated for 6.3 L/s @ 138 kPa (100 usgpm @ 45ft).

.2 Motor - 2 HP, 3450 RPM, 240 V/1 PH/60 Hz, oil filled, hermetically sealed, automatic reset, thermal overload protected (1 PH).

.3 Durable Epoxy Coated cast iron construction.

.4 Bearings - Lower ball & upper sleeve.

.5 Stainless Steel Motor Shaft

.6 Dual Mechanical Shaft Seals - Stainless steel, Carbon/Ceramic rotary.

.7 Impeller - Non-clogging bronze vortex design passes 2" spherical solids.

.8 50 foot UL Listed 3-wire neoprene cord and plug.

.9 50mm (2" NPT) discharge with 75mm (3") flange.

- .10 Stainless steel screws, bolts and handle.
- .11 Corrosion resistant powder coated epoxy finish.
- .12 Acceptable Product: "Zoeller" Model: 6295, Flygt, ABS

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

Part 4 Measurement And Payment

4.1 Method of Measurement and Payment

- .1 Sump pump
 - .1 The supply and installation of sump pumps shall be considered incidental to the Contract Lump Sum Price for "Mechanical Piping and Misc."

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation of the following:
 - .1 Sch. 80 PVC pressure relief piping
 - .2 Sch. 10 304 stainless steel drain piping

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).
 - .1 ANSI/ASME B16.15-02, Cast Bronze Threaded Fittings, Classes 125 and 250.
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A307-03, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM F492-95, Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings.

1.3 SUBMITTALS

- .1 Submit product data for following: valves.

Part 2 Products

2.1 DRAIN PIPE – STAINLESS STEEL

- .1 Piping
 - .1 304 stainless steel piping, sch. 10S, ERW, ASTM A312 Gr. TP304
- .2 Nipple
 - .1 threaded one end, sch. 40S, seamless, ASTM A312 Type 304
- .3 Fittings
 - .1 Butt weld, sch. 10S, ASTM A403 Gr.WP304, ANSI B16.9
- .4 Flanges
 - .1 Forged S.S. weld-neck or slip-on, ASTM A182 Gr. F-304, ANSI B16.5 Class 150 (Use flat face weld-neck or slip-on flanges and full face gaskets when connecting to flat face cast iron or plastic flanges.)
- .5 Branch Connections
 - .1 Equal tee and reducer, or reducing tee – butt weld
- .6 Bolting

- .1 BOLTS: S.S. ASTM A307 Gr.B, ANSI B18.2.1 Semi-finished Heavy Hex. Head, ANSI B1.1 UNC Class 2A Thread.
- .2 NUTS: S.S. ASTM A563 Gr.A, ANSI B18.2.2 Semi-finished Heavy Hex., ANSI B1.1 UNC Class 2B Thread.
- .7 Gaskets
 - .1 Compressed non-asbestos, 1.6mm (1/16") thickness

2.2 PRESSURE RELIEF PIPING – SCH. 80 PVC

- .1 Piping: Schedule 80 PVC to ASTM D1785
- .2 All PVC Schedule 40 pipe shall be manufactured from a Type I, Grade I Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454 per ASTM D1784. The pipe shall be manufactured in strict compliance to ASTM D1785 and D2665 (where applicable), consistently meeting and/or exceeding the Quality Assurance test requirements of these standards with regard to material, workmanship, burst pressure, flattening, and extrusion quality.

2.3 SUCTION PIPE

- .1 Galvanized Pipe: Schedule 10 to ASTM A 53
- .2 Zinc coating: average 460 Gm/m²

2.4 PLUG VALVE

- .1 NPS 2 ½ and over, flanged:
 - .1 General – Plug valve shall be suitable for waste water (sludge with 3% solids content) service with pressures up to 1200 kPa (175 psig). The exterior of the valve shall be coated with a universal alkyd primer. Valves shall be marked with the serial number, manufacturer, size, and working pressure on a corrosion resistant nameplate.
 - .2 Body – ASTM A126 Class B cast iron for working pressure up to 1200 kPa (175 psig).
 - .3 Plug – one-piece construction, made of ASTM A126 Class B cast iron with resilient facing per ASTM D2000-BG and ANSI/AWWA C504
 - .4 Connections – Flanged to ANSI B16.1, Class 125
 - .5 Bearings – Radial shaft bearings shall be constructed of self-lubricating type 316 stainless steel. The top thrust bearing shall be Teflon. The bottom thrust bearing shall be type 316 stainless steel.
 - .6 Actuator – provide extended bonnet with gear operator to suit.
 - .7 Port – Port area shall not be less than the pipe area.
 - .8 Acceptable Product: “Val-Matic” Series SS-601 or approved equal in accordance with B6.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with NPC and local authority having jurisdiction.
- .2 Assemble piping using fittings manufactured to ANSI standards.

Part 4 - Measurement And Payment

4.1 METHOD OF MEASUREMENT AND PAYMENT

- .1 Piping and Valves
 - .1 The supply and installation of piping and valves shall be considered incidental to the Contract Lump Sum Price for "Mechanical Piping and Misc."

END OF SECTION

PART 1 - GENERAL

1.1 Summary

- .1 Section Includes:
 - .1 Materials and installation of low-pressure metallic ductwork, joints and accessories.
- .2 Related Sections:
 - .1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 References

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A480/A480M-03c, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A635/A635M-02, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
 - .3 ASTM A653/A653M-03, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33 .
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .5 National Fire Protection Association (NFPA).
 - .1 NFPA 90A-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B-02, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
 - .3 NFPA 96-01, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition 1995 and Addendum No. 1, 1997.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.
 - .3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.

1.3 Quality Assurance

- .1 Certification of Ratings:

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

PART 2 - PRODUCTS

2.1 Seal Classification

- .1 Classification as follows:

<u>Maximum Pressure Pa</u>	<u>SMACNA Seal Class</u>
500	C
250	C
125	C

- .2 Seal classification:

- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.
- .3 Class C: transverse joints and connections made air tight with gaskets, sealant or combination thereof. Longitudinal seams unsealed.

2.2 Sealant

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

2.3 Duct Leakage

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

2.4 Fittings

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows.
 - .1 Rectangular: standard radius or short radius with single thickness turning vanes. Centreline radius: 1.5 times width of duct.
 - .2 Round: smooth radius. Centreline radius: 1.5 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 1.5 times width of duct or 45 degrees entry on branch.
 - .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 As indicated.
- .7 Obstruction deflectors: maintain full cross-sectional area.
 - .1 Maximum included angles: as for transitions.

2.5 Galvanized Steel

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

2.6 Hangers And Supports

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

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:
 - .1 For concrete: manufactured concrete inserts.
 - .2 For steel joist: manufactured joist clamp.
 - .3 For steel beams: manufactured beam clamps:

PART 3 - EXECUTION

3.1 General

- .1 Do work in accordance with SMACNA as indicated.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
 - .1 Ensure diffuser is fully seated.
- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.

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

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:

3.3 Watertight Duct

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

3.4 Sealing And Taping

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

3.5 Leakage Tests

- .1 Perform 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 Complete test before performance insulation or concealment work.

Part 4 Measurement and Payment

4.1 METHOD OF MEASUREMENT AND PAYMENT

- .1 Metal Ducts – Low Pressure to 500 PA
 - .1 The supply and installation of metals ducts shall be considered incidental to the Contract Lump Sum Price for “Ventilation System”.

~End~

PART 1 - GENERAL

1.1 Summary

- .1 Section Includes:
 - .1 Fans, motors, accessories and hardware.
- .2 Related Sections:
 - .1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 References

- .1 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.
- .2 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.

1.3 System Description

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
 - .2 Capacity: flow rate, total 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.

1.4 Submittals

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet. Include product characteristics, performance criteria, and limitations.
- .2 Shop Drawings:
 - .1 Submit shop drawings and product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

- .3 Provide:
 - .1 Fan performance curves showing point of operation, kW and efficiency.
 - .2 Sound rating data at point of operation.
- .4 Indicate:
 - .1 Motors, sheaves, bearings, shaft details.
- .5 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

PART 2 - PRODUCTS

2.1 Exhaust Fan (EF-1).

- .1 Direct drive centrifugal inline fan, rated for 378 L/s @ 62.5 Pa., 1550 FRPM, 120/1/60, 1/8 HP TEAO motor w/ thermal overload, galvanized steel housing, backward inclined aluminum wheel, two bolted access panels, integral duct connection flanges, ball bearing motors, corrosion resistant fasteners, spring hanging isolators and brackets, CSA labeled motor, c/w gravity backdraft damper
- .2 Acceptable Product: "Greenheck" Model: SQ-120-4

2.2 Exhaust Fan (EF-2)

- .1 Direct drive centrifugal inline fan, rated for 50 L/s @ 62.5 Pa., 1550 FRPM, 120/1/60, 1/8 HP TEAO motor w/ thermal overload, galvanized steel housing, backward inclined aluminum wheel, two bolted access panels, integral duct connection flanges, sleeve bearing motors, corrosion resistant fasteners, spring hanging isolators and brackets, CSA labeled motor, c/w gravity backdraft damper
- .2 Acceptable Product: "Greenheck" Model: SQ-60-D

PART 3 - EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Fan Installation

- .1 Install fans as indicated.
- .2 Bearings and extension tubes to be easily accessible.
- .3 Access doors and access panels to be easily accessible.

3.3 Cleaning

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

Part 4 MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 HVAC Fans

- .1 The supply and installation of HVAC Fans shall be considered incidental to the Contract Lump Sum Price for "Ventilation System".

~End~

PART 1 - GENERAL

1.1 Summary

- .1 Section Includes:
 - .1 Mechanical louvers; intakes; vents; and reinforcement and bracing for air vents, intakes and gooseneck hoods.
- .2 Related Sections
 - .1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 References

- .1 American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA)
 - .1 ANSI/NFPA 96-04, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E90-04, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .4 Society of Automotive Engineers (SAE)

1.3 System Description

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

1.4 Submittals

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions. Include product characteristics, performance criteria, and limitations.
 - .2 Indicate following:
 - .1 Pressure drop.
 - .2 Face area.
 - .3 Free area.
- .2 Quality assurance submittals:
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.

- .1 Contract Administrator will make available 1 copy of systems supplier's installation instructions.
- .3 Test Reports:
 - .1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

PART 2 - PRODUCTS

2.1 Louvre (L1)

- .1 Stationary drainable louvre, extruded aluminum construction, 102 mm (4") blades at 39 deg. angle, 600 x 600 mm dimensions, mill finish, 53.6% free area, 16 ga. aluminum bird screen.
- .2 Acceptable Product: "E.H. Price" Model: DE439.

PART 3 - EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Installation

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

Part 4 MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

- .1 Louvres, Intakes and Vents
 - .1 The supply and installation of louvers, intakes and vents shall be considered incidental to the Contract Lump Sum Price for "Ventilation System".

~End~

PART 1 - GENERAL

1.1 Summary

- .1 Section Includes:
 - .1 Supply and installation of electric unit heaters specified herein.
- .2 Related Sections:
 - .1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 References

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.46-M1988, Electric Air-Heaters.

1.3 Product Data

- .1 Submit product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.
- .2 Submit product data sheets for unit heaters. Include:
 - .1 Product characteristics.
 - .2 Performance criteria.
 - .3 Mounting methods.
 - .4 Physical size.
 - .5 kW rating, voltage, phase.
 - .6 Cabinet material thicknesses.
 - .7 Limitations.
 - .8 Colour and finish.
- .3 Submit product data sheets for unit heaters.
 - .1 Include product characteristics, performance criteria, physical size, limitations and finish.

1.4 Closeout Submittals

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

PART 2 - PRODUCTS

2.1 Electric Unit Heaters (EUH-1 and EUH-2)

- .1 Electric unit heaters shall be rated for 7.5 kW, 575/3/60, and shall have tubular heating elements, adjustable air flow louvers, permanently lubricated motors, overheat protection, phosphate coated 18 ga steel, and epoxy painted asa 61 grey. Fans/fan guards - fans shall be aluminum construction, static ally and dynamically balanced, and shall consist of combination fan guard / motor-mounting bracket. All units shall be complete with 120v controls & field mounted space thermostat, fan delay relay, and wall mounting bracket. All units shall be csa certified.

- .2 Acceptable Product: "Caloritech" Model: GE078Cc/w space stat, fan delay relay, and wall mounting bracket.

PART 3 - EXECUTION

3.1 Installation

- .1 Suspend unit heaters from ceiling or mount on wall as indicated.
- .2 Install thermostats in locations indicated.
- .3 Make power and control connections.

3.2 Field Quality Control

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Test cut-out protection when air movement is obstructed.
- .3 Test fan delay switch to assure dissipation of heat after element shut down.
- .4 Test unit cut-off when fan motor overload protection has operated.
- .5 Ensure heaters and controls operate correctly.

Part 4 MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

- .1 Unit Heaters - Electric
 - .1 The supply and installation of unit heaters shall be considered incidental to the Contract Lump Sum Price for "Ventilation System".

~End~