

Part 1 General

1.1 DESCRIPTION

- .1 This section specifies general clauses applicable to the supply and installation of all process mechanical systems.
- .2 The process mechanical systems include the anaerobic digester mixing systems handling process wastewater fluids.
- .3 The Work under this section shall include the supply, installation, testing and start-up of the Process Mechanical Material and Products to provide a complete and workable installation in accordance with the contract drawings and specifications and all applicable codes, standards and ordinances. Any work and/or other necessary materials not specifically mentioned in the specifications or shown on the drawings, but necessary to complete the installation, shall be furnished by the Contractor as if specifically mentioned herein and detailed.
- .4 All work related to process gas and the waste gas burner system are specified in Division 46.

1.2 RELATED SECTIONS

- .1 Refer to Division 26 for Electrical work related to Process Mechanical work.
- .2 Refer to Division 25 for Controls and Instruments related to Process Mechanical work.
- .3 All Sections Division 01 - are an integral part of this specification and shall be read in conjunction herewith.
- .4 The process mechanical drawings do not show structural details and any information involving accurate measurements of buildings. Refer to architectural and structural drawings as well as all other divisions of this specification.

1.3 WARRANTY

- .1 Furnish a written guarantee stating that all work executed in this contract will be free from defective workmanship and materials for a period of one (1) year from the date of substantial performance of work. The Contractor shall repair and replace any work which fails or becomes defective during the term of the guarantee/warranty, providing the operating and maintenance instructions have been complied with. The period of guarantee specified shall not, in any way, supplant any other guarantees of a longer period provided by Manufacturers or as called for in the project documents.

1.4 PERMITS, CERTIFICATES, AND FEES

- .1 The Contractor shall give all notices, obtain all permits and pay all fees so that the work specified herein may be carried out.
- .2 The Contractor shall make all necessary arrangements with Utilities for services and meters as required and pay for all the costs involved.
- .3 Arrange for inspection of all work by the authorities having jurisdiction over the work including local building, plumbing and utility representatives. On completion of the

work, present to the Contract Administrator the final unconditional certificate of approval of the inspecting authorities.

1.5 CODES AND STANDARDS

- .1 Comply with the requirements of the latest edition of the applicable CSA standards, the requirement of the Authorities, Federal, Provincial and Municipal Codes, the applicable standards of the Underwriters Association and all other Authorities having jurisdiction. Comply with the guidelines of Manitoba Conservation in the undertaking of the work. These codes and regulations constitute an integral part of these specifications.
- .2 Welding shall conform to the ANSI/ASME Power Piping Code and the ASME Boiler and Pressure Vessel Code.
- .3 Welders shall be qualified and licensed in Manitoba, and welder qualifications shall be in accordance with CSA-Z662.
- .4 Welding safety requirements shall be in accordance with CSA-W117.2 - Code for Safety in Welding and Cutting.
- .5 Work shall be performed in accordance with the Regulations of the Manitoba Workplace Health and Safety Act.
- .6 Installation shall be in accordance with the National Building Code and all regulations and codes of the Province, Territory or Municipality in which the work is located.
- .7 In case of conflict, the codes shall be taken as the minimum acceptable criteria where they exceed those in the contract documents. In no instance reduce the standard or scope of work, or intent established by the contract documents by applying any of the codes referred to herein. Where the contract documents indicate a standard exceeding code requirements, the contract documents shall take precedence.

1.6 APPROVED EQUALS

- .1 Approval of equal equipment shall be in accordance with B7.
- .2 Equipment shown on the drawings and specified is the recommended equipment and is to be used unless permission for an approved equal in accordance with B7 is obtained.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

- .1 All materials and equipment shall be delivered, handled and stored subject to the provisions contained herein and according to the manufacturer's recommendations.
- .2 Provide temporary storage facilities and heated storage where required for sensitive items such as motors.
- .3 Equipment, including pumps and motors, shall not be placed in temporary or final locations in the new structures before a date approved by the Contract Administrator. The date of delivery into the structure shall be commensurate with the construction progress and the suitability, with respect to temperature, humidity, etc. of the building.
- .4 Take precautions to maintain equipment in good condition and to avoid corrosion or other damage, which may affect the equipment's performance. Provide temporary coatings as required to prevent corrosion.
- .5 Leave factory covers in place and prevent entry of foreign materials into working parts of equipment.

- .6 Protect members and bearings with plastic covers.
- .7 Grease all shafts and sheaves to prevent corrosion.
- .8 The Contractor shall recognize the time interval required for complete construction before the structure is suitable for equipment installation. If equipment is manufactured before it is required at the site, the Contractor shall provide suitable heated dry storage space for the equipment, to the approval of the Contract Administrator. All equipment and motors shall be rotated at least weekly during the storage period, and after installation, until the equipment is placed in normal use.
- .9 All material damaged or otherwise harmfully affected during delivery, storage, handling or installation shall be replaced by the Contractor at his/her own expense.

1.8 EQUIPMENT SUPPORTS, ANCHORS, AND BASES

- .1 The Contractor shall provide all structural work required for foundation and support of units, foundation bolts, sleeves, washers, nuts, shims and templates to locate bolts.
- .2 Anchor bolts shall be set in concrete with one end of the bolt hooked as detailed; or sleeved anchor bolts as detailed may be set in concrete. Expansion type bolts drilled into concrete may not be used in lieu of anchor bolts.
- .3 Provide a minimum of 25 mm non-metallic grout between bedplates and concrete foundation, fill voids, finish and remove wedges after grout is set. Grout shall be Embecco or approved equivalent equal in accordance with B7, non metallic type.
- .4 Where grouting is required for bedplates and equipment bases on concrete foundations, the surface of the concrete foundation shall be roughened to provide a bond.
- .5 All bases shall be finished to match the floor.

1.9 MATERIALS

- .1 Provide new materials and equipment of first class quality, delivered, erected, connected and finished in every detail, and supplied with the acceptance of the Contract Administrator.
- .2 Assume responsibility of ensuring that equipment provided performs as specified.

1.10 INSTALLATION

- .1 Follow the recommended installation details and procedures for all equipment as found in the supplier's technical data, supplemented by the shop drawings, the contract drawings and the specifications and the directions of the Contract Administrator. Co-ordinate work with the work of other trades to avoid conflict.
- .2 Install mechanical work in advance of concrete pouring as necessary.
- .3 For equipment or material of the same type or classification, install only products of one manufacturer.
- .4 Install all equipment with adequate access for inspection and servicing and to provide minimum interferences. Conserve headroom and leave maximum usable space.
- .5 Employ only skilled tradesmen properly licensed by the Province or Territory, for all work requiring tradesmen with special skill.

- .6 Motors shall be aligned, shimmed and coupled to fit shafts, to the tolerances given by the manufacturer.
- .7 Set equipment in place and install piping, fittings, valves and other items. Make final adjustments in alignment and elevation before securely fastening equipment and other items in place.
- .8 Control alignment so that excess forces are not imposed on equipment when piping connections are tightened.
- .9 Do not tighten pipes until grout is set.
- .10 Tighten so that there are no excessive stresses set up in flanges.

1.11 VIBRATION ISOLATION

- .1 Provide vibration isolators for all mechanical motor driven equipment throughout the project, unless specifically noted otherwise. This shall include but not be limited to pumps and all piping connected to vibration isolated equipment.
- .2 Provide Vibration Isolators as manufactured by Vibro-Acoustics, Vibron or Air Master.
- .3 Provide all sound and vibration elimination materials by one supplier unless otherwise specified. Provide shop drawings showing isolator location, load forces, anchor positions, etc. and installation instructions.
- .4 Statically and dynamically balance rotating equipment for minimum vibration and low operating noise level.
- .5 Provide flexible connectors for pipes to all equipment supported by vibration isolators.
- .6 Provide flame proof flexible connectors between fans, heaters, equipment and ducts.
- .7 Equipment installed by the Contractor shall operate smoothly without excessive wear, adjustment and attention. Vibration shall not exceed the manufacturer's specified limits for individual products. Vibrations in pumps shall be within acceptable field vibration limits as outlined in the Standards of the Hydraulics Institute.

1.12 GUARDS

- .1 Provide vibration free guards on all exposed drives and rotating parts, to meet the requirements of the Regulations of the Manitoba Workplace Health and Safety Act.
- .2 Provide means to permit lubrication, use of test instruments and movement of motors to adjust belt tension.

1.13 MINOR DEVIATIONS

- .1 The Contractor shall allow for additional material such as pipe and ducts for modifications that may be required to correct minor conflicts or deviations.

1.14 PRIMARY MEASURING ELEMENTS

- .1 Install all primary elements specified in Division 25 – Integrated Automation.

1.15 SHOP DRAWINGS

- .1 Shop drawings shall be submitted in accordance with Section 01 33 00 - Submittals, and in accordance with the requirements of the various divisions.

- .2 Materials incorporated into the work prior to approval of shop drawings shall be removed and replaced at the Contract Administrator's discretion and at the Contractor's expense.

1.16 OPERATION AND MAINTENANCE MANUALS

- .1 Submit operation and maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals, and in accordance with the requirements of Division 40, all sections.

1.17 TRAINING

- .1 Refer to Section 01 79 00 – Demonstration and Training.

1.18 COMMISSIONING

- .1 Refer to Section 01 98 13 – General Commissioning Requirements.
- .2 As part of commissioning activities, develop schedule of pumps and record thereon identifier, location, service, purchase order number and date, manufacturer, and identification data.
- .3 Incorporate the City of Winnipeg equipment identification into the document. Obtain numbering system from Contract Administrator.

1.19 MANUFACTURER'S REPRESENTATIVE

- .1 Refer to Division 01 General Requirements, Section 01 98 13 – General Commissioning Requirements and to other sections of Division 40 with regard to start up and check out services by the manufacturers of equipment.
- .2 Arrange and pay for field services of Supplier's representatives required for instruction on specialized portions of the installation.

1.20 PAINTING

- .1 All unpainted equipment and appurtenances shall be given shop prime paint suitable for field painting.
- .2 Do not paint over nameplates.
- .3 Stainless steel shall not be painted.
- .4 Clean shop applied paint surfaces that become marked. Touch up with primer and paint as required.
- .5 Hangers, supports and fabricated equipment shall be primed and painted to match existing.

1.21 IDENTIFICATION OF EQUIPMENT

- .1 Provide a manufacturer's nameplate on each piece of equipment as follows: minimum size 75 mm x 35 mm x 2.5 mm thick laminated plastic with black face and white centre. Letters to be 6 mm high.
- .2 Fasten nameplates securely in a conspicuous place.
- .3 Identify each piece of equipment by type and number. Obtain numbering system from Contract Administrator.

1.22 IDENTIFICATION OF PIPING

- .1 All piping shall be colour coded to match existing piping of equivalent systems.
- .2 Use Stencil painted or glue-on lettering for pipe identification letters.
- .3 Bands shall be 25 mm wide.
- .4 Use standard plastic colour bands and marker tags on small piping.
- .5 Direction arrows shall be black 150 mm x 25 mm.
- .6 Arrows shall be painted at each branch and termination point.
- .7 Locate markers from usual operating areas and identify piping runs at least once in each room and where piping enters and leaves a room.

1.23 ELECTRIC STARTING SWITCH IDENTIFICATION

- .1 Identify electric starting switches, remote push button stations and equipment supplied under this division with lamacoid plates having 6 mm minimum letter size. Identification to state equipment controlled.

1.24 CLEANUP AND DISINFECTION

- .1 All piping and equipment shall be thoroughly cleaned of dirt, cuttings and other foreign substances.
- .2 Disconnect, clean and reconnect whenever necessary for purposes of locating and removing obstructions.
- .3 Flush and chlorinate all potable water systems as specified in plumbing codes and where applicable, in accordance with AWWA standards for Disinfection of Facilities.
- .4 The Contractor shall provide bacteriological testing showing that domestic pipe cleanliness meets provincial standards prior to placing potable water systems into service.

1.25 LUBRICATION

- .1 For all equipment, furnish lubricants in sufficient quantity for 12 months operation by the Purchaser.
- .2 Identify lubricants furnished by brand, grade and item of equipment for which it is intended.
- .3 Operate, drain and flush out bearings and refill with a new change of oil before completion.

1.26 DRAWINGS OF RECORD

- .1 Refer to Division 01, Section 01 78 00 - Closeout Submittals.
- .2 Drawings of Record are required for process mechanical revisions.
- .3 The Contractor shall maintain, at the site, a separate set of "red line" process mechanical drawings on which he/she shall record all changes and deviations from the original contract plans and specifications.

1.27 MOTORS

- .1 Refer to Division 26 for all motor design requirements.

1.28 CUTTING AND PATCHING

- .1 The Contractor shall locate and provide holes and sleeves for all process mechanical work in accordance with the contract drawings and specifications.

1.29 TEMPORARY USE

- .1 Refer to Section 01 52 00 - Construction Facilities regarding temporary use of process mechanical piping and/or equipment.

1.30 PATENTS

- .1 Pay all royalties and licence fees, and defend all suits or claims for infringement of any patent rights, and save the City of Winnipeg and the Contract Administrator harmless of loss or annoyance on account of suit, or claims of any kind for violation or infringement of any letters patent or patent rights, by the Subcontractor or anyone directly or indirectly employed by him or by reason of the use by him or them or any part machine, manufacture or composition of matter on the work, in violation or infringement of such letters patent or rights.

1.31 INSTRUCTION TO PURCHASERS

- .1 Where specified elsewhere in Division 40, manufacturers to provide demonstrations and instruction.
- .2 Provide instruction to operating staff during regular work hours prior to acceptance and turn-over.
- .3 Availability of approved operation and maintenance manuals to the Plant operators are mandatory during all training sessions.
- .4 Use as-built drawings, audio visual aids, etc. as part of instruction manual.
- .5 Additional sections of the specifications may define and describe training and number of days for start up of each type of equipment. Utilize the most stringent.

1.32 DOCUMENTATION AND SYSTEMS ACCEPTANCE

- .1 Meet requirements stated in Section 01 78 00 - Closeout Submittals.
- .2 Contractor shall obtain suitable document signed by the Purchaser or his representative, confirming:
 - .1 Purchaser has received satisfactory instruction in operation and maintenance of all equipment and systems.
 - .2 Operation and maintenance manuals have been provided to the Purchaser.
 - .3 Specified spare parts of components, keys, removables, handles, tools and the like, have been accepted by the Purchaser.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 The supply and installation of process valves applicable to the Anaerobic Digester Mixing System pump and pipe system. Excluded and process gas valves which are specified in division 46.

1.2 RELATED SECTIONS

- .1 Section 40 05 00 – Common Work Results for Process Integration
- .2 Section 40 20 00 – Liquid Process Piping

1.3 SUBMITTALS

- .1 The Contractor shall submit shop drawings and product data as follows:
 - .1 Assembly drawings and material list.
 - .2 Details of all parts and principal dimensions.
 - .3 Submit installation manuals before shipment of any equipment.
 - .4 Submit operation and maintenance manuals 30 days prior to start up.

1.4 SUPPLIERS

- .1 All valves and operators of the same type shall be provided by one manufacturer.

1.5 MEASUREMENT AND PAYMENT

- .1 All costs for the work and materials specified in this section shall be included in the lump sum price bid for the Project.

Part 2 Products

2.1 MATERIALS

- .1 Two port ball valves:
 - .1 Two piece stainless steel body
 - .2 Full standard port
 - .3 12 mm to 50 mm sizes to 6895 kPa working pressure and larger sizes up to 75 mm shall be to 5516 kPa working pressure
 - .4 Type 316 stainless steel wetted parts to CF8M
 - .5 Blow out proof stem
 - .6 Solid stainless steel ball
 - .7 PTFE seat and packing
 - .8 Lever handle
 - .9 Threaded ends to suit connection
 - .10 Trueline N620, Kitz, Jenkins, Crane, Mueller or approved equal in accordance with B7

- .2 Wastewater Air Release Valves:
 - .1 Size as shown on drawings; 50ø valves with NPT, screwed male connection, and 75ø through 200ø valves with studded, flanged connection conforming to ANSI B16.1 Class 125
 - .2 Double orifice c/w integral anti-surge orifice mechanism
 - .3 Tubular, single chamber, stainless steel fabricated body, hollow direct acting float, solid HDPE large orifice float, stainless steel nozzle, woven dirt inhibitor screen, EPDM seals and seat
 - .4 Discharge orifice shall be of equal diameter to the nominal valve size
 - .5 Small orifice nozzle shall have a flat seating land surrounding the orifice to prevent damage to the seal
 - .6 Valve shall be leak tight throughout the range of 50 kPa to 1500 kPa (7.2 psi to 217.5 psi)
 - .7 Air and gas shall be discharged throughout the range of 50 kPa to 1000 kPa (7.2 psi to 145 psi), and shall remain leak tight in the absence of air
 - .8 Pressure rating: 1000 kPa (145 psi)
 - .9 Valve shall automatically limit transient pressure rise or shock to 1.5x rated working pressure, and shall not suffer from deformation, leaking, or damage when subjected to 2x rated working pressure
 - .10 Discharge shall be directly connected to a drain line of size equal to the valve's inlet, as shown on the drawings
 - .11 In addition to the valve/valves shown on the drawings, provide one (1) shelf spare valve complete with attachments
 - .12 Vent-O-Mat RGX series or approved equal in accordance with B7
- .3 Plug Valve:
 - .1 Sized to match pipe shown on drawings
 - .2 Cast iron body to ASTM A126 Class B; welded nickel seat
 - .3 Valve shall meet ANSI/AWWA C517
 - .4 Permanently lubricated radial shaft bearings of 316 SS
 - .5 Flanges to ANSI-B16.1, Class 125
 - .6 One piece construction plug c/w EPDM resilient facing suitable for H₂S-containing liquid
 - .7 Adjustable packing
 - .8 Thrust washers of 316 SS and Teflon
 - .9 Drip tight shut off up to rated working pressure
 - .10 Pressure rating to 1200 kPa (175 psi) for valves up to 300ø; 1035 kPa (150 psi) for valves up to 900ø
 - .11 Fusion bonded epoxy interior and exterior coating
 - .12 For horizontal installation, install valve such that the seat is downstream and when open the plug is located at the top; for vertical installation ensure seat is at the top of the valve
 - .13 Minimum open area of 80%
 - .14 Manual valve actuators shall be as follows and as indicated on the drawings:
 - .1 100 mm and smaller – hand lever

- .2 150 mm and larger – totally enclosed, grease packed gear actuator c/w position indicator and handwheel
- .3 Chainwheel – as specified below
- .15 Val-Matic Cam-Centric Series #5800R, DeZurik Model PEC (Eccentric), Pratt Ball Centric, Milliken or approved equal in accordance with B7
- .4 Knife gate valves:
 - .1 Wafer style, fabricated knife gate valve
 - .2 Stainless steel flanges drilled and tapped to ANSI-B16.5, Class 150 standard
 - .3 Type 316 SS body and gate, and Type 304 SS stem
 - .4 Guides to allow mounting horizontally
 - .5 Turns to open counter-clockwise
 - .6 Pressure rating: 960 kPa (140 psi)
 - .7 EPDM resilient seated, bi-directional drip tight shut-off
 - .8 Manual actuators as follows:
 - .1 Sizes 350 and smaller: handwheel operator
 - .2 Sizes 400 and larger: fully enclosed, grease packed bevel gear actuator c/w handwheel
 - .3 Maximum operating rim pull on the manual operator at 340 kPa pressure differential shall not exceed 180 N.
 - .9 Trueline F8112 series, DeZurik Series C, Fabri-Valve C67 or approved equal in accordance with B7
- .5 Wafer style swing checks:
 - .1 For valves less than 75ø only
 - .2 Stainless steel body to ASTM A-351 CF8M, ANSI series stainless steel disc to ASTM A-240, Type 304
 - .3 Valve closes drip tight prior to reversal of flow condition
 - .4 1035 kPa rating
 - .5 Resilient o-ring seat of Buna N or Viton
 - .6 Stainless steel hinge, pins and spring
 - .7 Suitable for horizontal or vertical installations
 - .8 Check-Rite Model No. 210, DFT Model WLC, or approved equal.
- .6 Solenoid valve:
 - .1 Single seated, direct acting
 - .2 Type 304 stainless steel body
 - .3 Globe body control valve
 - .4 Seals and discs of PTFE
 - .5 Normally closed
 - .6 Explosion proof
 - .7 120 VAC, 60 Hz
 - .8 ASCO Red Hat general purpose enclosure, Parker/Skinner, or approved equal in accordance with B7
- .7 Sampling valve:

- .1 Type 316 stainless steel wetted parts
 - .2 Stainless steel handle and handle bolt
 - .3 Viton stem seal
 - .4 1035 kPa pressure rating & 345 kPa seat test
 - .5 Lever actuator and sharp, metal-to-metal seat
 - .6 Fabri-Valve Figure 151, North Port, or approved equal in accordance with B7
- .8 Manual gear operator:
- .1 Manual gear operators shall be sized for the operating rim pull of 80 N at maximum working pressure differential across the valve
 - .2 Provide hand lever operator for valves 100 mm and smaller
 - .3 Provide handwheel operators for gate valves, knife gate valves and globe valves unless operators are specified
 - .4 Provide geared type actuator complete with valve position indicator for valves 150 mm and larger. Handwheel operator shall be provided unless otherwise specified
- .9 Chainwheel operator
- .1 Chainwheel operators shall include chain wheel, sprocket rim, chain guide, chain away holder, hammer blow mechanism, and non-sparking brass chain
 - .2 Chainwheel material: ductile iron
 - .3 Chainwheel coating: epoxy
 - .4 Handwheel attachments: 304 stainless steel
 - .5 Sized to operate valve as per manufacturer's recommendations
 - .6 Babbitt Steam Specialty Company hammer blow chain wheel or approved equal in accordance with B7
- .10 Pneumatic operator
- .1 Service: on – off service
 - .2 Environment: inside 4°C to 90°C
 - .3 Air Supply: 80 psig
 - .4 Function: double action. Air pressure is supplied to port of open-chamber to push gear rack and rotate the pinion to drive the valve open and discharge air from close-chamber. Air pressure is supplied to port of close-chamber to push gear rack and rotate the pinion to drive the valve closed and discharge air from open-chamber.
 - .5 Body and end cap material: ductile iron
 - .6 Drive yoke/pinion: stainless steel
 - .7 Drive thrust pin/rack: stainless steel
 - .8 O-ring material: nitrile rubber - Buna-N
 - .9 Shaft bearings material: alloy steel c/w heat treated plating
 - .10 Tie rods: plated steel
 - .11 Environment: NEMA 7, corrosion resistant
 - .12 Air filter / pressure regulator to set valve pressure
 - .13 Integral lockout mechanism

- .14 Morin Series B, Emerson Field Q or approved equal in accordance with B7.
- .11 Manual override gear box
 - .1 Provide declutchable gear operators for local manual operation of pneumatically operated valves during emergency control on air failure, or as a local control in the event of controller malfunction.
 - .2 The hand wheel is clutched in, the valve is under local manual control and the remote control is "locked out".
 - .3 Body: Cast aluminum.
 - .4 Gear quadrant: Aluminum bronze.
 - .5 Worm shaft: High grade aluminium / hard anodized.
 - .6 Temperature: -4°F to +176°F.
 - .7 Stroke adjustment: +5° and -5° at each end.
 - .8 Movement: 0° - 90°.
 - .9 Finish: Two part polyurethane coating.
 - .10 Fasteners: Stainless steel.
 - .11 El-o-matic MO Series, Morin Manual Declutch Override, or approved equal in accordance with B7
- .12 Pneumatic operator solenoid valve
 - .1 Operating environment: Class I, Division II, group A, B, C, or D, hazardous location and corrosion resistant
 - .2 Body: aluminum
 - .3 Coil housing: NEMA 7
 - .4 Air connections: ¼" supply and 1/8" exhaust
 - .5 Operating pressure: 40 psig min, 150 psig max
 - .6 120 VAC, 60 Hz
 - .7 Manual override
 - .8 Keystone Figure 791 or approved equal in accordance with B7
- .13 Pneumatic operator position monitor
 - .1 Operating environment: Class I, Division II, group A, B, C, or D, hazardous location and corrosion resistant
 - .2 Shall provide open/close signal
 - .3 Body and cover: die cast aluminum c/w electrostatic powder coating
 - .4 Enclosure to IP66/67
 - .5 Dome shall provide adjustable, high-contrast, full angle viewing of valve position
 - .6 Suitable for direct mounting to pneumatic actuator
 - .7 M20 cable entries fitted with weatherproof plug
 - .8 15 amp V3 mechanical switches with SPDT contacts
 - .9 120 VAC
 - .10 Keystone Figure 792 or approved equal in accordance with B7
- .14 Pressure switches:
 - .1 Provided as per Division 26.

- .2 Provide ball valve on all pressure switches.
- .15 Shop finishes:
 - .1 All unfinished iron and steel work on the valves shall be thoroughly cleaned and painted with approved shop coat; refer to Division 09. All finished parts shall be coated with heavy grease or a mixture of white lead and tallow to prevent corrosion during shipment and installation. Bronze work shall be left bright.
- .16 Field painting:
 - .1 All exposed surfaces of valves shall be painted after installation; refer to Division 09.

Part 3 Execution

3.1 FIELD PAINTING

- .1 All exposed surfaces of valves shall be painted after installation; refer to Division 09.

3.2 DELIVERY

- .1 Provide for unloading and storage of the valves on the site of the Work.

3.3 VALVES AND OPERATORS

- .1 Install all valves and operators in strict accordance with manufacturer's shop drawings and instructions.
- .2 Install extension stems, stem supports and other accessories as required and as shown on drawings.

3.4 TESTING

- .1 Field test all valves in presence of the Contract Administrator to demonstrate the installation is correctly completed and all valves are operating satisfactorily.

3.5 TRAINING

- .1 Refer to 01 79 00 – Demonstration and Training.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 The supply and installation of miscellaneous process mechanical fixtures and appurtenances applicable to the Anaerobic Digester Mixing System pump and pipe system.

1.2 RELATED SECTIONS

- .1 All Sections - Division 01
- .2 Division 03 - Concrete
- .3 Section 40 05 00 – Common Work Results for Process Integration
- .4 Section 40 05 23 – Process Valves
- .5 Section 40 20 00 – Liquid Process Piping

1.3 REFERENCES

- .1 CAN3-B79-M79, Floor Drains

1.4 SUBMITTALS

- .1 The Contractor shall submit shop drawings and product data in accordance with Section 01 33 00 – Submittals and as follows:
 - .1 Assembly drawings and material list.
 - .2 Details of all parts and principal dimensions.
 - .3 Submit installation manuals before shipment of any equipment.
 - .4 Submit operation and maintenance manuals 30 days prior to start up.

1.5 QUALITY ASSURANCE

- .1 Execute work of this section only by skilled tradesmen regularly employed in the installation of mechanical systems.

1.6 SUPPLIERS

- .1 All fixtures and gauges of the same type shall be provided by one manufacturer.

1.7 MEASUREMENT AND PAYMENT

- .1 All costs for the work and materials specified in this section shall be included in the lump sum price bid for the Project.

Part 2 Products

2.1 MATERIALS

- .1 Pressure gauges:

- .1 Provide 115 mm diameter, cast aluminum pressure gauges – black finish – stainless steel internals – dial type to CGSB 91-GP-1 – glass window, white dial, black lettering – ½ of 1% accuracy unless otherwise stated.
 - .1 Pressure range:
 - .1 0 - 414 kPa (0 - 60 psi) on pump discharge lines
 - .2 -101-103 kPa (-15 - 15 psi) on pump suction lines
 - .2 Provide threaded connection type diaphragm seal c/w flushing connection. Sized to match the pressure gauge. Metallic diaphragm shall be welded to top housing to ensure maximum leak integrity.
 - .1 Diaphragm and lower housing must be compatible with process media: Hastelloy C276 or Tantalum for media containing hydrogen sulfide (H₂S)
 - .2 Fill fluid shall be suitable for vacuum and compound gauge ranges.
 - .3 Gauges located in outdoor environment shall be dry type, all others liquid filled
 - .4 Use materials compatible with system requirements
 - .5 Provide ball valve on all pressure gauges
 - .6 Acceptable Gauge Manufacturers: Terrice, Taylor, Weiss, Weksler, Winters, Marshall Town, Ashcroft or approved equal in accordance with B7.
- .2 Thermometers:
 - .1 230 mm industrial type with cast aluminum case, clear acrylic window, red-mercury indicating fluid, black figures brass stem, and shall be adjustable type. Provide separable brass wells to suite pipe diameter and extensions for insulation.
 - .2 Thermometer's range to suit service. Graduate thermometers with Fahrenheit and Celsius scales.
 - .3 Acceptable manufacturers: Terrice, Taylor, Weiss, Marshall Town, Winters, or approved equal in accordance with B7.
- .3 Pressure switches:
 - .1 Provided as per Division 26.
 - .2 Provide ball valve on all pressure switches.
- .4 Floor Drains
 - .1 Floor drains: to CAN3-B79
 - .2 Type II: heavy duty, cast iron body, heavy duty non-tilting or hinged lacquered cast iron grate, integral seepage pan and clamping collar.
 - .3 Drains: Zurn ZN415 epoxy coated cast iron body with reversible clamp device and adjustable 127 mm diameter nickel bronze 6.35 mm thick "Type B" (ZN-400-B) strainer, secured with SS screws and 100 mm throat on strainer.
 - .4 For floor drains designated FD "B", provide in addition Zurn Z-414 round funnel, 102 mm diameter.
- .5 Cleanouts
 - .1 Line cleanouts in PVC pipe shall be Emco Line Cleanout SXSX with polyurethane gasketed plug secured to body with full size pipe opening.

- .6 Modular Seals
 - .1 Consisting of rubber links shaped to continuously fill the annular space between the pipe and wall opening.
 - .2 Modular seal elements: EPDM.
 - .3 Hardware: Type 316 stainless steel to ASTM F593-95.
 - .4 Glass reinforced nylon pressure plates c/w permanent identification of size and manufacturer's name.
 - .5 Manufactured in an ISO-9001:2000 facility.
 - .6 Cored openings through wall sized larger than pipe to accommodate modular seal, as shown on drawings.
 - .7 PSI-Thunderline/Link-Seal Modular Seal S-316 or approved equal in accordance with B7.

Part 3 Execution

3.1 DELIVERY

- .1 Provide for unloading and storage of the fixtures on the site of the Work.

3.2 GAUGES AND FIXTURES

- .1 Install all gauges and fixtures in strict accordance with manufacturer's shop drawings and instructions.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 The general requirements for supply and installation of all anaerobic digester mixing process mechanical piping systems.

1.2 RELATED SECTIONS

- .1 Division 01 – General Requirements
- .2 Division 09 – Finishes
- .3 Section 40 05 00 – Common Work Results for Process Integration
- .4 Section 40 05 23 – Process Valves

1.3 PIPING MATERIAL

- .1 Piping labelled “SS” on the drawings shall be SCH 10 stainless steel unless indicated otherwise.
- .2 Piping labelled “PVC” on the drawings shall be SCH 80 PVC unless indicated otherwise.

1.4 DESIGN REQUIREMENTS

- .1 The design has been completed to the degree necessary for the Contractor to tender the project. The pipe support system is not fully detailed and will require the Contractor to undertake some design for the piping systems to be installed.
- .2 Piping supports are generally not shown on the process/mechanical layout drawings. Provide the design of piping supports, pipe guides, and anchors based upon final piping layout. Typical support details and structural attachments shown on the drawings indicate the level of quality that will be considered acceptable.
- .3 The Contractor is responsible for the final aspects of the pipe support system and thrust restraint design. The components of the design that will be generated will be as follows:
 - .1 Piping support system design, including details and spacing of all supports. The support system will ensure that the weight of the pipework and commodities, and the need for lateral and vertical support are considered fully.
- .4 Design documentation shall be submitted to the Contract Administrator as necessary to indicate acceptability of the piping systems’ support and thrust restraint. The documentation shall be stamped and sealed by a Professional Engineer registered in the Province of Manitoba.

1.5 QUALITY ASSURANCES

- .1 Welding materials, fabrication standards and labour qualifications must conform to ANSI/ASME B31.1, ANSI/ASME B16.25, ASME Section IX, and the Provincial Board

of Labour Regulations. For steam systems operating over 690 kPa, conform to ANSI/ASME B31.3.

- .2 Use welders fully qualified for pipe welding and licensed by Provincial Authorities.
- .3 Domestic Water, Drainage and Vent Piping: Provincial and Municipal Codes.

1.6 SUBMITTALS

- .1 Welding: Prior to commencing any welding of stainless steel pipe, prepare and submit to the Contract Administrator a written description of welding techniques including but not limited to materials, methods, and quality control. Identify differences in shop and field techniques. Written procedures shall be stamped and sealed by a Professional Engineer registered in the Province of Manitoba and qualified for welding design.
- .2 Radiographic weld test results.

1.7 REFERENCES

- .1 ASTM D2564-88, Specification for Solvent Cements for Poly (Vinyl-Chloride)
- .2 ASTM A778, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products
- .3 ASTM A403, Wrought Austenitic Stainless Steel Pipe Fittings
- .4 ASTM A312, Seamless and Welded Austenitic Stainless Steel Pipe
- .5 ASTM A240, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
- .6 ASTM F738M, Standard Specification for Stainless Steel Metric Bolts, Screws, and Studs
- .7 ANSI B16.11, Forged Steel Fittings, Socket-Welding and Threaded
- .8 ANSI B16.21, Nonmetallic Flat Gaskets for Pipe Flanges

1.8 MEASUREMENT AND PAYMENT

- .1 All costs for the work specified in this section shall be included in the lump sum price bid for the Project.

Part 2 Products

2.1 MATERIALS

- .1 Pipe for non-buried service:
 - .1 Polyvinyl Chloride
 - .1 CSA 181.2.
 - .2 Class 12454B PVC compound.

- .3 Schedule 40 and solvent weld joints.
- .2 Stainless Steel
 - .1 ASTM A312 Type 304L pipe, seamless.
 - .2 Service: sludge mixing system
 - .3 Pipe Schedule 10, or as indicated on the drawings.
 - .4 Test pressure for all pipes at the stated maximum working pressure for the pipe, up to 1,035 kPa (150 psi).
 - .5 Minimum vacuum rating of 100 kPa (14.5 psi).
 - .6 Longitudinally welded by Tungsten Inert Gas (TIG) for all sludge piping and/or Metal Inert Gas (MIG) method elsewhere.
 - .7 Ends prepared for welding or to suit connections as shown on drawings.
 - .8 Provide flanges where required to connect to valves and equipment and at 3 m maximum spacing on straight runs.
 - .9 Less than 75 ϕ : ASTM-A403 Type 304L pipe.
- .2 Pipe Fittings:
 - .1 Stainless Steel:
 - .1 ASTM-A774, Type 304L.
 - .2 Service: sludge mixing system
 - .3 Wall thickness to match or exceed line pipe wall.
 - .4 Elbows to 400 mm to be pressed type.
 - .5 Elbows 450 mm and larger to be fabricated as smooth flow type.
 - .6 Backing flanges to be stainless steel, ANSI-B16.5 Class 150 standard.
 - .7 Ends to be prepared to suit piping as required.
 - .8 Less than 75 ϕ : provide fittings of the same class as the pipe, conforming to ASTM-A403 and ANSI B16.11.
 - .2 PVC:
 - .1 For pressure service to CSA-B137.3.
 - .2 For non-pressure service to CSA-181.2.
 - .3 Schedule of fittings to match pipe.
 - .4 Solvent joint fittings to match pipe.
 - .5 Flanges, reducing bushings and other fittings to be compatible with line pipe material.
 - .6 To AWWA C111 rubber gasket type where required.
- .3 Flanges:
 - .1 Flanges for stainless steel pipe shall be weld-neck type.
 - .2 Welding neck flanges shall be same material as pipe, fabricated to ANSI B16.5, and rated for 1035 kPa (150 psi) or as shown on the drawings.
 - .3 Use flat face flanges to connect to cast iron flanges, and raised face flanges to connect to raised face flanges.
 - .4 Flange class shall be plainly marked on all flanges.
- .4 Bolts and nuts:

- .1 Bolts and nuts shall be to AWWA C207.
- .2 Bolts and nuts shall be stainless steel to ASTM Type 304, hexagonal heads.
- .3 Size and length to match flanges and valves.
- .5 Flange gaskets:
 - .1 Use gasket materials for flanged connections suitable for the temperature, pressure, and corrosivity of the fluid conveyed in the pipeline. Ensure that gasket material is non-reactive with pipe material. Do not use flange material that contains carbon or graphite for stainless steel pipe.
 - .2 Unless otherwise specified, minimum gasket material thickness for full face gaskets shall be 1.6 mm thick for pipe 75ø to 250ø, and 3.2 mm thick for pipe greater than 250ø.
 - .3 Unless otherwise specified, minimum gasket material thickness for raised face ring gaskets shall be 1.6 mm thick for pipe 75ø to 100ø, and 3.2 mm thick for pipe greater than 100ø.
 - .4 Cloth inserted rubber SBR, Garlock Style 22 or approved alternate for temperatures below 100°C.
 - .5 Use flat ring gaskets with raised face flanges, conforming to ANSI B16.21.
 - .6 For flanges in air piping use 1.6 mm neoprene, Garlock 7797 gasket or approved alternate.
 - .7 Use full faced gaskets with flat face flanges, conforming to ANSI B16.21.
- .6 Flexible Process Pipe Sections:
 - .1 Single, wide arch rubber expansion joint with flanged ends.
 - .2 PTFE lined core extending through the entire length of the fitting.
 - .3 Provide retaining rings and pipe anchors to prevent damage to flanges.
 - .4 Redflex T-205 Teflon Lined Expansion Joint or approved equal in accordance with B7.
- .7 Sleeve type couplings:
 - .1 Use steel couplings, epoxy shop coated, with stainless steel nuts and bolts, and plain grade gaskets.
 - .2 Couplings to be by Robar, Romac or approved equal in accordance with B7, standard length, standard weight.
 - .3 Transition couplings to be Robar, Romac or approved equal in accordance with B7.
 - .4 For underground service use couplers with followers and middle rings fully coated epoxy and installed with harness, nuts, bolts and rings packed with protective Denso Plast and coated with Denso tape.
 - .5 Joint harness details shall be in accordance with AWWA Steel Pipe Manual M11.
 - .6 Design of joint harness shall be based on an operating pressure of 1035 kPa (150 psi) unless otherwise noted.
 - .7 Harness nuts and bolts to be hot dipped galvanized.
- .8 Flanged adapters:

- .1 Robar Style 7506 to suit the type of pipe or approved equal in accordance with B7.
 - .2 Plain Grade gasket.
 - .3 Epoxy shop coating.
- .9 Welding outlets:
- .1 Fabricate to the requirements of ANSI-B16.9, ANSI-B16.11 and ANSI-B31.1.
 - .2 Welded outlets include weldolets, sockolets and thredolets.
- .10 Pipe sleeves:
- .1 Pipe sleeves shall be SCH 10 stainless steel, or as shown on the drawings.
 - .2 All pipe sleeves labelled as having a puddle flange on the drawings shall have a 50 mm by 10 mm thick ring continuously welded all around the middle of the pipe length.
- .11 Supports and hangers – general:
- .1 Hangers and supports shall conform to ANSI Code for Pressure Piping B31.1.
 - .2 Materials, design and manufacture for Pipe Hangers and Support shall be in accordance with ANSI/MSS SP 58.
 - .3 All supports, hangers, guides, sway braces, restraints, dampeners, bolts, washers and nuts shall be stainless steel or hot dip galvanized.
 - .4 Hangers and supports shall be sized to suit the pipe sizes as shown on drawings and as recommended by the manufacturer.
- .12 Pipe supports:
- .1 Wall supports use Grinnell Fig. 194, Fig. 195, or Fig. 199 welded steel brackets hot dipped galvanized, or as shown on the drawings.
 - .2 Floor Supports use concrete supports as detailed on drawings.
 - .3 Pipe saddle supports use Grinnell Fig. 264 adjustable pipe saddle support complete with riser pipe and floor flange.
 - .4 Strap supports use Grinnell Fig. 262 for 100 mm and smaller pipe. Provide straps for larger pipe as detailed on drawings.
 - .5 Any part of a hanger or other pipe support in direct contact with stainless steel shall be nylon coated with NCA 1477 nylon thermoplastic 0.5 mm thick or shall be of 304 stainless steel. Provide felt paper between pipe and concrete pipe supports to prevent bonding.
 - .6 Wall supports for PVC pipe up to 50 mm diameter shall be Grinnell tube strap or approved alternate.
- .13 Pipe hangers:
- .1 For non-insulated pipe of 50 mm and smaller use Grinnell Figure CT97C coated adjustable pipe ring complete with hanger rod and expansion case or insert for mounting on concrete surface.

- .2 For non-insulated pipe to 750 mm use adjustable steel yoke pipe roll Grinnell Fig. 171. For pipes larger than 750 mm, provide hangers as detailed on the drawings.
- .3 For concrete inserts use Grinnell Fig. 152, Fig. 117 and Fig. 285 to suit service conditions and pipe size.
- .4 For ceiling flanges, use Grinnell Fig. 153.
- .5 Hanger rods shall be machine threaded both ends and shall be Stainless Steel.
- .6 Spring hangers shall be Grinnell Fig. 80 V or 81 H constant support spring hangers.
- .7 Any part of a hanger or other pipe support in direct contact with stainless steel shall be nylon coated with NCA 1477 nylon thermoplastic 0.5 mm thick or shall be of 304 stainless steel. Provide felt paper between pipe and concrete pipe supports to prevent bonding.

Part 3 Execution

3.1 NUTS AND BOLTS

- .1 Install nuts and bolts so that bolts have a minimum of two exposed threads projecting after tightening; with a maximum of 8 threads projecting.
- .2 Apply Denso paste to exposed threads, flanges and coupling bolts.

3.2 INSTALLATION OF PIPE AND FITTINGS

- .1 Route piping in an orderly manner and maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls. Group piping wherever practical at common elevations.
- .2 Prior to commencing piping work, examine route for conflicts and notify the Contract Administrator of any conflicts. Obtain approval of the Contract Administrator for any relocations.
- .3 Install to piping lines and elevations shown on the drawings.
- .4 Install all piping parallel to building walls.
- .5 Do not cut or weaken the building structure to facilitate installation.
- .6 Determine exact location of each pipe in the field with respect to adjacent and interconnecting piping and equipment.
- .7 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.
- .8 Provide clearance for proper installation of insulation and for access to valves, air vents, drains and unions.
- .9 Install all piping systems in accordance with the ANSI code for pressure piping, B31.1.

- .10 Provide flanged joints intermittently in all welded piping systems to facilitate removal of every section of the piping systems by two men and without cutting any pipe or joint.
- .11 Provide unions intermittently in all screwed piping systems to facilitate removal of valves and every section of the piping system without cutting any pipe or joint.
- .12 Provide temporary bracing and supports to adequately support pipes and fittings during installation.
- .13 Where the required piping is not shown on drawings or is shown diagrammatically, the pipes shall be installed in such a way as to conserve head room and interfere as little as possible with the spaces through which they pass.
- .14 Grade horizontal drainage and vent piping at 2% minimum.
- .15 Maintain grade on all draining pipes. Horizontal water piping shall be run with a grade of 0.2% and provide hose bib drains at low points.
- .16 On closed systems, equip low points with 20 mm drain valves and hose nipples.
- .17 Make reductions in water and steam pipes with eccentric reducing fittings installed to provide drainage and venting. Top flat for water, bottom flat for steam.
- .18 Where piping is to connect to equipment, dimensions shown on the drawings are based on catalogue information of first named supplier.
- .19 Modify work to suit final dimensions shown on shop drawings for equipment.
- .20 Ascertain the correct equipment dimensions before ordering piping closure lengths and fittings. Review of drawings by the Contract Administrator will not relieve the Contractor of his/her obligation in this respect.
- .21 Pipe the discharge from all relief valves (not including pump discharge air release valves), safety valves, vents, drains, equipment blow downs, water columns, and overflows to the nearest building drain. Terminate above drains so drips can be easily seen.

3.3 JOINTING PIPES – GENERAL

- .1 Clean pipes inside and outside before assembly. Remove welding slag.
- .2 Ream pipes and tubes.
- .3 Make screwed joints using approved compound or teflon tape applied to male threads. Use thread tape on PVC pipe.
- .4 American National Taper pipe thread must be used for all screwed connections. Remove burrs and chips and ream or file the pipe ends out to size or bore. Not more than two (2) imperfect threads exposed when joint make-up.
- .5 Make screw joints metal to metal. Do not use lampwick or other packaging material in making up screwed joints.

- .6 Use Teflon tape, red lead and linseed oil or other approved non-toxic joint compound applied to male threads only.
- .7 PVC pipe and socket fittings shall be jointed by use of solvent based cements manufactured in accordance with ASTM D2564.
- .8 Connect pipes to equipment as shown or specified, without springing the pipes.
- .9 Provide complete isolation of dissimilar metals.
- .10 Use standard fittings for direction changes.
- .11 Follow the recommendations of the manufacturer for jointing pipes and installing couplings and fittings.

3.4 WELDING STAINLESS STEEL PIPING

- .1 Welds shall be made by a certified welder, skilled in welding stainless steel pipes. Submit certifications for all welders and submit details of proposed methods.
- .2 Prepare pipe ends by grinding and bevelling; then clean using stainless steel brushes and acetone.
- .3 Select filler rods and electrodes to conform with the pipe composition and submit lists for review.
- .4 Make tack welds employing gas tungsten arc methods and remove while making the root pass.
- .5 Use gas tungsten arc welding for materials to 3 mm thick; and for root pass for heavier thicknesses, use Gas Metal Arc Welding or Shielded Metal Arc Welding.
- .6 Use argon only as arc shielding gas and purge gas.
- .7 All welds shall have full penetration without shrinkage or porosity. Welds shall be smooth and shall not have undue protrusions on the pipe interior.
- .8 Inspections and Tests
 - .1 Examinations are to be performed by a specialist qualified in accordance with CSA W178-1973 and W178.2-1982 and approved by the Contract Administrator.
 - .2 Provide a visual examination of all welds, including entire circumference of weld externally and whenever possible internally.
 - .3 Inspect and test the first two (2) welds made by every welder and at least 5% of all welds, selected at random by the Contract Administrator, by non-destructive full gamma ray radiographic (hereinafter referred to as “radiography”) tests.
 - .4 Identify each radiographic film with date, location, name of welder and submit to the Contract Administrator. Interpretation of radiographic films to be done by a qualified radiographer.

- .5 If any weld fails the radiographic tests, tests will be extended to all welds made by welder responsible.
- .6 Re-inspect and re-test any repaired or re-worked welds.
- .9 All welds shall be pickled and passivated.
- .10 No field weld will be allowed, unless approved by the Contract Administrator.

3.5 RUBBER GASKET JOINTS

- .1 Make rubber gasket and mechanically coupled victaulic joints in carbon steel pipe, PVC pipe or other pipes in accordance with the manufacturer's instructions. Use appropriate tools to pull joints, to field cut joints and to prepare pipes for joining. After assembly check the gasket position.

3.6 FLANGED JOINTS

- .1 Fit flanged joints so that gaskets are bearing uniformly and joints are even. Apply an anti-seize compound to bolt threads and tighten bolts evenly.

3.7 VALVES AND OPERATORS

- .1 Install all valves and operators in strict accordance with manufacturer's shop drawings and instructions.
- .2 Valve floor stand and operators shall be oriented as shown on the drawings.
- .3 Install extension stems, stem supports and other accessories as required and as shown on drawings for the connection of valve operators to floor stand units.
- .4 If pipe sleeves through concrete slabs for floor stands are not in vertical line with gear operators other than as shown on the drawings, provide universal joints on the extension operating stem for the correction of alignment.

3.8 EXPANSION PIECES

- .1 Install piping to permit free movement of piping caused by thermal expansion and contraction except where it is anchored.
- .2 Provide for expansion and contraction by installing suitable expansion pieces as is necessary or where indicated.
- .3 Provide expansion pieces having ratings equivalent to the test pressures specified for the particular piping system and wetted surfaces of material similar to that of the piping system.
- .4 Design expansion pieces for the lengths of straight runs shown and the temperature differentials specified.
- .5 Provide anchors and guides where necessary to direct expansion into expansion pieces.

3.9 INSTALLATION OF SUPPORTS AND HANGERS

- .1 Support all piping after alignment and before tightening joints.
- .2 Do not move pipe after tightening joints.
- .3 Provide all hangers, supports, anchor bolts, washers and nuts to support pipes at the lines and elevations indicated and/or as detailed on the drawings.
- .4 Provide inserts in concrete, concrete piers and anchor bolts as required. Provide reinforcing bars in concrete for inserts carrying pipe over 100 mm in diameter.
- .5 Bolt base flanges to the floors or to concrete.
- .6 Provide all necessary sway braces, dampeners, flexible hoses and restraints to eliminate all movements of piping due to vibration. Install additional braces and anchors as necessary to eliminate vibrations.
- .7 Provide hangers, supports, anchors, guides, dampeners, flexible hoses, restraints and sway braces that will cope with the loads and thrust forces from all directions so that all pipe joints will function and thrust is not transferred to the equipment to which the pipe is connected.
- .8 Maximum hanger spacing and minimum rod size shall be in accordance with the following:

Pipe Size	Rod Size	Maximum Spacing Steel	Maximum Spacing PVC
Up to 25 mm	10 mm	1200 mm	1200 mm
25 – 50 mm	10 mm	1800 mm	1800 mm
65 – 90 mm	12 mm	2400 mm	2100 mm
100 – 250 mm	16 mm	2400 mm	2100 mm
150 mm	20 mm	3600 mm	2400 mm
200 – 300 mm	22 mm	5500 mm	2400 mm
350 mm and up	25 mm	6500 mm	2800 mm

- .9 A pipe hanger support or brace shall be provided at each fitting, which changes the direction of flow or splits flow, and at each proposed valve.
- .10 Install sufficient hangers and supports to provide an adequate safety factor as outlined in ANS1-B31.1.
- .11 Drilling into concrete, and using expansion type inserts will be permitted only on approval of the Contract Administrator.

3.10 PIPES THROUGH FLOORS AND WALLS

- .1 Provide standard stainless steel pipe sleeves where pipes are cast through floors and walls. Use material, size, and orientation of pipe sleeves as indicated on the drawings.
- .2 Where indicated, install sleeves flush at walls and projecting at floors as detailed or 50 mm above floor surfaces and flush with bottom.

- .3 Provide continuously welded rings on pipes passing through walls below grade or where walls are watertight. The thrust/seepage rings shall be as detailed on the drawings.
- .4 Remove coating from pipes to be cast in concrete to permit a good bond.
- .5 Coat surfaces of stainless steel in contact with concrete with bitumastic.
- .6 Where electrical insulation from concrete rebar is required, use link seals with pipe sleeves where shown on drawings.
- .7 There shall be no direct contact between structural steel and stainless steel.
- .8 Seal space between sleeves and pipes with non-hardening mastic Duraseal A or approved equal in accordance with B7.
- .9 Where thrust restraint is required design according to AWWA Manual M11 or as detailed.

3.11 CLEANING

- .1 Clean all pipes, fittings and miscellaneous items after installation.
- .2 Remove all materials from pipes, whatever their origin, by flushing with water, blowing with air and dismantling and manually cleaning.
- .3 Prevent entrance of foreign materials from pipes to equipment or pumps.
- .4 Pickle stainless steel lines and wash to remove stains. Pickle all welds and brush with stainless steel brushes; then wash with hot water.

3.12 SHOP FINISHES

- .1 Shop priming of the equipment shall be as specified in Division 09.

3.13 FIELD PAINTING

- .1 Field painting shall be in accordance with Division 09.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

- .1 All Sections of General Conditions form a part of this Specification. They shall be read and fully adhered to exactly as if repeated here in full.
- .2 Refer to all other Divisions of the Specifications and these Documents to determine their effect upon the work of this Section.
- .3 All sections of all the Divisions of the Specification and all other documents included as part of this document form part of the Contract Documents.

1.2 SCOPE

- .1 Refer to Section 26 05 00 for project electrical scope of work.
- .2 This section covers the supply and installation of electric heat tracing cable.

1.3 RELATED WORK

- .1 Training – 01 79 00
- .2 Commissioning - 01 98 13
- .3 Close Out Submittals – 01 78 00
- .4 Asset List – Section 25 31 04

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 26 05 00. Shop drawings shall show pertinent information such as cable make and model number in addition to all pertinent cable data.

1.5 APPROVALS

- .1 All heating cables and accessories shall be approved by C.S.A. for application in dry, wet and damp locations, type designation 3A, 3B, and 3C, installed on the specified pipe.

1.6 APPLICATION

- .1 The constant wattage heating cable is intended for freeze protection of biogas lines.

1.7 QUALITY ASSURANCE

- .1 Heating cable and accessories to C.S.A. C22.2 No. 130-M1985 and Amendments, Heating Cables and Heating Cable Sets.
- .2 Heating cable and accessories in accordance with the Electrical Safety Code and shall be CSA approved for installation on stainless steel pipes.

Part 2 Products

2.1 HEAT TRACE CABLES

- .1 Electric tracing cable:
 - .1 Shall be complete with the following features:
 - .1 Copper Bus Wire (12 AWG)
 - .2 Nichrome heating element
 - .3 FEP Teflon inner insulation
 - .4 FEP grade Teflon insulation sheath
 - .5 Tinned copper grounding braid
 - .6 FEP grade Teflon overjacket
 - .7 Moisture resistant
 - .2 Conduit size shall be compatible so that cable may be pulled in with relative ease.
 - .3 All service heat trace cable shall be rated 120V, 1 ϕ , constant wattage
 - .1 100 foot replacement cable for SHT-6 to SHT-8 - 8 watts/ft c/w controllers, end seals and thermostats as manufactured by Raychem. Acceptable product: cable RMI-100-08-120, RMI-JB3 Connection kit, AMC-HT thermostat. Provide all end seals and accessories required.
 - .2 New cable for new gas piping on Digester #11 Roof. Two runs required, one on bottom of pipe, one on top of pipe. Top pipe cable to be RMI-065-04-120. Bottom pipe cable to be RMI-065-08-120. Provide RMI-JB3 connection kit, AMC-HT thermostat for each cable. Provide all end seals and accessories required. Provide new cables fed from existing breaker panel to provide power for each heat trace system.
- .2 Heat Trace Controller:
 - .1 Constant wattage heat trace cable thermostat controller shall have the following features:
 - .1 Electrical ratings to suit cable being utilized
 - .2 EEMAC 4 enclosure
 - .3 Two operating and one high limit thermostat set at 3°C (operating) and 29°C (high limit) each c/w sufficient length of factory supplied thermostat sensor cable to suit specific installation. Confirm all required thermostat sensor cable length prior to shipment.
 - .4 Acceptable manufacturer shall be Raychem
- .3 Electrical Insulation
 - .1 The insulating jackets shall be one piece applied with a single extrusion and shall withstand, without failure, a test voltage of 2,500 VDC for one minute.
- .4 Braid Overshield
 - .1 The primary insulation shall be shielded with a nickel-copper braid. The braid shall have a cross-sectional area greater than or equal to that of one of the conductors. The braid shall be covered with a continuous fluoropolymer outer jacket of suitable thickness and corrosion resistant properties to prevent corrosion of the braid.
- .5 Thermal Performance
 - .1 The manufacturer shall submit minimum output temperature curves for each heat cable type. The manufacturer shall detail the test procedure to verify this output. As a minimum, this will consist of an apparatus which will enable the output of the cable to be measured while installed on a pipe under thermal insulation. Output shall be measured in watts per meter.
- .6 Terminal end seal kits: certified for installation in damp conditions to CSA-C22.2 No.130 and consisting of:
 - .1 Constant Wattage:
 - .1 Heat shrink type.
 - .2 Heat trace cable shall be connected to thermostats as indicated.

- .7 Power connection kits: connect to pipe and to CSA-C22.2 No.130 as indicated.
 - .1 Constant Wattage:
 - .1 Base.
 - .2 Top.
 - .3 Sealing gasket.
 - .4 Terminal block.
 - .5 Locknuts.
- .8 Heating cables shall be self-regulating in nature and vary their output in response to temperature variations.
- .9 Self-regulating heating cable design shall be capable of producing 20W/m in dry air, 39W/m under snow and ice conditions at 0°C and withstand a maximum continuous exposure temperature of 85°C.
- .10 Available watt densities shall be 8W/ft at 10°C.
- .11 Available voltages shall be 120 VAC.
- .12 The self-regulating cable will have a minimum installation temperature of -51°C and a minimum bend radius of 32mm. Cable must be capable of being cut to desired length to accommodate the installation conditions and must form a continuous heating circuit.

2.2 CABLE CONSTRUCTION

- .1 Cable construction shall consist of two parallel nickel plated copper bus wires (16 AWG), a radiation cross-linked semi conductive heating matrix, a radiation cross-linked dielectric insulation, a tinned copper braid and a polyolefin over jacket.
- .2 Long term stability shall be established by the service life performance test power IEEE 515-1997.
- .3 Self-regulation heating cables must meet or exceed the IEEE 515, IEEE515.1, CSA 130.1, CSA 130.2, CSA 138 standards and must be approved for use in ordinary and hazardous locations Class 1, Division 2, Groups A,B,C,D and Class II, Division 2, Groups F,G.

2.3 MANUFACTURER

- .1 Acceptable manufacturer shall be Raychem or approved equal in accordance with B7.
- .2 ACCESSORIES: All accessories shall be of same manufacturer as heat trace cable.

Part 3 Execution

3.1 WARRANTY

- .1 The manufacturer shall warrant to the City of Winnipeg that any part of the product which proves to be defective and which is returned to the manufacturer within 1 years will be replaced at no charge to the City of Winnipeg.

3.2 INSTALLATION

- .1 The manufacturer shall provide detailed installation instructions for applying heat tracing to piping.

- .2 All heat trace system components other than heat trace cable must be mounted off the pipe, typically on a beam or stanchion to prevent overheating.
- .3 The manufacturer shall provide training for the installers of the heat tracing cable. The manufacturer shall provide qualified personnel for on the site inspection of completed installations and shall certify that the installation has been done according to the manufacturer's specifications.
- .4 Installation and terminating of heating cables to be performed by qualified journeyman electrician.
- .5 Handle heating cable with proper care.
- .6 Do not drag cable on the ground.
- .7 Do not kink cable.
- .8 No splices shall be allowed.
- .9 For SHT-6 to SHT-8 cable replacement, connect to existing power feed cable.
- .10 For Digester #11 new cables, provide new power feed cables connected to existing breaker panel. Provide new 120VAC, 15A breaker for each cable.

3.3 TEST PROCEDURE

- .1 After completing heating cable installation, the insulation resistance between the bus wires and the grounding braid should be checked using a 2500 VDC megger. Minimum readings should be 20 meg ohms regardless of the heating cable length. Original values for each circuit shall be recorded (obtain sample sheets from the Contract Administrator) and deficiencies shall be reported to the Contract Administrator. Include all recorded information in O & M manuals.
- .2 The manufacturer shall conduct on-site inspections and provide test procedure training for the installer.

END OF SECTION