

SECTION 11322

VORTEX GRIT CHAMBERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope

1. Furnish and install equipment and appurtenances for two vortex grit chambers located in the Preliminary Treatment Area of the Headworks Building
2. Grit removal and collection from influent wastewater after passing 3 millimeter screening equipment in vortex, velocity control grit chamber
3. Recessed impeller pump with suction pipe at the bottom of each vortex grit chamber
4. Miscellaneous process piping, motors, power and motor controls for grit chamber velocity control mechanism and collection system

B. Additional Requirements Specified Elsewhere

1. Section 01340: Shop Drawings, Product Data, and Samples
2. Section 01400: Quality Control
3. Section 01600: Materials and Equipment
4. Section 01730: Operating and Maintenance Data

C. Related Requirements Specified Elsewhere

1. Section 02615: Ductile Iron Pipe
2. Section 03300: Cast-In-Place Concrete
3. Section 03600: Grout
4. Section 05500: Metal Fabrications
5. Section 05501: Anchor Bolts and Drilled-In Anchors
6. Section 07150: Dampproofing
7. Section 09900: Painting
8. Section 11314: Recessed Impeller Pumps
9. Section 11321: Grit Separator Equipment
10. Section 13300: Utility Control System
11. Section 15060: Pipe and Pipe Fittings
12. Division 16: Electrical

1.2 QUALITY ASSURANCE

A. Supplier's Qualifications

1. All equipment supplied by a single manufacturer or supplier
2. Experienced in manufacture of equipment of this type and size
3. Design basis
 - a. Smith & Loveless, Inc. "Pista-Grit Chamber Model No. 12.0B"

- b. Equivalent products of other manufacturers may be accepted subject to compliance with design, function, materials, and performance of the specified items with acceptance of alternative products solely at Owner's discretion

1.3 SUBMITTALS

- A. In accordance with Section 01340
- B. Manufacturer's Literature and Illustrations
- C. Manufacturer's Specifications and Illustrations
 - 1. Sufficient data to verify compliance with specifications and to illustrate construction and assembly of the products
 - a. Vortex grit chamber details
 - 1) Manufacturer
 - 2) Type and Model
 - 3) Flow and head loss for all design conditions specified
 - 4) Piping connections
 - 5) Size and rate or efficiency of material removal
 - 6) Dimensions
 - 7) Flow control baffle weights, dimensions and installation templates
 - 8) Grit chamber cover weights, loads and dimensions
 - 9) Grit collection hopper cover weights, loads and dimensions
 - b. Propeller and propeller drive tube
 - 1) Manufacturer
 - 2) Type and model
 - 3) Rotative speed
 - 4) Dimensions
 - 5) Weight
 - c. Motors
 - 1) Manufacturer
 - 2) Type and model including insulation class
 - 3) Rated size (hp)
 - 4) Temperature rating and service factor
 - 5) Dimensions
 - 6) Weight
 - 7) Demonstration of suitability for specified job conditions
 - d. Drive
 - 1) Manufacturer
 - 2) Type and model
 - 3) Input and output speeds
 - 4) Gear ratios
 - 5) Service factor (24-hour continuous service)
 - 6) Torque rating
 - 7) Bearing type and life
 - 2. General
 - a. Materials
 - b. Parts

- c. Devices
 - d. Accessories
 - e. Dimensions
 - f. Net equipment weights
 - g. Data on shop painting
- D. Shop Drawings
- 1. Fabrication
 - 2. Assembly
 - 3. Installation
 - 4. Anchor bolt setting templates
- E. Certification of Compliance
- 1. Manufacturer's affidavit of compliance certifying
 - a. All materials and equipment comply with these specifications
 - b. Equipment is properly installed and operating within specification tolerances
 - c. All tests have been performed with satisfactory results
- F. Operating and Maintenance Manuals in accordance with Section 01730

1.4 JOB CONDITIONS

- A. Located in Preliminary Treatment Area of the Headworks Building
- B. Indoor, heated location
 - 1. Refer to Section 11331 for design ambient temperature conditions
- C. Screened influent sewage
- D. Preceded by screening equipment capable of removing material 3 millimeters and larger
- E. All electrical equipment, components, and work in the Preliminary Treatment Area of the Headworks Building shall conform to NEC Class 1, Division 1, Group D unless otherwise noted on the Drawings

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN REQUIREMENTS

- A. Design flows for each grit chamber
 - 1. Initial average day flow: 0.75 MGD
 - 2. Initial peak hour flow: 1.3875 MGD
 - 3. Design average day flow: 2.50 MGD
 - 4. Design peak flow: 4.625 MGD

5. Future average day flow: 4.25 MGD
 6. Future peak hour flow: 7.8625 MGD
 7. Future build-out average day flow: 6.00 MGD
 8. Future build-out peak hour flow: 11.10 MGD
 9. Continuous feed
- B. All electrical equipment, lubrication, and bearings located above the Preliminary Treatment Area operating floor
- C. Steel and cast iron factory assembled equipment
- D. Vortex Grit Chambers
1. Number required: 2
 - a. One chamber to have clockwise flow direction
 - b. One chamber to have counterclockwise flow direction
 2. Flow through 360° design as shown on the Drawings providing for maximum liquid travel for effective grit removal
 3. Chambers constructed of cast-in-place concrete as detailed on the Drawings
 4. Include flow control baffles on the inlet and outlet of the main grit chamber
 - a. Inlet baffle shall control flow into grit chamber to ensure proper vortex flow and prevent short-circuiting
 - b. Outlet baffle shall control flow out of grit chamber by acting as weir controlling water levels in grit chamber and inlet channel
 5. Maximum head loss through chamber
 - a. At 4.625 mgd = 0.50 feet
 - b. At 11.10 mgd = 0.71 feet
 6. Grit storage hopper located below mixing chamber as shown on Drawings
 7. Grit chamber floor plate constructed of steel
 - a. Maximum 3" opening between drive tube and floor plate for grit to pass to storage hopper
 - b. Recessed so that top of plate is flush with slab
 - c. Two piece construction with lifting slots for removal to access storage hopper below
 8. Inlet and outlet channels 3'-0" wide as detailed on Drawings
 - a. Influent baffle and coanda ramp as detailed on the Drawings
 - b. Inlet channel to include internal baffle to provide a 2'-0" flow channel for initial and design flows
 - c. Assure grit does not settle in inlet channel
 9. Removal of material at specified future peak hour flow at the following rates:
 - a. 95% of grit greater than 50 mesh in size
 - b. 85% of grit greater than 70 but not less than 50 mesh in size
 - c. 65% of grit greater than 100 but not less than 70 mesh in size
 - d. A decrease in removal efficiency is not allowed for flow rates less than the design flow
 10. The grit chamber shall operate on the vortex principal
 11. Moving parts subject to wear and stoppage located above the water surface

E. Grit Storage Hopper

1. Cast-in-place concrete with grout fill as detailed on the Drawings
2. 5'-0" diameter
3. Grout fill sloped at 60° from horizontal to discharge pipe
4. Minimum effective storage volume: 100 cu ft
5. Discharge pipe: 4" ductile iron
6. Grit bed fluidization by mechanical means
 - a. Mechanical mixing device attached to propeller drive tube
 - b. Provide constant agitation to maintain grit fluidity
 - c. Mixing device specifically designed for fluidizing grit collected in storage hopper

F. Propeller

1. 72" diameter maximum
2. 60" diameter minimum
3. Blades bolted to 10³/₄" diameter propeller drive tube
4. Variable pitch, axial flow
5. Vertical distance from center line to chamber floor: 6"
6. Hydraulically scour grit moving across bottom of chamber
 - a. Hydraulic currents to lift organics
 - b. Adjustable grit scouring intensity

G. Drive and Motor

1. Drive propeller and grit bed fluidizer for grit collectors GC-1 and GC-2
2. 10³/₄" diameter propeller drive tube driven by a large, totally enclosed combination spur gear and turntable bearing
3. Totally enclosed helical gear motor
4. A pinion mounted on the output shaft of the helical gear motor shall drive a large spur tooth bull gear enclosed in a heavy cast iron case
 - a. The spur gear pinion shall be cut from heat treated steel
 - b. The bull gear shall rotate with a minimum 21" diameter turntable bearing for durability and stability
 - c. The pinion and bull gear shall be a service factor of 5.0 or greater at standard operating speeds
5. Rotative speed: 21 rpm maximum
6. The motor shall not be overloaded under any normal conditions encountered

2.2 MATERIALS

A. Vortex Grit Chamber Equipment

1. Separator chamber and storage hopper: Cast-in-place reinforced concrete
2. Grit chamber floor plate: ½" thick ASTM A36 steel
3. Structural steel shapes includes baffles: ASTM A36
4. Drive tube: ASTM A36 steel, hot-dipped galvanized
5. Propeller: ASTM A36 steel
6. Piping: Ductile iron

7. Propeller connecting rods: ASTM A36 steel, bolted or welded
8. All submerged metal surfaces ¼" minimum thickness unless otherwise indicated

B. Drive Unit

1. Housing: Heavy cast iron
2. Gears: High quality machined and hardened steel for high strength and long wear

C. Bearings

1. B-10 life: 50,000 hours
2. Turntable bearing B-10 life: 20 years
3. Continuous duty per AGMA

2.3 FABRICATION AND MANUFACTURE

A. General

1. All bearings, sprockets, and operating mechanisms to be above water surface
2. Welds on submerged or partially submerged surfaces to be continuous
3. Sharp corners to be dulled with power grinder
4. All carbon steel parts to be epoxy coated except where specified to be hot-dipped galvanized

B. Vortex Grit Chambers

1. Cast-in-place reinforced concrete structures
2. Structure to include steel inlet and outlet baffle and steel grit chamber floor plate cover complete and ready for installation of propeller drive equipment
3. Grit chamber floor plate
 - a. Two-piece construction
 - b. 3" maximum clearance to propeller drive tube
 - c. Lifting slots
 - d. No attachments to propeller or drive tube assembly
4. Grit hopper shall include grit pump suction line and grit bed fluidization device connected to propeller driver tube
5. Install checkered plate over open areas as shown on drawings
6. Grit removed from bottom of grit storage hopper and discharged by means of a recessed impeller vortex grit pump to the grit separator equipment
7. Interior surfaces of grit chamber and storage hopper shall be formed round
 - a. Segmented, straight or flat panel forms of any width are not acceptable

C. Propeller Drive Equipment

1. Pre-assembled unit
2. Constructed to minimize overhung weight
3. Replaceable bearing
4. 10¾" diameter torque tube

D. Drive and Motor

1. Support and drive upper end of impeller drive tube with helical gear type speed reducer
2. Fully housed motor and reducer running in oil
3. Motor connected to torque drive tube through bull gear box
 - a. Specifically designed for this service
 - b. 10³/₄" torque tube opening
 - c. Sealed with bottom air bell opening to prevent water from entering gearbox in case of flooding
4. Anti-friction bearings throughout
5. Maximum nameplate horsepower: 2.0
6. 480 VAC, 60 Hz, 3-phase
7. Normal starting torque with low starting current
8. All electrical work to conform with NEC Class 1, Division 1, Group D unless otherwise indicated on the Drawings

E. Shop prime in accordance with Section 01600

1. Assure compatibility of shop prime coating with finish coatings in accordance with Section 09900

2.4 PAINTING AND COATINGS

A. All surfaces to be painted or coated except

1. Stainless steel
2. Aluminum
3. Galvanized
4. Nickel or chromium
5. Rubber and plastic

B. All surfaces to receive prime, intermediate and/or finish painting or coating at the factory

C. Surface Preparation

1. Non-immersion service: Steel Structures Painting Council (SSPC) - SP6 Commercial Blast Cleaning
2. Immersion service: Steel Structures Painting Council (SSPC) - SP10 Near White Blast Cleaning

D. Painting or Coating System

1. Manufacturer's standard coating system
2. Use only mercury-free, lead-free, fume-proof paint or coatings
3. Paint or coatings must be suitable for atmosphere containing hydrogen sulfide

E. Refer to Section 01600 for additional requirements

2.5 ANCHOR BOLTS

- A. Manufacturer to specify type, size, number required, etc.
 - 1. Refer to Section 05501 for general requirements
- B. Manufacturer to provide anchor bolt setting template and/or setting instructions
- C. Anchor bolts will be furnished by installation contractor

2.6 CONTROLS

- A. Provide one control panel for the equipment of each vortex grit chamber
- B. Equipment at each vortex grit chamber shall be independently operated through its own control panel
- C. Control panels to be wall mounted in the Electrical and Control Room of the Headworks Building
- D. The Preliminary Treatment Area of the Headworks Building will include hazardous environment monitoring devices. Should a hazardous environment condition occur, it will be indicated by the SCADA system which will in turn send a shut down signal to the equipment in the area. The vortex grit chamber equipment control panel must be able to accept this signal and upon its activation immediately de-energize all grit collection equipment in the Preliminary Treatment Area
- E. Provide a local emergency stop pushbutton at each vortex grit chamber in a NEMA 7 enclosure in the Preliminary Treatment Area
 - 1. Local stop pushbutton will serve as local disconnect switch
 - 2. Provide stop pushbutton with lockout cover or latching hasp
- F. Control Panel
 - 1. Number required: 2, one for each grit chamber
 - 2. Enclosure rating: NEMA 4
 - 3. Control panel component rating: NEMA 4X
 - 4. Completely prewired and factory tested prior to shipment
 - 5. Main disconnect switch capable of being locked in the Off position
 - 6. Accept input power of 480 VAC, 3-phase, 60 hertz
 - 7. Provide all logic devices, switches, relays and other appurtenances necessary for proper equipment operation and control
 - 8. Include the following minimum electrical devices
 - a. FVNR motor starter and motor overload protection
 - b. Transformer for 120 VAC control system power
 - c. Main circuit breaker
 - 9. Include the following minimum pilot and control devices
 - a. On/Off selection switch for propeller drive motor

- b. Emergency stop pushbutton
 - c. System reset pushbutton
 - d. Run indicating light: Green
 - e. Fault indicating light: Red
 - f. Hour or run time meter
 - g. Run output contact
 - h. Fault output contact
 - i. Input contact for equipment shutdown signal from SCADA system
10. Provide circuitry and devices to shutdown the equipment upon the following conditions
 - a. Motor overload/fault
 - b. Control panel emergency stop pushbutton activation
 - c. Local emergency stop pushbutton activation
 - d. Receipt of SCADA system shutdown signal
 11. Clearly label all front panel mounted items and devices on the outside front of the panel
 12. Clearly label all wires and terminal points inside the control panel
 13. All power and control wiring shall be 600 Volt insulated copper and sized for the required load, 14 AWG minimum
 14. All circuit breakers shall be thermal magnetic molded case units
 15. All selector switches, pushbuttons and pilot lights shall be heavy-duty, water/oil tight, corrosion resistant units rated for NEMA 4X service
 16. All terminal blocks shall be pressure connector type with marking strips and covers suitable for copper connectors sized for the application
 17. All control relays shall be industrial plug in type rated for the appropriate application load

2.7 SPARE PARTS

- A. One complete set of all seals and gaskets
- B. One set of replacement bearings except for turntable

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 01600 for requirements

3.2 INSTALLATION

- A. Inspection

1. Inspect materials and equipment for signs of damage, pitting, rust, decay or other deleterious effects of storage, transportation, handling, etc.
 - a. Replace or repair any materials or equipment showing such effects to the satisfaction of the Engineer and Owner
 - b. Replace damaged materials or equipment with identical new materials or equipment

B. Equipment Installation

1. Handle, install, connect, clean, condition, align and adjust products and equipment in strict accordance with manufacturer's instructions and in conformity with specification requirements
 - a. Maintain one complete set of manufacturer's installation instructions at the jobsite during installation and until installation is accepted by the Engineer and Owner
 - b. Perform all work in accordance with manufacturer's instructions
 - 1) Do not omit any preparatory step or installation procedure unless specifically modified or exempted by contract documents
 - 2) Should job conditions or specification requirements conflict with manufacturer's instructions, consult with Engineer prior to proceeding
 - c. Shimming between machined surfaced is not permitted
2. Provide lubricants as recommended by the manufacturer
 - a. Provide sufficient quantity to
 - 1) Fill all lubricant reservoirs
 - 2) Replace all lubricant consumed during testing, startup and operation prior to acceptance of equipment by Owner

C. Paint and Coatings

1. Recoat all shop coated surfaces damaged prior to product acceptance to the satisfaction of the Engineer and Owner
 - a. Use paint and/or coating materials identical to those used by manufacturer for shop priming and painting
 - b. Utilize surface preparation procedures as specified herein or as may be appropriate for repairs needed

D. Adjustment and Cleaning

1. Perform all required adjustments, tests, operational checks, cleaning and other startup activities required

3.3 FIELD TESTING

- A. Ensure all bearings and gear reducers are properly lubricated
- B. Make all necessary initial adjustments to put equipment into operation
- C. Operate equipment for 24 hours
- D. Log drive motor amperages
- E. Test grit removal efficiency to indicate compliance with required performance
- F. Perform all other manufacturer's standard battery of tests
- G. Equipment: No indication of binding, unusual loads, intermittent operation, or other problems

3.4 FIELD QUALITY CONTROL

A. Provide Manufacturer's Field Service

1. Minimum two trips to project site at one-half (½) day each
2. Qualifications of manufacturer's representative
 - a. Authorized representative of the manufacturer
 - b. Experienced in the application and installation of the subject work, materials and equipment
3. Services provided by representative
 - a. Provide guidance regarding proper installation
 - b. Supervise installation of equipment furnished under this section
 - c. Inspect, check, adjust and test equipment installed, as required, and approve final installation
 - d. Be present when equipment is placed in operation
 - e. Revisit site as often as required to correct all problems and until equipment installation and operation are acceptable to Engineer and Owner
4. Manufacturer's representative to instruct Owner's personnel in the operation and maintenance of the equipment furnished. Minimum one-half day including classroom and field training. May be combined with startup services

B. Furnish three (3) copies of written report to Engineer certifying that

1. Equipment is properly installed and lubricated
2. Equipment is in accurate alignment and balance
3. Equipment is free from any undue stress imposed by connecting piping, anchor bolts, etc.
4. Equipment has operated satisfactorily under full load conditions and as specified through full operating range
 - a. Provide water flow-through test performance results
 - 1) Head loss conditions at 4.625 mgd throughput rate
 - 2) Submerged operation of grit vortex equipment
 - 3) Grit removal pump performance with clean-water flooded suction

END OF SECTION