

INDEX TO
SECTION 46 23 66
GRIT REMOVAL SYSTEM

Paragraph	Title	Page
PART 1 – GENERAL		
1.01	Scope	46 23 66-1
1.02	Design Requirements	46 23 66-1
1.03	Submittals and Operation and Maintenance Manuals Quality Assurance	46 23 66-2
1.04	Quality Assurance	46 23 66-2
1.05	Manufacturer	46 23 66-4
PART 2 – PRODUCTS		
2.01	Grit Concentrator	46 23 66-4
2.02	Grit Pump (See Spec Section 46 23 67)	46 23 66-5
2.03	Controls and Instrumentation	46 23 66-6
2.04	Sequence of Operation	46 23 66-7
2.05	Utility Requirements	46 23 66-7
2.06	Materials and Finishes	46 23 66-7
PART 3 – EXECUTION		
3.01	Delivery and Installation	46 23 66-8
3.02	Start-Up, Training and Manufacturer's Services	46 23 66-8
3.03	Functional Testing	46 23 66-8
3.04	Manufacturer's Certificate(S)	46 23 66-8

SECTION 46 23 66**GRIT REMOVAL SYSTEM****PART 1 – GENERAL****1.01 SCOPE**

- A. Work described in this section includes furnishing all labor, equipment, materials, tools and incidentals required for a complete and operable installation of the grit removal system as shown on the drawings and specified herein. The manufacturer shall supply the equipment and the general contractor shall install the equipment.

1.02 DESIGN REQUIREMENTS

- A. The Grit Removal, Washing, and Dewatering System shall:
1. Removal efficiency, as outlined in each components section below, shall be based on the following gradation:

% Passing Cumulative									
Micron	75	106	150	212	300	425	600	1000	
Georgia	1.0	5.1	17.8	39.8	60.1	70.8	81.4	94.3	Physical Average
Georgia	0.8	6.7	32.2	56.6	85.6	93.5	97.5	100	SES Average

- B. The Grit Removal System shall be comprised of the following components:
1. Eutek HeadCell® Grit Concentrator
 2. Control Panel
- C. The Grit Concentrator unit shall be placed in a concrete tank and receive the incoming screened flow. The Grit Concentrator shall provide sufficient surface area to remove the specified grit particles from the specified peak flow and concentrate the grit in a sump at the bottom of the unit. The de-gritted effluent from the Grit Concentrator shall be weir discharged as shown on the drawings.
- D. The Grit Concentrator shall be all-hydraulic, self-activating and shall not require internal moving parts.
- E. The Grit Pump shall convey the concentrated grit slurry from the underflow of the Grit Concentrator to the Grit Washing / Classification unit.
- F. The system to be furnished hereunder shall be made by a manufacturer regularly engaged in such work and who has furnished similar installations and had them in successful and continuous operation for a minimum period of ten years.

- G. Data on performance testing, service history and operation of existing installations using the submitted equipment shall be made available to the Engineer, upon request, for use in determining that the Grit Removal components offered meets the intent of the contract, performance requirements and criteria stated in these specifications.
- H. The Grit Concentrator technology shall be designed utilizing Computational Fluid Dynamics (CFD) and field data to verify its flow regime, head loss and grit removal characteristics. Upon request, data on the computation methods used and generic simulation results shall be made available to the engineer.
- I. Units using a piped upflow influent distribution design to feed the grit concentrator shall not be accepted.
- J. Designs with hydraulic turns greater than 45 degrees shall not be allowed.
- K. Multiple flexible connections to the trays shall not be allowed.
- L. Units using Apex valves shall not be accepted.
- M. Equipment using paddles or air to supplement or induce a vortex shall not be accepted.

1.03 SUBMITTALS AND OPERATION AND MAINTENANCE MANUALS

- A. Submittals shall be provided in accordance with the General Conditions and shall include the following:
 - 1. Manufacturer's catalog data and descriptive literature including equipment weights and performance data.
 - 2. General arrangement and dimensional drawings of the grit removal system.
 - 3. Written recommended procedures for job site storage, handling, and installation of the equipment.
 - 4. Hydro International's Intellectual Property licensing agreement.
- B. Operation and maintenance manuals shall be provided at the completion of the job and in accordance with the General Conditions. The manuals shall include the following data:
 - 1. Alignment, adjustment, and repair instructions.
 - 2. MANUFACTURER'S installation instructions.
 - 3. Assembly diagrams.
 - 4. Troubleshooting guide.
 - 5. Lubrication instructions.
 - 6. Recommended spare parts lists and predicted life of parts subjected to wear.

1.04 QUALITY ASSURANCE

- A. Warranty
 - 1. Any product that proves defective in material, workmanship or design within twelve (12) months after final acceptance shall be, at the discretion

of the MANUFACTURER, modified, repaired or replaced, or Buyer's payment for the products shall be refunded. This shall be Buyer's sole remedy.

- B. Certificate of Compliance
1. The MANUFACTURER shall warrant that the Grit Removal System to be supplied shall be manufactured in strict compliance with the Contract Specifications.
 2. The Manufacturer representative shall inspect and certified that the equipment is installed according to the manufacturer installation prior to start-up.
- C. The system shall be furnished by a MANUFACTURER who is ISO 9001:2008 Certified.
- D. MANUFACTURER shall be successful in the experience of manufacture, operation, and servicing of Grit Removal Systems of type, size, quality, performance, and reliability equal to that specified for a period of not less than ten (10) years. The MANUFACTURER shall submit evidence of experience having supplied a minimum of ten (10) installations in North America of similar size to the proposed system and with a maximum surface loading of 11.8 gpm/square foot or less at the specified peak design flow.
- E. In the absence of verifiable experience, the MANUFACTURER shall be required to provide an extended warranty and subsequent Performance Bond for the same number of years that the MANUFACTURER was found lacking in experience from the specified ten (10) year period. The performance bond shall commence with acceptance of the equipment and time described herein and beyond the standard warranty period.
- F. If equipment other than that shown on the Drawings is submitted to the Engineer for consideration as an equal, it shall be the responsibility of the MANUFACTURER requesting approval to submit with the request a revised design and layout of the mechanical equipment acceptable to the ENGINEER. Revised drawings shall show the proposed location of the alternate unit, and area required for withdrawal space of replacement or serviceable components. This drawing shall also show clearances of adjacent equipment and service area required by that equipment.
Changes in architectural, structural, electrical, mechanical and plumbing requirements for the alternate shall be the responsibility of the Manufacturer requesting approval. This shall include the cost of redesign by affected designers. Any additional cost incurred by affected subcontractors shall be the responsibility of the MANUFACTURER and not the OWNER.
- G. Seller shall warrant its products against infringement upon, or violation of, any patent, copyright, trade secret, or any other proprietary right of any third party. In the event of a claim by any third party against the Owner, the Owner shall promptly notify the Seller. The Seller shall then defend such claim, in the Owner's name, but at Seller's expense, and shall indemnify the Owner against any loss, cost, expense or liability arising out of such claim whether or not such claim is successful.
- H. *(OPTIONAL) Approved equal MANUFACTURERS shall furnish performance test*

results by an independent party documenting that the System has achieved the specified performance requirement in a minimum of three installations. MANUFACTURERS that are approved as equal are not excused from providing the specified products as outlined below.

1.05 MANUFACTURER

- A. The entire Grit Removal System shall be manufactured by Hydro International, Hillsboro, OR. 2925 NE Alcock Drive #140, Hillsboro, Oregon, 97124, telephone 503-615-8130. Being named or bidding as an equal does not relieve the manufacturer of meeting these specifications.
- B. Alternate manufacturers shall require the engineer's written approval 30 days prior to bid opening.

PART 2. PRODUCTS

2.01 GRIT CONCENTRATOR

- A. Design Data
 - 1. Number of Units: 1
 - 2. Size: 12' diameter
 - 3. Number of Trays per Unit: 11
 - 4. Surface Area/Unit: 1243 ft²
 - 5. Peak Loading Rate: 11.2 gpm/ft²
 - 6. Performance: 95% removal of all grit (specific gravity 2.65)
≥ 75 microns at average flow
 - 7. Performance: 95% removal of all grit (specific gravity 2.65)
≥ 106 microns at peak flow
 - 8. Average Flow/Unit: 8 mgd with no more than 2" headloss
 - 9. Peak Flow/Unit: 20 mgd with 12" headloss
 - 10. Influent Duct Opening: 5'-10"H x at least 3' W
 - 11. Discharge: Weir
 - 12. Underflow Connection: 4"
 - 13. NPW Connection: 1" NPT
 - 14. Materials of Construction: 304 SS Support structure/duct/underflow; PE trays
- B. Operation
 - 1. Flow shall transition from the inlet channel or pipe to the trays via an inlet duct positioned above the trays. Each tray shall be connected to the inlet duct by a horizontal nozzle with a rectangular cross section and large clear openings. Round nozzles which reduce cross sectional area shall not

be allowed. Designs with hydraulic turns greater than 45 degrees shall not be allowed.

2. The Grit Concentrator shall have a maximum surface loading rate of 11.8 gpm/square foot to ensure adequate surface area for settling and specified particle removal efficiency. No exceptions shall be allowed.
3. The Grit Concentrator shall be characterized by a controlled boundary layer flow to enhance settleable solids concentration and removal.
4. The Grit Concentrator shall be all-hydraulic consisting of self-cleaning corrosion resistant, non-metallic trays with no moving parts within the unit.
5. All flow passages shall be self-cleaning and free of sharp projections or fittings that may snag stringy or fibrous materials.
6. Water shall be continuously supplied to the solids underflow sump.

C. Construction

1. The inlet flume shall be constructed of Minimum 14 gauge formed stainless steel sheet with minimum 3" clear openings. Multiple flexible connections to the trays shall not be allowed. Units using a piped upflow influent distribution design shall not be accepted. Designs with hydraulic turns greater than 45 degrees shall not be allowed.
2. Grit Concentrator trays shall be molded thermoplastic with a minimum ¼ inch thick LDPE on the pans and sidewalls. Formed and welded stainless steel trays shall not be allowed.
3. The stack of trays shall securely fit into a stainless-steel support frame. The support frame shall fit and secure to the bottom of the CONTRACTOR supplied concrete support structure.
4. A stainless-steel grit collector shall be provided with the Grit Concentrator for collection and removal of settled solids to the respective Grit Separation / Classification /Washing unit. The grit collector shall be installed in the CONTRACTOR supplied concrete tank and incorporate the flanged underflow and threaded fluidizing pipe connections.
5. All pipe flanges shall conform to ANSI B16.1 bolt pattern.

D. Valves and Accessories

1. The Grit Concentrator shall be provided with the following accessories:
 - a) One (1) 1" bronze globe valve to regulate the system water flow rate to the grit collector.
 - b) One (1) 1" bronze ball valve for shut off
 - c) One (1) 8-40_gpm acrylic flow meter
2. Unions or quick disconnects are to be incorporated into the piping on either side of the flow meter for ease of removal and cleaning. The quick disconnects or couplings are to be supplied and installed by the contractor.

2.02 GRIT PUMP (SEE SPEC SECTION 46 23 67)

2.03 CONTROLS AND INSTRUMENTATION

A. Control Panel

1. One (1) control panel shall be furnished, completely pre-wired and tested.
2. The control panel shall adhere to the following specifications:
 - a) Enclosure Rating: NEMA 4X
 - b) Material: 316SS
 - c) Voltage: 460 Volt
 - d) Phase: 3 Phase
 - e) Frequency: 60 Hz
 - f) Load: TBD Amp
 - g) Logic: Programmable Relay
3. The Control panel shall contain all timers, VFDs, switches, indicator lights, and other components necessary to operate the following equipment:
 - a) One (1) Grit Pump
 - b) One (1) Grit Classification unit
4. The control panel shall be supplied with a Transformer with 480-volt primary winding and 120-volt secondary winding with fused secondary.
5. The control panel shall be supplied with applicable control relays and time delay relays with a minimum one extra normally closed and one extra normally opened contact is provided for each relay. The control panel shall also control solenoid reuse water valve.
6. Where remote monitoring is required, the panel shall be provided with all dry contacts necessary.
7. The panel door layout shall include the following items:
 - a) Front panel mounted combination main disconnect switch and circuit breaker
 - b) Back lit, push-to-test Power On indicating light
 - c) System three position HOA switch
 - d) System Emergency Stop push button
 - e) *System Alarm Reset push button (optional)*
 - f) Grit Pump running light
 - g) Grit Pump three position HOA switch
 - h) Grit Pump fail indicating light
 - i) Grit Pump manual START push button
 - j) Grit Pump manual STOP push button
 - k) Grit Pump manual speed potentiometer
 - l) Grit Separation / Classification three position HOA switch

- m) Grit Separation / Classification utility water three position HOA switch.
- n) Grit Separation / Classification backwash water valve three position HOA switch
- o) Grit Separation / Classification auxiliary backwash pushbutton
- p) Grit Separation / Classification RUNNING indicating light
- q) Grit Separation / Classification supply valve OPEN light
- r) Grit Separation / Classification backwash valve OPEN light
- s) Grit Separation / Classification WET/DRY/REMOTE three position switch

2.04 SEQUENCE OF OPERATION

1. The system shall be controlled manually operation, manual starting and stopping, and system shut down when a fault is detected.
2. Clarified plant water shall be supplied and distributed between the Grit Concentrator fluidizing line, the Grit Washing / Classification unit.
3. Screened raw wastewater shall be gravity fed into the Grit Concentrator continuously.
4. Grit Washing / Classification unit
 - a) Grit slurry from the Grit Concentrator shall be pumped to the Grit Washing / Classification continuously.
5. Grit Classifier unit
 - a) The Grit Dewatering and Classification unit shall run In CONTINUOUS mode. In INTERMITTENT operations the screw will run off and on using adjustable timers. When the screw stops, the water solenoid valve closes with a default run time of 5 minutes. The default stop time is 15 minutes. The Hydrogritter Screw Classifier requires a continuous 5 gpm @ 40 +/- 10 psig of clarified "reuse water".
 - b) While the dewatering unit is running, water shall be directed to the sluice of the classifier unit.
 - c) After a System Shut Down the Grit Dewatering Classifier shall continue to operate for a pre-determined amount of time to allow for the removal and dewatering of all grit accumulated in the clarifier. The off-delay timer shall be adjustable from 0-60 minutes with a typically delay off time of 15 minutes.

2.05 UTILITY REQUIREMENTS

- A. WATER
 1. The Grit Concentrator Unit shall require a minimum supply of 20 gpm clarified non-potable water at a minimum 50 psig.
- B. ELECTRICAL
 1. The system shall require one (1) 480 VAC, three phase electrical service connection to operate

2.06 MATERIALS AND FINISHES

A. MATERIALS

1. All stainless steel used for the fabrication of the equipment shall conform to the following standards:

Plate and Sheet	ASTM A 167 ASTM A 240
Bar	ASTM A 276 ASTM A 479
Tube	ASTM A 312

B. EXTERIOR SURFACES FINISHES

1. All surfaces shall be free of sharp edges, weld spatter and residue. All welds shall be ground smooth.
2. All stainless-steel surfaces shall be acid washed.
3. All non-submerged exterior surfaces shall be Glass Bead Blasted to a uniform finish.

PART 3. EXECUTION

3.01 DELIVERY AND INSTALLATION

- A. The equipment and material shall be shipped complete except where partial disassembly is required by transportation regulations or for protection of components.
- B. Spare parts shall be packed in containers bearing packing lists clearly designating contents and pieces of equipment for which they are intended.
- C. The CONTRACTOR shall inspect equipment prior to unloading and notify the MANUFACTURER of any damage to equipment within 5 days to effect proper remedial action. Failure to notify the MANUFACTURER of damage to equipment prior to unloading shall void all warranties pertaining to subject equipment.
- D. The CONTRACTOR shall unload, store and safeguard equipment, materials, and spare parts in accordance with MANUFACTURER'S recommendations.

3.02 START-UP, TRAINING AND MANUFACTURER'S SERVICES

- A. A factory trained representative for the equipment specified herein shall be present at the jobsite and/or classroom designated by the Owner for a maximum of four (4) 8-hour man-days (two (2) visits) for installation inspection, plant startup, functional testing, and operator instructions; travel time excluded. A minimum of 30 days notice is required to schedule manufacturer's services. Any services with less than 30 days notice shall be billed for service time and actual travel costs.

3.03 FUNCTIONAL TESTING

- A. Prior to plant startup, all equipment shall be inspected for proper alignment, operation, connection, and satisfactory operation by means of a functional test. It is the General Contractor's responsibility to duly notify the MANUFACTURER of any inabilities to perform functional testing prior to operator training.

3.04 MANUFACTURER'S CERTIFICATE(S)

- A. Provide MANUFACTURER'S certificate of installation and commissioning following functional testing and startup.
- B. Provide MANUFACTURER'S OEM Software Licensing Agreement following acceptance and final payment.

END OF SECTION 46 23 66

INDEX TO
SECTION 46 23 67
GRIT REMOVAL PUMP

Paragraph	Title	Page
PART 1 – GENERAL		
1.01	Description	46 23 67-1
1.02	Quality Assurance	46 23 67-1
1.03	Submittals	46 23 67-1
1.04	Operation & Maintenance Data	46 23 67-1
1.05	Delivery, Storage & Handling	46 23 67-2
1.06	Services of manufacturer	46 23 67-2
PART 2 – PRODUCTS		
2.01	Pumps	46 23 67-2
PART 3 – EXECUTION		
3.01	Installation	46 23 67-7

SECTION 46 23 67**GRIT REMOVAL PUMP****PART 1 GENERAL**

1.01 Description

There shall be supplied as shown by the plans one (1) horizontal vortex-type slurry pumping units specifically designed to pump slurries of grit, debris and organic solids without clogging.

1.02 QUALITY ASSURANCE

- A. All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.
- B. To insure a consistent high standard of quality, the manufacturer of this pumping equipment shall comply with the requirements of the ISO 9001 Quality and ISO 14001 Environmental Management Systems, and such compliance shall be verified by an independent certification agency approved by the International Organization for Standardization. Documentation shall be submitted for approval showing compliance with this requirement, and the equipment will not be released for shipment until approved.
- C. Unit responsibility. Pumps, complete with motor, V-belt, baseplate, necessary guards, and all other specified accessories and appurtenances shall be furnished by the pump manufacturer to insure compatibility and integrity of the individual components and provide the specified warranty for all components.
- D. The vortex-type pumps specified in this section shall be furnished by and be the product of one manufacturer.

1.03 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 0133 00.
- B. Submit manufacturer's installation instructions, and inspection under provisions of Section 01 45 23.
- C. The submittal data shall be prepared, in its entirety, by the equipment manufacturer. Shop drawings prepared by the manufacturer's sales representative, fabrication shop or other than the listed manufacturers shall not be acceptable. No additions or modifications to the manufacturer's submittal will be accepted, with the sole exception of a cover sheet provided by the manufacturer's local representative.

1.04 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01 78 23.
- B. Include installation instructions, assembly views, lubrication instructions, and replacement parts lists.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect under provisions of Section 01 65 00.

1.06 SERVICES OF MANUFACTURER

- A. Furnish the services of a representative of the pump manufacturer to assist in adjusting and testing the equipment furnished, to supervise the initial operation, and to make final adjustments as may be necessary to assure the OWNER that the pumps is are in satisfactory operating condition.
- B. Furnish sufficient supervision, data, and information from the manufacturer to train operators in the proper operation and maintenance of the pumps furnished.

PART 2 PRODUCTS

2.01 PUMPS

A. PERFORMANCE

- 1. The pumps shall be designed for continuous operation and will be operated continuously under normal service.

B. OPERATION CRITERIA

	Flow GPM	TDH FT	Max. Pump RPM	Solids Passage	Min. Suction Dia.	Min. Disch. Dia.	Min. Motor Size
Primary Design Condition	300	15	900	4	4	4	10
Secondary Design Condition	400	12	900	4	4	4	10

C. DESIGN

- 1. Since these pumps will be used to pump abrasive grit and other solids, the pumps shall be specifically designed to both optimize wear resistance and then maintain hydraulic performance as wear occurs.
- 2. The pumps shall be of a fully recessed, Slurry Type design, with the impeller mounted completely out of the flow path between the pump inlet and discharge connection, so that solids are not required to flow through the impeller. All flow path clearances within the pumps shall be equal to or greater than the discharge diameter, so that all solids which will pass through the discharge will pass through the pump.

3. The impeller shall be constructed of 650 Brinell Ni-Hard or Hi-Chrome Iron and specifically designed to maintain hydraulic pumping performance as wear occurs.
- a. The impeller shall be of cup design such that the deepest portion of the vane is not located at the vane tips and the tips are surrounded by a thick-sectioned rim of the following thickness:

Pump Size	Minimum Impeller Dia. @ Outside Rim	Minimum Rim Thickness @ Wear Area	Minimum Vane Thickness @ Wear Area	Impeller Minimum Ni-Hard or Hi-Chrome Iron Weight
4 In.	16 In.	1-5/8 In.	7/8 In.	90 Lbs.

- b. The hydraulic design shall be such that the length of the impeller vane increases as wear occurs to the rim, allowing as-new or better pumping performance throughout the wear cycle of the impeller.
- c. The hydraulic design of the impeller shall preferentially direct flow to a sacrificial, independently replaceable suction piece. The suction piece shall be easily accessible and replaceable, without the need to disassemble any other component of the pump.
- d. Pump-out vanes on the rear shroud of the impeller are not acceptable. Impellers of the radial design that incorporate the impeller in a recessed portion of the volute or wearplate are not acceptable.
4. A removable wearplate of Ni-Hard or Hi-Chrome Iron shall be provided behind the impeller designed to direct flow from behind the impeller to the center of the volute for maximum protection to the casing.
5. The packing housing shall be a separate piece bolted to the bearing housing for ease of removal. Designs that incorporate the stuffing box as an integral part of the wear plate and/or backplate assembly are not acceptable.
6. The pump casing shall be of the two-piece radially split type, with a separate and removable suction piece designed so that the impeller can be withdrawn without the need to remove the discharge casing or disturb the discharge piping. The casing shall be constructed so that it can be reversed for opposite rotation and shall be of Ni-Hard or Hi-Chrome Iron. To insure a liberal wear allowance, the casing and suction piece shall be constructed, and the entire wet end weights shall be, as follows:

Discharge Diameter	Casing Minimum	Suction Piece at Wear Area	Weight* of Wearing Parts
4 In.	3/4 In.	1-1/4 In.	500 lbs.

*Suction piece, impeller, casing, and wear plate.

7. The pump's head vs. capacity curve shall slope upward toward shutoff in one continuous curve with no points of inflection capable of causing hunting at any pump operational speed.
8. Pumps shall be equipped with slotted raised-face flanges to receive 125 lb. standard bolting. Special case slots shall be cast in to retain bolts and to fasten the case to the bearing housing and to the intake for easy case removal.

D. MATERIALS OF CONSTRUCTION

1. The parts exposed to abrasive wear – case, removable suction piece, impeller, and wearplate shall be of all Ni-Hard or Hi-Chrome Iron material conforming to ASTM Designation A532-75 Class I or Class III, Type A, and be a minimum of 650 Brinell hardness for maximum wear resistance. Brinell values below this are not acceptable.
2. Test bars shall be cast integrally with the case and suction piece and shall remain attached to the casting upon final delivery to the owner. Test bars shall be of sufficient thickness to represent the average thickness of the cast part. After receipt of final delivery, the owner may at any time prior to the final acceptance, remove the test bar and independently verify compliance to the material and hardness specification. Failure of the tested bars to meet the specified requirements shall be cause for rejection.

E. BEARING HOUSING

1. The bearing housing shall be of cast iron, ASTM A48CL-25.
2. The shaft shall be of ASTM A108, Grade 1045 (or equal) steel, and shall be protected by a removable, hardened Type 410, 416 or 420 stainless steel shaft sleeves.
3. Bearings shall be oil bath lubricated. The oil reservoir shall be sealed at both ends to prevent entrance of foreign matter. The thrust bearings shall consist of three angular contact ball bearings for maximum protection from all thrust loads. The bearing housing will be equipped with a pressure venting device and oil fill and drain taps. A built-in sight glass shall be furnished to check proper oil level. The bearings shall be rated for a minimum B10 life of 100,000 hours, without credit for any rear pump-out vanes to balance hydraulic thrust.

F. SHAFT SEALING

1. Mechanical Seal
 - a. A single cartridge mechanical seal requiring no external flushing shall be furnished in the pump. The seal shall utilize a rotational sealing ring mounted in an elastomer cup with an o-ring mounted stationary ring

loaded by a non-fouling, conical spring encapsulated in Viton. Installation of the seal shall require no measurements or scribe marks on the shaft.

- b. The rotational sealing ring shall be made of tungsten carbide Grade VC 805, the surface of which shall be lapped to a flatness not to exceed three helium light bands. The sealing ring shall be bonded inside a Viton rubber cup, which shall have three (3) integrally molded anti-rotational lugs to prevent the rotary seal face from turning within the rotary body. Additionally, the rotary body shall have three (3) 1/8" solid stainless-steel pins to also prevent the rotary seal face from turning within the rotary body.
- c. The stationary sealing ring shall be also be constructed of tungsten carbide Grade VC 805. The surface shall be lapped to a flatness not to exceed three helium light bands. The stationary ring shall have a slot milled on the side opposite of the mating side, which engages an anti-rotation pin. Stationary sealing rings of converted carbon or other surface-only treatments are not acceptable.
- d. The spring that loads the rotational sealing ring shall be cone-type, non-fouling design and shall run in the pumped product without fouling or hang-up. The spring metal material shall be SAE1095 Carbon Steel, ASTM A-682 heat-treated to a Rockwell C hardness of 45 to 50 and be totally encapsulated in Viton for protection from the pumped fluid. The product side of the spring shall have a minimum 1/4" thick Viton rubber covering for corrosion/abrasion protection. Seals which use single coil, multiple coil, bellows and rubber-in-shear designs are not acceptable.
- e. To minimize the number of points where the slurry must be sealed, the mechanical seal assembly shall have no more than three (3) o-rings: one (1) shaft sleeve o-ring, one (1) stationary face o-ring, and one (1) retainer o-ring. O-rings are to be made of Viton. Seals using more than three (3) o-rings are not acceptable.
- f. All metal components not encapsulated in Viton shall be constructed of abrasion-resistant CD4MCu ASTM A-743. Surface finish shall be a maximum of 64 RMS.
- g. The seal shall be capable of running with up to ± 0.025 " radial shaft deflection and ± 0.040 " axial shaft deflection without leakage, damage, or loss of performance.
- h. A seal chamber of Hi-chrome iron, ASTM A-532, minimum 600 Brinell, shall be provided to mount the seal and to provide a reservoir of adequate volume for the pumped product to contact and to lubricate the seal faces. The seal shall be installed into the seal chamber from the impeller side of the pump so that only the casing/suction piece and impeller need to be removed to gain complete access to the seal for inspection and/or maintenance.

- i. Seals requiring a water or product flush may be furnished in lieu of the non-flushed seal, provided the contractor furnishes, at no extra charge, all of the external auxiliary equipment necessary for the flushing system, including, but not limited to:
 - 1) Isolated water/flush supply system to the seal, including pump, reservoir, pressure reduction valve, solenoid valve, bypass piping and check valve, all furnished in a suitable enclosure, associated wiring, and modifications to the motor control center to actuate the solenoid valve.
 - 2) A pressure gauge, flowmeter, shutoff and isolation valves, manual throttle valve, and strainer at the pump.
 - 3) All tubing/piping shall be stainless steel.

G. MOUNTING

1. Belt Drive

- a. The pump manufacturer shall provide a common pump and motor base, constructed of a minimum 3/8-inch-thick fabricated steel, suitably reinforced to support the full weight of the pump, motor, belt drive and guards.
- b. The pump manufacturer shall furnish and install a separate, adjustable motor base with handwheel adjustment so that the motor can be easily moved for V-belt tensioning and adjustment, TB Woods type MC 3B, modified with a welded steel gusset, or equal.
- c. The pump manufacturer shall supply and install belts and sheaves to drive the pump at the speed necessary to meet the rated conditions.
- d. The drive shall be of the stationary control variable speed TB Woods type 'SVS' or equal, which allows a speed change by means of an adjustment to the motor sheave when the drive is not in operation.
- e. An approved fiberglass or thermoplastic belt guard shall be provided to safely enclose the belt drive. If metal guards are furnished, they shall be of all 316-stainless steel construction with suitable lifting eyes and handles to aid in removal.

H. MOTOR

1. Motor shall be horizontal, TEFC type, 10 HP, 3 Phase, 60 Cycle, 460 Volt, 1760 RPM, and shall be connected to the pump by the drive method specified. All motors shall be of nationally known manufacture and shall conform to NEMA standards and specifications.
2. Performance Testing

- a. A certified shop test shall be performed on each pumping unit in accordance with the test code of the Hydraulic Institute protocol "A". Tests shall be sufficient to determine the curves of head, input horsepower, and efficiency for capacity from shutoff to 150% of design flow. A minimum of five points, including shutoff, shall be taken for each test run. At least one point of the five shall be taken as near as possible to each specified condition.
- b. Results of the performance tests shall be certified by a Registered Professional Engineer and submitted for approval before final shipment.
- c. A representative of the owner shall witness the certified test.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install the pumps in accordance with the manufacturer's instructions.
- B. Lubricate the equipment before start-up.
- C. Conduct Field Tests to demonstrate that the pump(s) perform in accordance with the specifications.
- D. One trip of two (2) days shall be provided for the services of a factory technician for start-up and O&M instruction to the Owner's personnel.

INDEX TO
SECTION 46 23 67.1 – Grit Classifier

Paragraph	Title	Page
PART 1 – GENERAL		
1.1	Description of Work	46 23 67.1-1
1.2	Quality Assurance	46 23 67.1-1
1.3	Submittals	46 23 67.1-1
1.4	Operation and Maintenance Data	46 23 67.1-2
1.5	Delivery, Storage, and Handling	46 23 67.1-2
1.6	Services of Manufacturer	46 23 67.1-2
1.7	Conditions of Service and Performance	46 23 67.1-2
PART 2 – PRODUCTS		
2.1	Cyclone	46 23 67.1-2
2.2	Classifier	46 23 67.1-3
2.3	Optional Equipment	46 23 67.1-6
PART 3 – EXECUTION		
3.1	Installation	46 23 67.1-6

Section 46 23 67.1

Grit Classifier

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. Furnish and install one (1) degritting system(s), consisting of one (1) 12-inch minimum diameter screw-type dewatering classifier, complete with one (1) 10-inch minimum diameter grit cyclone per classifier.

1.2 QUALITY ASSURANCE

- A. All degritting equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein. Manufacturers shall provide evidence of at least five (5) installations in which identically sized equipment has provided satisfactory performance for a minimum of five (5) years in a similar application. No consideration will be given to individually sized equipment that has not been commercially available for at least five (5) years.
- B. To insure a consistently high standard of quality, the manufacturer of this pumping equipment shall comply with the requirements of the ISO 9001 Quality System, and such compliance shall be verified by an independent certification agency approved by the International Organization for Standardization. Documentation shall be submitted for approval showing compliance with this requirement, and the equipment will not be released for shipment until approved.
- C. The complete degritting system specified in this section shall be furnished by, and be the product of, one manufacturer including the grit pump, cyclone, classifier and all specified accessories and appurtenances, to ensure compatibility, integrity of individual components and unit responsibility.

1.3 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Submit manufacturer's installation, start-up instructions under provisions of Section 01 75 15.
- C. The submittal data shall be prepared, in its entirety, by the equipment manufacturer. Shop drawings prepared by the manufacturer's sales representative, fabrication shops, or other than the listed manufacturers will not be acceptable. No additions or modifications to the manufacturer's submittal will be accepted, with the sole exception of a cover sheet provided by the manufacturer's local Representative.
- D. The classifier and cyclone operating parameters, i.e., cyclone feed rate, pressure and underflow and classifier pool area, weir length, screw speed, submergence, and slope, have been selected to avoid build-up of fine grit in the classifier tank, which will cause grit of the desired size to be lost. Changes in any of these parameters will not be acceptable unless a detailed submittal showing calculations and operating data provides evidence that any such change will not affect the

ability of the system to perform as specified.

1.4 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01 78 15.
- B. Include installation instructions, assembly views, lubrication instructions, and replacement parts lists.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, handle and protect the equipment under provisions of Section 01 65 00.

1.6 SERVICES OF MANUFACTURER

- A. Furnish the services of a representative of the degritting system manufacturer to assist in adjusting and mechanical testing of the equipment furnished, to supervise the initial operation, and to make final adjustments as may be necessary to assure the Owner that the degritting system is in satisfactory operating condition.
- B. Furnish sufficient supervision, data, and information from the manufacturer to train operators in the proper operation and maintenance of the equipment furnished.

1.7 CONDITIONS OF SERVICE AND PERFORMANCE

- A. Grit collector underflow shall be pumped to the grit cyclone(s). The cyclone(s) shall separate inlet feed into two streams: overflow and underflow. The overflow shall include the majority of the liquid along with lighter organic materials. The underflow shall be concentrated grit slurry which shall be directed into the grit classifier. The grit classifier shall further remove organic material and shall separate the grit for discharge into a grit disposal system.
- B. Each cyclone shall be sized for an inlet feed of 300 - 400 gpm at a pressure of 10 -15 psi. At the inlet feed conditions specified, each grit cyclone shall be capable of removing 95 percent of the grit entering the inlet feed that is larger than 150 mesh and has a specific gravity of 2.65 or greater.
- C. At the inlet feed conditions specified, each grit classifier shall be capable of removing 95 percent of 150 mesh and larger grit from the underflow of the cyclone.

PART 2 – PRODUCTS

2.1 CYCLONE

- A. Each cyclone shall consist of a heavy-duty cast iron volute feed chamber with one fabricated steel cylindrical section with 2 conical sections and two apex sections of aluminum to minimize overhung weight.
 - 1. Each section of the cyclone shall be individually lined and protected from the high velocity grit by a replaceable rubber or liner. The cyclone shall be constructed so that any section of the liner can be replaced independently.
 - 2. A hinge and quick disconnect clamp shall be provided between the apex assembly and lower cone section to allow removal of material which may clog the apex, without disconnecting any piping on the cyclone itself.

- B. The inlet feed to the cyclone shall be 4-inch, the overflow 6-inch, with Victaulic connections furnished by the cyclone manufacturer. Cast iron adaptor pieces will be provided with ANSI 125 lb. flat face flanges. The adaptor piece will be fitted with a cast iron elbow on the overflow so that the flange face will mate up with horizontal piping.
- C. Each cyclone shall be supplied complete with a 2-inch apex.
- D. The cyclone vortex finder shall be 4-inch diameter and made of Ni-Hard with a minimum hardness of 500 Brinell.
- E. Each cyclone inlet feed shall be tapped for a 1" NPT gauge connection and a diaphragm-protected pressure gauge shall be provided by the cyclone manufacturer.
- F. The cyclone underflow shall feed into the classifier for washing and dewatering and be sized so that the proper hydraulic loading is provided to the classifier.
- G. The cyclone overflow will feed to piping furnished by the contractor which must be properly and adequately vented to prevent siphoning.
- H. The cyclone manufacturer shall supply a fabricated 316 stainless steel support to mount the supplied cyclones.
 - 1. The cyclone shall be attached to a minimum 3/8-inch 316 stainless steel mounting plate, properly oriented such that the cyclone underflow discharges directly into the classifier feedbox.

2.2 CLASSIFIER

- A. Each classifier shall consist of a full flare fabricated 316 stainless steel grit settling tank with a screw-type grit conveyor.
- B. The classifier shall have a minimum pool area at maximum water level of 8.3 square feet, a minimum weir length of 28.3inches, and a screw speed of 12 RPM maximum.
 - 1. The classifier pool depth and weir height shall be adjustable by removable weir bars.
 - 2. The grit settling tank shall be constructed of 1/4" 316 stainless steel plate, suitably reinforced and mounted on 316 stainless steel supports at a slope of not more than 3-1/2 inches per foot. The tank shall be designed to provide a settling compartment where grit separation takes place, with a minimum full water depth of 150% of the screw diameter.
 - 3. The weir overflow shall discharge into a launder box equipped with a screwed pipe nozzle or Victaulic fitting for connection to 2 1/2-inch drain connection.
 - 4. The classifier tank shall be provided with a welded bar, running from the top of the tank to below the water level to provide a sluice channel, in order to prevent the buildup of grit opposite the raked material, to aid in drainage. The manufacturer shall supply and install a valve cock with a 3/8-inch NPT nipple for the spiral sluice water. A 115-volt, single phase solenoid valve, which is compatible with the motor enclosure, shall also be supplied and installed by the manufacturer for the sluice water line and connected by the electrical contractor to open when the Hydrogritter motor is activated.
 - 5. Each classifier tank shall be fitted with a grit discharge opening, located such that

accumulated grit at the top (dry) end of the screw conveyor shall exit the tank in a vertical down direction through the grit discharge opening.

- C. Each classifier tank shall be supplied complete with a fabricated feed box to facilitate the introduction of underflow from the cyclone into the classifier.
1. The feed box shall be reinforced minimum 12-gauge 316 stainless steel plate, and shall be fitted with a wear protector, coated with ¼-inch thick neoprene to protect against abrasion, and to function as a splashguard. The wear protector and splashguard shall be internal to the feedbox such that no splashing will be allowed outside the feedbox. Radial flow diffusers shall not be acceptable.
 2. The feed boxes shall have hinged covers, to provide for inspection of the cyclone apexes without disturbing the cyclone piping or alignment. The hinged covers shall be provided with two snap buckles, one on each side, for quick release.
 3. The feed boxes shall be designed and located by the manufacturer to minimize short-circuiting to the overflow weir of the classifier, and to handle maximum cyclone underflow discharge.
 4. The classifier manufacturer shall be responsible for ensuring that the feed boxes are designed to dissipate energy generated from the cyclone underflow, to minimize disruption of the classifier pool.
- D. The grit shall be removed from the bottom of the settling compartment and discharged by means of a 50% pitch, 12-inch diameter screw-type conveyor.
1. The screw shall be made from pre-formed heavy 316 stainless steel flight sections welded to the shaft and fitted with replaceable wearing shoes.
 - a. The screw shaft of the conveyor shall be a minimum of 3-inch diameter, Schedule 80 pipe, and shall be designed with a maximum stress of 3000 psi, and a fatigue at 98% reliability of 20 years minimum. If calculations are required, they shall be signed by a registered Professional Engineer, showing compliance with these requirements and shall be submitted for approval.
 - b. The flights shall be a minimum thickness of 12-gauge 316 stainless steel, welded to the pipe shaft. The flights shall be a minimum height of 4 inches, as measures along the face of the flight.
 - c. Wearing shoes shall be abrasion resistant and mounted on the flights by means of flat head screws and nuts. The abrasion resistant wearing shoes shall be made of ARS, and shall be a minimum of 10 gauge in thickness by 4-inches high.
 - d. The screw shall have the capacity to remove 3/4 tons per hour of grit from the grit settling tank.
 - e. Shaftless spirals shall not be considered equal and are not acceptable.
- E. The screw conveyor shall be rigidly supported at both the upper and lower ends, so that the screw conveyor is mounted above, and does not contact, the classifier tank. This mounting shall provide for a clearance between the screw conveyor and the tank bottom, so that a buildup of sand or grit will provide a bed for the screw, eliminating tank wear, and providing a drainage area for the conveyed grit.

1. The upper end of the screw conveyor shall be connected to a cycloidal motion speed reducer. The cycloidal speed reducer shall be designed so that all torque is transmitted by rollers and shall be capable of withstanding shock loads of 500% of rated loading.
 - a. Gear-type speed reducers are not acceptable.
 - b. The cyclodrive shall be connected to a 1/2 HP, totally enclosed motor by means of a belt drive and fitted with a guard of the same material as the spiral guard.
 2. The lower end of the screw shall be supported by a submerged bearing, housed in a water-tight cast iron housing, suitable for completely submerged operation in grit service.
 - a. The bearing shall be designed to accept radial loads from the spiral screw conveyor.
 - b. The cast iron housing shall be provided with stainless steel cap screws, and fill and drain plugs.
 - c. The bearing shall utilize a sealed bronze sleeve-type bearing, running completely submerged in oil, and shall require only yearly inspection and oil change.
 - d. The bearing shall be provided with permanent stellite seals to prevent the leakage of oil and infiltration of grit and other foreign particles into the housing. The seal shall be of the self-compensating type, consisting of two mating hardened steel alloy rings, each held in place by a rubber toric. The wearing surfaces of the rings shall be precision lapped to form an initial sealing band of approximately 1/32 inch in width. The seal shall be designed such that as seal rings wear through normal operation, the pressure from the rubber torics shall push the rings further against each other to form a broadened contact band.
 - e. Lower bearing designs incorporating conventional packing, requiring external flushing, or bearings located outside the grit tank will not be acceptable.
- F. The complete drive assembly, screw conveyor, and lower bearing assembly shall be designed so that the screw can be raised for inspection without the need to disassemble any components, or to drain the classifier tank.
1. The complete drive assembly shall be pivoted at the shaft centerline so that the screw assembly can be raised for periodic inspection.
 2. The lower end of the assembly shall be attached to a manually operated handwheel and screw-type lifting device designed to allow the entire assembly to be lifted above the maximum water level. Cable type lifting systems are not acceptable.
 3. The belts and sheaves on the drive assembly shall be covered with a guard of the same material as the combination classifier spiral guard.
- G. The classifier shall be fitted with an OSHA approved classifier spiral guard to enclose the entire settling tank during normal operation. The classifier spiral guard shall be designed to prevent objects from coming into contact with moving parts while the classifier is in operation.
1. The classifier spiral guard shall be provided in two pieces for ease of removal and to minimize the weight of any single piece.

2. The cover shall be clamped to the classifier tank, to allow for removal, regular maintenance, and inspection. The clamps shall be designed so that they cannot be removed without the use of tools. Welded on or permanently affixed covers are not acceptable.
 3. The cover shall be made of the same material as the tank with expanded metal viewing windows to allow for inspection of the settling pool and upper portion of the spiral.
- H. For corrosion-resistance, all non-submerged ferrous metal pieces shall be near white metal blasted to spec SSPC-SP10 before being primed and top coated with a two-part epoxy with a minimum solids content of 58% to a dry film thickness of 3 to 5 mils.
1. All submerged metal pieces shall be coated with a two-part coal tar epoxy with a minimum solids content of 75% to a dry film thickness of 16 to 20 mils.
 2. Stainless steel parts shall receive a cosmetic blast with non-ferrous media to remove all weld stain markings and give the surface a uniform appearance. Stainless steel parts will not be coated.

2.3 OPTIONAL EQUIPMENT

- A. Classifier safety stop switch: The classifier tank will be fitted with an emergency stop system.
1. The tank will be fitted with a vinyl coated wire rope running the periphery of the classifier tank and connected to the safety stop switch.
 2. When the wire rope is pulled, it will actuate the safety stop switch that must be connected by the Contractor in such a way that the classifier motor will immediately shut down.
 3. The switch shall be fitted with a single pole double throw micro switch at each end.
 4. The switch shall be fitted with a raised flag for positive identification of when the switch has been actuated. The switch shall be reset by raising the flag arms to their original position.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install the degritting system in accordance with the manufacturer's instructions.
- B. Lubricate the equipment before start-up.
- C. Conduct field tests to demonstrate that the system performs according to the specifications.
- D. 3 days over one trip of field service for start-up, testing and O&M instruction shall be provided.

END OF SECTION