

Approved: 2008-12-31

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 All other sections.

1.2 REFERENCES

- .1 ANSI/ASME Boiler and Pressure Vessel Code, Section VIII, Division 1
- .2 ANSI/ASME B31.1 Power Piping
- .3 ANSI/ASME B31.3 Chemical Piping
- .4 ANSI/ASME B31.9 Building Service Piping
- .5 ANSI B32.1 Metal Products
- .6 CSA CAN3-S16.1M – Steel Structures for Buildings (Limit State Design)
- .7 CSA W59-M Welded Steel Construction (Metal Arch Wlding)
- .8 CSA-S244 Welded Aluminum Design and Workmanship (Inert Gas Shielded Arch Processes)
- .9 CSA W47.1 Certification of Companies for Fusion Welding of Aluminum
- .10 TSSA (Technical Standards Safety Authority)

1.3 SUBMITTALS

- .1 Refer to Section 013300 – Submittal Procedures

Part 2 Products

2.1 FIXING EQUIPMENT, FASTENERS AND FITTINGS

- .1 Provide all foundation bolts, fixing equipment and fittings to adequately position and maintain all the equipment in its final location and in the Works.
- .2 Foundation bolts, fixing equipment, fasteners and fittings shall by type 316 stainless steel and shall be adequate to maintain stability and rigidity of the equipment supplied.
- .3 Provide adequate templates, foundation bolts and instructions for the installation contractor for placing cast-in-concrete devices.

2.2 STAINLESS STEEL ANTI-SEIZE LUBRICANT

- .1 Use stainless steel anti-seize lubricant with stainless steel fasteners.

2.3 LIMIT SWITCHES

- .1 Provide limit switches, specific for valve operators with heavy-duty contacts and EEMAC-4 enclosures, to be Honeywell, Allen-Bradley or Square-D heavy duty plug-in type LS switches.

2.4 EQUIPMENT NOISE LEVELS

- .1 Design equipment for quiet operation with the overall sound pressure level at any equipment not exceeding 80 dBA when measured on the “a” weighting network using survey and field methods conforming to ANSI S1.13 and CSA Z107.2.

2.5 EQUIPMENT GUARDS

- .1 Provide, for couplings, belts, chain drives, extended shafts and exposed moving parts, securely mounted guards with the following features:
 - .1 Reinforced and neatly formed minimum 2.8 mm sheet steel or expanded sheet metal.
 - .2 Eliminate sharp edges with suitable borders neatly welded to perforates sheet.
 - .3 Pivoting access covers for shaft speed measurement.
 - .4 Hot-dip galvanize the guards after fabrication.

2.6 BASEPLATES FOR MECHANICAL EQUIPEMENT

- .1 Mount equipment and driver on a common baseplate in a compact arrangement unless otherwise specified.
- .2 Construct equipment baseplates of heavy cast iron or of welded structural steel sections at least 13 mm thick. Provide mounting plates at least 20 mm thick for mounting equipment and driver. Suitably stiffen structural steel baseplates to eliminate resonance and to absorb vibration from the equipment.
- .3 Machine surfaces for mounting equipment and driver to an arithmetical average roughness height of less than 3.175 micrometers.
- .4 Provide closed baseplates suitable for grouting with grout holes, vent holes and anchor bolt holes.
- .5 Where leakage or condensation may occur from equipment, equipment baseplates with a drip lip 40 mm high to encircle the exterior of the base. Provide bossed drain connections to drip lips below the gutter invert of at least 25 mm N.P.T. Provide piping from the drain connections to the building drainage system.

2.7 FLANGES

- .1 For equipment, valves and devices with integrally cast flanges, provide flanges to the dimensions and drilling of ANSI B16.1 or ANSI B16.5 with bolt-holes straddling the vertical centreline.
- .2 For fabricated equipment and vessels, provide flanges of the same material as the equipment or vessel. Stainless steel lap-joint flanges with carbon steel backing rings are not acceptable. Neither lap-joint Van Stone flanges are acceptable on gas systems. Orient flanges with bolt-holes straddling the vertical centreline.
- .3 Finish flanges in accordance with MSS standard of practice SP-6.

2.8 BEARINGS

- .1 Provide bearings, for rotating equipment, selected on the basis of a B-10 life expectancy as defined by the Anti-Friction Bearing Manufacturers Association at rated conditions of service of at least 100,000 working hours, unless otherwise specified.
- .2 Provide alemite grease fittings for bearing lubrication.

2.9 EQUIPMENT NAMEPLATES

- .1 Securely fit, in an easily read location, corrosion-resistant metal nameplates with impressed type lettering on equipment. Include the following information:
 - .1 For pumps, mixers, scrapers, etc..
 - .1 Model number
 - .2 Serial Number
 - .3 Capacity
 - .4 Head
 - .5 Impeller diameter
 - .6 Efficiency
 - .7 Brake power
 - .8 Bearing make and model number
 - .9 Other information required to uniquely identify the equipment

2.10 FINISHES

- .1 Finish piping and mechanical equipment to the following quality:
 - .1 Welds free of slag, ground and buffed.
 - .2 Surfaces of castings ground smooth
 - .3 Corners and edges on sheet metal work rounded.
 - .4 Stainless steel pipe free of steel wire rope marks.
 - .5 Material, piping and equipment free of dents.
 - .6 Machines surfaces finished to specific tolerances.

2.11 EQUIPMENT AND PIPE PROTECTION

- .1 Where specified, prepare surfaces, shop prime and factory finish equipment in accordance with Manufacturer's requirements.Execution

2.12 WORKMANSHIP

- .1 All work to be carried out by a qualified journeyman of the related trades.

2.13 INSTALLATION

- .1 Provide instruction and supervision as required to the mechanical installation contractor.
- .2 Following installation complete Certificate of Satisfactory Installation.

2.14 EQUIPMENT START-UP

- .1 Refer to Section 019113 – Start-up, Commissioning and Performance Testing.

2.15 OPERATOR TRAINING

- .1 Provide operator training in accordance with Section 017900 – Demonstration and Training.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 All other sections.

1.2 SUMMARY OF WORK

- .1 This section details the supply, design, fabrication, delivery, inspection of installation, testing, start-up and initial operation of the Digester No. 11 pumped mixing system equipment including pumps, nozzles, assemblies, accessories and associated controls.
- .2 Associated piping, supports, valves and ancillaries required to provide a complete installed system shall be provided by the Installation Contractor to complement the equipment supply limits defined herein. These requirements shall be clearly identified in the proposal.
- .3 The preliminary design drawings showing the pumped mixing system equipment attached to this RFP are general in nature and are not intended to show exact details. The selected Bidder shall cooperate with the Installation Contractor to resolve the detailed features and equipment dimensions.
- .1 Provide mechanical mixing systems for the following processes:
 - .1 Anaerobic Digester (herein referred as Digester No. 11).
- .2 Wherever in this section an action is specified to be performed, such action shall be performed by, and shall be the responsibility of, the Bidder unless specifically indicated otherwise.
- .3 Refer to Section 017900 – Demonstration and Training for the training requirements.
- .4 Refer to Section 019113 – Start-up, Commissioning and Performance Testing for the scope of work related to start-up, commissioning and performance testing requirements.

1.3 SUBMITTALS

- .1 Refer to Section 013300 – Submittal procedures for submittals requirements related to shop drawings, certificates, commissioning plan, commissioning report and operation and maintenance manuals. In addition, provide the following information as minimum related to the pumped mixing system for Digester No. 11:
 - .1 General arrangement drawings including dimensions, size and location of connections, and equipment weights.
 - .2 Process and Instrumentation diagram (P & ID)
 - .3 Layout of mixing nozzles, scum control nozzles, and mixing piping within the tanks, including pipe sizes, from the floor of the tank up to each nozzle.
 - .4 Details of crank boxes, gear boxes, articulating joints, control rods, and shaft seals for rotatable nozzles, if applicable to the design.
 - .5 Cross-sectional details including cross-referenced materials list for all equipment.
 - .6 Complete catalogue information, descriptive literature, and specifications.
 - .7 General layout of each pump unit complete with motor and drive showing anchor bolt locations, casing position, directional rotation, and electric motor terminal box location.

- .8 Certified pump performance curve showing head, capacity, efficiency, net positive suction head, and power expressed in kilowatts over the entire range of the pump.
 - .9 Details of impeller size, pump rpm and solid sphere passing capacity.
 - .10 Dimensional drawings of motors and drives and details including full output power in kilowatts, rpm and slip.
 - .11 Details of mechanical seals.
 - .12 Standard factory test results for motors.
 - .13 Routine maintenance requirements prior to plant startup.
 - .14 Start-up instructions including lubricant requirements, electrical requirements, etc.
 - .15 Certification that anchor bolt calculations indicating adequacy of bolt sizing and anchor embedment have been performed and signed by a professional structural engineer.
 - .16 Electric motor manufacturer's overhaul instructions.
 - .17 Special shipping, storage and protection, and handling instructions.
 - .18 Manufacturer's written/printed installation instructions, including:
 - .19 Recommended bolt torques.
 - .20 Installation instructions indicating assembly, mounting and anchorage requirements, alignment and assembly tolerances, and points of connection for ancillary services.
 - .21 Information on proposed factory-applied coating system. Include manufacturer's descriptive technical catalog literature and specifications, and written manufacturer's Certificate of Compliance that the factory-applied coating system is identical to the requirements specified.
 - .22 Where system proposed is different from that specified, or where, in the manufacturer's opinion, the coating system proposed exceeds the requirements specified, submit complete technical literature for the proposed system for review.
- .2 Computational Fluid Dynamics (CFD) Analysis
- .1 A comprehensive Computational Fluid Dynamics (CFD) analysis shall be undertaken for the proposed works that will model the specified mixing flows specific to the digester tank within this specification. The CFD analysis shall indicate Volume Averaged Velocities equal to or greater than 0.15 m/sec and active volume mixing greater than or equal to 90% based on a simulated tracer washout test for the proposed mixing system based on 4% solids digested sludge. The report along with the underlying CFD computer files shall be submitted to the Contract Administrator for review to substantiate the results obtained. Proof of a current license for the software used shall also be submitted.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Refer to Section 016100 – Common Product Requirements for delivery, storage and handling requirements.
- .2 Inspect equipment following delivery and complete Certificate of Satisfactory Delivery and submit in accordance with Section 013300 – Submittal Procedures.

1.5 INSTALLATION REQUIRMENTS

- .1 Provide detailed written instructions to the installation contractor for installation of all components of the Work.
- .2 Inspect the equipment following installation and complete Certificate of Satisfactory Installation.

1.6 QUALITY ASSURANCE

- .1 Provide a written process guarantee indicating that the performance criteria identified herein will be met.

Part 2 Products

2.1 MIXING SYSTEM FUNCTION

- .1 The mixing equipment will mix the contents of an anaerobic digester. The feed sludge to the digester is co-thickened primary sludge and waste activated sludge having an average monthly solids concentration ranging from 2.0 to 6.0 percent dry solids by weight.
- .2 Sludge may include sand, grit, rags, stringy and fibrous material and other settleable solids typically found in municipal wastewater. The mixing equipment shall be designed for reliable operation without plugging or fouling.
- .3 The mixing equipment shall be designed to meet the specified performance requirements and to be suitable for installation in a digester having the following characteristics:

Digester No. 11- Tank Characteristics	
Type	Concrete, circular, flat bottom, fixed roof
Number of Roof Support Columns:	16
Interior Diameter:	33.5 m
Maximum Side Water Depth:	8.16 m
Maximum Liquid Volume:	7,200 m ³
Largest Opening in Roof for Installation of Equipment	2.74 m x 2.74 m
Digester No. 11 – Sludge Characteristics	
Minimum Solids Concentration (% dry solids by weight)	2.0 %
Maximum Solids Concentration (% dry solids by weight)	6.0 %
Temperature Range	37 – 39 °C

2.2 Design Standard and Acceptable Manufacturers

- .1 Design Standard
 - .1 Rotamix as manufactured by Vaughan Co., Inc.
- .2 Acceptable Manufacturers
 - .1 Rotamix as manufactured by Vaughan Co., Inc.

.2 Jetmix as manufactured by Siemens

2.3 MIXING SYSTEM PERFORMANCE

- .1 The mixing equipment shall meet the following performance requirements, as determined by the performance tests specified herein, during both continuous operation and intermittent operation at the minimum duty cycle recommended by the mixing system manufacturer:
 - .1 Achieve an active liquid volume not less than 90 percent of the actual liquid volume.
 - .2 Achieve the specified active volume within 30 minutes of start-up the mixing system from a settled state.
 - .3 Variation in the sludge total solids concentration at any point in the digester shall not be greater than plus or minus 10 percent from the mean total solids concentration of the tanks when the mean total solids concentration is between 2.0 and 6.0 percent dry solids by weight, as determined by the solids profile test.
 - .4 Variation in the sludge temperature at any point in the digester shall not be more than plus or minus 1.0 degree C from the mean temperature of the digester, as determined by specified temperature profile test.

2.4 MIXING NOZZLES

- .1 Mixing nozzles shall be designed shall be specifically tailored in order to optimize the mixing effectiveness and efficiency for Digester No. 11 at the NEWPCC.
- .2 Mixing design shall include nozzle location, direction of discharge and outlet velocity.
- .3 Provide all nozzle assemblies with grooved joint fittings and couplings to permit easy disassembly for cleaning. Select couplings that prevent nozzles from rotating out of position.
- .4 Mixing nozzle assemblies shall be:
 - .1 Single or dual directional discharge nozzles.
 - .2 Supported by a base elbow anchored to the floor of the tank or concrete equipment base.
 - .3 Glass lined with a hardness of 73C Rockwell or Hi chrome.

2.5 MIXING PUMPS

- .1 Provide a duty and standby pump for Digester No. 11.
- .2 Pumps shall be horizontal, centrifugal, end suction, dry pit style, chopper type impeller with left of right handed arrangement as indicated on the preliminary drawings included with this RFP.
- .3 Pump bearings shall be lubricated with oil.
- .4 The rated capacity, head and maximum pump speed shall be determined. The friction losses in the pump suction piping and discharge piping within the tank control building, is to be determined and confirmed based on the preliminary drawings included with this RFP.
- .5 The drive shall be V-belt connected, TEFC electric motor suitable for 575V, 3-phase, 60 Hz power supply.
- .6 The motor size shall be determined by the Contractor. The motor shall be sized such that the actual power input to the motor at any point on the pump performance curve shall not

exceed 95 percent of the motor nominal power rating and for full speed run-out condition of the pump performance curve.

- .7 The maximum motor speed shall not exceed 1800 rpm.
- .8 Align the motor and pump on the base at the factory prior to shipment.
- .9 Motor starters are to be supplied by the installation contractor.

2.6 FOAMING AND SCUM CONTROL

- .1 Provide dedicated foam and scum suppression system complete with any associated controls. The system shall consist of but not limited to a pipe-mounted dual-nozzle foam and scum suppression system.
- .2 The upper foam suppression nozzle shall be assembled complete with deflector and located 150-300 mm above liquid level or as determined suitable for this application. The lower scum nozzle is to be located about 300-600 mm below liquid level for scum breakup and ensure upper surface rotation below the foam suppression nozzle and deflector.
- .3 This dual nozzle assembly is to be mounted near the tank periphery and aimed radially inward towards the center of the tank.
- .4 The system shall be designed to utilize the tank contents, which will be pumped through a spray nozzle to create a dispersed and an even spray pattern of droplets to effectively break surface foam bubbles to control digester foaming.
- .5 The spray nozzles shall be ASTM A536 glass-lined cast ductile iron or Hi chrome, with 25 mm (1.0 inch) nominal wall thickness to protect against abrasive conditions, and a long straight taper length of at least 300 mm (12 inches). Straightening vanes are not permitted to avoid the potential for plugging.
- .6 The inlet pipe/deflector assembly shall be constructed of 316 SS for all components located within tank.

2.7 PROTECTIVE COATINGS

- .1 Shop prime and paint all mixing equipment.
- .2 Protect internal machine surfaces with a corrosion-protective compound.

2.8 SPARE PARTS

- .1 Provide the following spare part:
 - .1 One set of bearings per pump
 - .2 One shaft sleeve per pump
 - .3 Three sets of gaskets per pump
 - .4 Two sets of mechanical seals per pump

Part 3 Execution

3.1 DESIGN PHASE

- .1 Following award of the project meet with the Contract Administrator to review the scope of work and discuss the proposed design.
- .2 Following the meeting prepare shop drawings for review by the Contract Administrator.

3.2 FABRICATION AND DELIVERY

- .1 Following approval of shop drawings by the Contract Administrator commence fabrication of the mixing equipment.
- .2 Cover costs to ship the equipment to the work site or to the installation contractor.
- .3 Coordinate with the installation contractor regarding unloading and storage of equipment.
- .4 Following successful delivery complete Form 101 – Certificate of Successful Delivery and provide it to installation contractor.

3.3 CONSTRUCTION PHASE

- .1 Provide instruction and periodic supervision to the installation contractor during all phases of the installation.
- .2 Provide verification of tank dimensions, elevations and sleeve locations prior to each concrete pour.
- .3 Following the completion of the installation complete Form 102 - Certificate of Satisfactory Installation and provide it to installation contractor.

3.4 START-UP AND COMMISSIONING

- .1 Undertake Equipment Start-up, Clean Water Test, Commissioning and Guaranteed Performance Testing in accordance with Section 019113 – Start-Up, Commissioning and Performance Testing.
- .2 Following the completion of successful commissioning complete Form 103 – Certificate of Satisfactory Commissioning and provide it to installation contractor.

3.5 GUARANTEED PERFORMANCE TESTING

- .1 Performance testing shall be in accordance with Section 019113 – Start-Up, Commissioning and Performance Testing and provide it to installation contractor.
- .2 Following the completion of successful performance testing complete Form 104 – Certificate of Satisfactory Performance Testing and provide it to installation contractor.

3.6 OPERATOR TRAINING

- .1 Provide operator training in accordance with Section 017900 – Demonstration and Training.
- .2 Co-ordinate with installation contractor for scheduling the training seminar.

END OF SECTION

CERTIFICATE OF SATISFACTORY DELIVERY

FORM 101

I have inspected the equipment delivered and unloaded at the site and have confirmed that delivery and unloading is satisfactory except as noted below. I have also informed the installation contractor of the storage requirement for the equipment at the site.

PROJECT: _____

ITEM OF EQUIPMENT: _____

REFERENCE SPECIFICATION: _____

OUTSTANDING DEFECTS: _____

CONTRACTOR'S REP

DATE

INSTALLATION CONTRACTOR'S REP

DATE

CERTIFICATE OF SATISFACTORY INSTALLATION

FORM 102

I have completed my check and inspection of the installation listed below and confirm that it is satisfactory and that defects have been remedied to my satisfaction, except as noted below:

PROJECT: _____

ITEM OF EQUIPMENT: _____

REFERENCE SPECIFICATION: _____

OUTSTANDING DEFECTS: _____

CONTRACTOR'S REP

DATE

INSTALLATION CONTRACTOR'S REP

DATE

CERTIFICATE OF SATISFACTORY COMMISSIONING

FORM 103

Commissioning has been completed in accordance with the specification, except as noted below:

PROJECT: _____

ITEM OF EQUIPMENT: _____

REFERENCE SPECIFICATION: _____

OUTSTANDING DEFECTS: _____

CONTRACTOR'S REP

DATE

CERTIFICATE OF SATISFACTORY PERFORMANCE

FORM 104

Guaranteed Performance Acceptance Testing has been completed and meets the requirements stated in the specification, except as noted below:

PROJECT: _____

ITEM OF EQUIPMENT: _____

REFERENCE SPECIFICATION: _____

OUTSTANDING DEFECTS: _____

CONTRACTOR'S REP

DATE