SECTION 11321

GRIT SEPARATOR EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope

1. Furnish and install one centrifugal grit separator (cyclone) and one grit dewatering screw (classifier) with appurtenances
2. Function: Receive grit and other solids removed in vortex grit chambers and pumped to cyclone separator
3. Location: Upper operating level of the Preliminary Treatment Area in the Headworks Building
4. Discharge washed and dewatered grit to a screenings container for disposal off site

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 03600: Grout
3. Section 05501: Anchor Bolts and Drilled-In Anchors
4. Section 09900: Painting
5. Section 11314: Recessed Impeller Pumps
6. Section 11322: Vortex Grit Chambers
7. Section 13300: Utility Control System
8. Section 15060: Pipe and Pipe Fittings
9. 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. Wemco Hydrogritter Separator, Model 12F 100DC
   b. Equivalent products of other manufacturers may be accepted subject to compliance with design, function, materials, and performance of the specified items and subject to acceptance by Owner in its sole discretion

1.3 SUBMITTALS

A. In accordance with Section 01340

B. Manufacturer's Specifications and Illustrations

1. Sufficient data to verify compliance with specifications and to illustrate construction and assembly of the products
   a. Grit separation equipment
      1) Manufacturer
      2) Type and model
      3) Design flow, minimum and maximum, and pressure drop
      4) Piping connections
      5) Size and rate or efficiency of material separation
      6) Dimensions
      7) Weight
   b. Dewatering Screw
      1) Manufacturer
      2) Type and model
      3) Maximum flow rate
      4) Screw rotative speed
      5) Bearings
      6) Dimensions
      7) 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) Design voltage and current draw
   d. Drive
      1) Manufacturer
      2) Type and model
      3) Input and output speeds
      4) Speed 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. Weights
   g. Data on shop painting
   h. Design calculations

C. Shop Drawings

1. Fabrication
2. Assembly
3. Installation
4. Anchor bolt setting templates

D. 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

E. 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 minimum and maximum ambient temperature

C. Grit from vortex grit chambers

1. Municipal wastewater

D. Fluid pumped by recessed impeller pumps

E. Preceded by screening equipment capable of removing material 3 millimeters and larger

F. 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

G. Headworks Design Flows

1. Initial average day flow: 0.75MGD
2. Initial peak hour flow: 1.3875 MGD
3. Design average day flow: 2.50 MGD
4. Design peak hour flow: 4.625 MGD

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN REQUIREMENTS

A. Flow

1. Grit pump flow rate to cyclone
   a. Minimum: 180 gpm
   b. Rated point: 220 gpm
   c. Maximum: 250 gpm
   d. Refer to Section 11314 - Recessed Impeller Pumps for operating characteristics of grit pumps which feed this equipment
2. Continuous feed during grit pumping cycle
   a. Initial flow: Cycle time - once every 4 hours, run time 5 minutes
   b. Design flow: Cycle time - once every 2 hours, run time 5 minutes
   c. Future build-out conditions: Run 5 minutes of every hour

B. All electrical equipment, piping, lubrication and bearing parts located above the Preliminary Treatment Area operating slab

C. Steel and cast iron factory assembled units

D. Grit Separation Equipment

1. Mounted at 22½° from horizontal
2. Mounted on dewatering unit tank/housing
3. Inlet pressure: 5 psi
   a. 10 psi maximum
   b. Refer to Section 11314 - Recessed Impeller Pumps
4. Construction to minimize overhung weight
5. Replaceable liner for protection of steel and iron materials from high velocity grit
6. Flanged inlet and outlet connections
   a. Inlet: 4 inch
   b. Outlet: 6 inch
7. Outlet vented to atmosphere to prevent siphoning
8. Underflow feed to grit dewatering unit
9. Vortex finder: 4 minimum
10. Allow removal of material which may clog apex without disconnecting any piping on cyclone
11. Volute feed chamber
12. 95% removal of material larger than 150 mesh having specific gravity of 2.65 or greater
13. Properly sized to meet hydraulic loading of dewatering unit
14. Properly sized to handle hydraulic capacity of grit pumps

E. Grit Dewatering Unit

1. Capable of dewatering and elevating grit at minimum rate of 0.75 tons/hour
2. Full-flared grit settling tank with shafted spiral screw type conveyor
3. Grit settling tank

a. At maximum water level the minimum pool area shall be 8 sq ft
b. Maximum full water depth of 150% of screw diameter
c. Designed as settling compartment where grit separation takes place
d. Adjustable weir to control tank water level: 24 inches long minimum
e. Structural steel support
f. Weir overflow shall discharge into launder box
g. 2-inch minimum diameter drain connection
h. 2½-inch minimum diameter organic return connection
i. Grit removal from bottom of settling compartment
j. Maintenance performed without draining tank
k. ⅜-inch minimum sluice water valve cock connection at grit discharge
l. Feed box
    1) Liner for abrasion protection and splash guard
    2) Hinged covers to allow for inspection of cyclone apex without disturbing cyclone and its piping
    3) Designed to handle maximum cyclone discharges
    4) Minimize short-circuiting to classifier overflow weir
    5) Dissipate energy generated from cyclone discharge to minimize classifier pool disturbance
m. Grit chute
    1) Direct dewatered grit away from grit port
    2) Removable for inspections without disturbing classifier operation
    3) Angled to allow for fall/flow of grit into screenings container per Drawings

4. Screw
    a. 50% pitch minimum
    b. 12-inch diameter minimum
    c. Steel flights welded to shaft
    d. Replaceable wearing shoes
    e. Clearance between screw and tank to allow buildup of grit and sand for screw bed eliminating tank wear
    f. Rigidly supported by bearings at upper and lower end
    g. Lower bearing
        1) Submerged, watertight and suitable for grit service without oil leakage or grit infiltration
        2) Manually operated lifting device
        3) Raised above maximum water level
        4) Sealed; oil lubricated, or grease lubricated
        5) Manual, central lubrication system: Extend lubrication lines and grease fittings from lower bearing to easily accessible area at top of settling tank
    h. Upper bearing supported by drive
    i. Screw operated at 12 RPM maximum
    j. Screw inclined at 12-inches horizontal to 3½-inches vertical
    k. Dewatering length: 30-inches minimum
5. Drive and Motor
    a. Cycloidal motion speed reducer or helical gear type reducer
    b. Totally enclosed motor
    c. Constant speed V-belt drive
    d. Rotative speed: 1800 rpm maximum

e. Anti-friction bearings
f. Designed for shock loads of 500% of rated loading
g. Motor and reducer pivoted at shaft centerline so that the screw assembly can be raised

6. ⅜-inch minimum diameter pipe and spray nozzle for grit washing in screw conveyor
   a. 1 - 2 gallons per minute maximum
   b. 40 psi maximum
   c. Provide solenoid valve interlocked to drive motor

2.2 MATERIALS

A. Grit Separation Equipment

1. Volute feed chamber: Cast iron
2. Cylindrical and conical sections: ASTM A36 steel and aluminum
3. Structural steel shapes: ASTM A36
4. Replaceable liner: Gum rubber or molded neoprene
5. Vortex finder: NiHard, Brinell hardness 500 minimum
6. Piping: Ductile iron

B. Grit Dewatering Unit

1. Structural steel shapes: ASTM A36, ¼-inch minimum
2. Dewatering tank: ASTM A36, ¼-inch minimum
3. Screw conveyor: ASTM A36, 12 gauge minimum

C. Bearing

1. B-10 life: 50,000 hours
2. Continuous duty per AGMA

2.3 FABRICATION AND MANUFACTURE

A. General

1. All bearings (except lower bearing), sprockets, operating mechanisms to be out of water
2. Welds on submerged or partially submerged surfaces to be continuous
3. Sharp corners to be dulled with power grinder

B. Grit Separation Equipment

1. Preassembled unit
2. Constructed to minimize overhung weight
3. Completely lined and protected from high velocity grit
4. Replaceable liner
   a. Replace any section independently
5. Underflow feed to grit dewatering unit
6. Suitable for mounting at 22½° from horizontal

a. Structural supports connected to dewatering unit tank/housing
b. Inlet and outlet connections located at grit discharge end of dewaterung unit

7. Apex valve manufactured from resilient material
8. 125 lb ASA cast iron flanges
9. Hinge and quick disconnect clamp provided between apex assembly and lower cone section to allow removal of material which may clog apex without disconnecting any piping on the cyclone
10. Tap inlet for 1-inch NPT gauge connection
    a. Provide diaphragm protected pressure gauge

C. Grit Dewatering Unit

1. Pre-assembled unit
2. Mechanism to include steel dewatering tank, dewatering screw, overflow weir, supporting steel, drive unit, and discharge assembly
3. Tank to include organic return connection and drain connection
4. Adjustable weir for control of water level in tank
5. Constructed so maintenance can be performed without draining the settling tank
6. Mounted on steel supports and anchor bolted to concrete equipment base
7. Designed to structurally support grit separator equipment
8. Weir overflow to discharge to a launder box
9. Grit removed from bottom of tank and discharged by means of a screw type conveyor
    a. Preformed heavy steel flights welded to shaft
    b. Replaceable wearing shoes attached to flights with bolts and nuts
10. Lower bearing assembly
    a. Manual lifting device
    b. Raise lower bearing above maximum water level
    c. Water tight enclosure
11. Spray nozzle for washing grit carried by screw conveyor

D. Drive and Motor

1. Support and drive upper end of screw conveyor with cycloidal motion speed reducer or helical gear type speed reducer
2. Fully housed motor and reducer running in oil
3. Motor connected to speed reducer by V-belt arrangement
    a. 18 gauge galvanized steel guard or fiberglass guard
4. Antifriction bearings throughout
5. Motor and drive assembly pivoted at shaft centerline so screw assembly can be raised
6. Maximum nameplate horsepower: 0.5
7. 480 V, 60 Hz, 3-phase
8. All electrical work to conform with NEC Class 1, Division 1, Group D, unless otherwise indicated on the Drawings

E. Expanded metal protective guard over full length of rotating screw

F. Shop prime in accordance with Section 01600

1. Provide specifications for shop coatings demonstrating compatibility with specified field-applied finish coating(s)

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
   a. Provide manufacturer's standard color
   b. Owner to select color from manufacturer's standard color chart
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 grit separator equipment

B. Grit separator equipment shall be operated through its own control panel

C. Control panel 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 in the SCADA system which will in turn send a shut down signal to the equipment in the Area. The vortex grit separator equipment control panel must be able to accept this signal and upon its activation immediately de-energize all equipment in the Preliminary Treatment Area

E. Provide a local emergency stop pushbutton at the grit separator in a NEMA 7 enclosure

1. Provide locking hasp or locking cover on emergency stop pushbutton to provide for local disconnect switch with lockout

F. Operation of grit separator equipment shall be initiated by a run signal from either one of the grit pumps

G. Control Panel

1. Number required: 1
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. Include all logic devices, programmable relays, timers and appurtenances for proper equipment operation
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. Hand/Off/Auto selection switch for drive motor
      1) When in Hand, equipment to operate continuously
      2) When in Auto, equipment to operate as follows
         a) When a run signal is received from either one of the grit pumps, this will initiate separator operation and energize an adjustable fail timer
            (1) If the separator starts and its operation is confirmed before the fail timer times out, the fail timer shall reset
            (2) If the separator does not start and its operation is not confirmed before the fail timer times out, the separator will be in a fault condition and a shutdown signal will be sent to each grit pump
         b) When the grit pump run signal terminates, an adjustable Off delay timer will be energized while the separator continues to run.

When the timer times out, the separator will be de-energized and the system will reset

b. Emergency stop pushbutton with lock at motor location
c. System reset pushbutton
d. Run indicating light: Green
e. Fault indicating light: Red
f. Hour or run time meter
g. Solid state fail timer with a minimum adjustable range of 0 to 30 seconds at one (1) second increments
h. Solid state off delay timer with a minimum adjustable range of 0 to 20 minutes at one (1) minute increments
i. Run output contact
j. Fault output contact to SCADA system
k. Fault output contact to grit pump GP-1
l. Fault output contact to grit pump GP-2
m. Input contact for run signal from grit pump GP-1
n. Input contact for run signal from grit pump GP-2
o. 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 V-belts for drive unit

C. One lower bearing assembly

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. Ensure V-belt drive is properly installed and tensioned

C. Make all necessary initial adjustments to put equipment into operation

D. Operate equipment for 24 hours with clean water from grit pumps

E. Log drive motor amperages

F. Test grit removal efficiency to indicate compliance with required performance

1. Evaluate within 45 working days of commencement of operation with raw municipal wastewater

G. Perform all other manufacturer's standard battery of tests

H. 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
   a. Minimum one-half day including classroom and field training
   b. 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

END OF SECTION