

## SECTION 43 21 13

PUMPS: WATER, CENTRIFUGAL  
01/08

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASME INTERNATIONAL (ASME)

- ASME B16.1 (2009) Standard for Gray Iron Pipe Flanges and Flanged Fittings; Classes 25, 125 and 250
- ASME B16.5 (2009) Standard for Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24
- ASME B73.1 (2007) Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process

## ASTM INTERNATIONAL (ASTM)

- ASTM A 276 (2008) Standard Specification for Stainless Steel Bars and Shapes
- ASTM A 743/A 743M (2006) Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application
- ASTM A 995/A 995M (2009) Standard Specification for Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts

## HYDRAULIC INSTITUTE (HI)

- HI 1.1-1.2 (2000) Centrifugal Pump Nomenclature

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- NEMA MG 1 (2007) Standard for Motors and Generators

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (2007; AMD 1 2008) National Electrical Code - 2008 Edition

## 1.2 GENERAL REQUIREMENTS

### 1.2.1 Selection Criteria

Design pumps using hydraulic criteria based upon actual model developmental test data. Select pumps at a point within the maximum efficiency for a given impeller casing combination. Deviations within 3 percent of maximum efficiency are permissible, provided the lesser efficiency is not less than the specified efficiency. Pumps having impeller diameters larger than 90 percent of the published maximum diameter of the casing or less than 15 percent larger than the published minimum diameter of the casing will be rejected. Acceptable maximum impeller diameter calculations shall not be based on percentage of impeller diameter range for a given casing.

### 1.2.2 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Pumps of the same type shall be the product of one manufacturer.

### 1.2.3 Safety Requirements

Fully enclose or properly guard gears, couplings, projecting set-screws, keys, and other rotating parts, so located that any person can come in close proximity thereto.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

#### Installation; G

Drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Show on the Drawings proposed layout and anchorage of equipment and appurtenances, in accordance with Note 4 on Drawing S-2, and equipment relationship to other parts of the work including clearances for maintenance and operation. Provide a complete listing of equipment and materials.

### SD-03 Product Data

#### Materials and Equipment; G

Manufacturer's descriptive data and technical literature, including make, model, weight, and horsepower of each equipment assembly. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.

Performance data curves showing head, capacity, horsepower demand, NPSH required, required submergence, and pump efficiency over entire operating range of pump from shutoff to maximum capacity. Detailed drawings showing equipment dimensions, size, and locations of connections and weights of associated equipment. Power and control wiring diagrams, including terminals and numbers. Complete motor nameplate data per NEMA MG1. Factory finish system for the equipment. Provide special storage and protection, and handling instructions. Include list of special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.

#### Instructions; G

Proposed diagrams, instructions, and other sheets, including approved wiring and control diagrams showing the complete layout of the entire system, including equipment, piping valves, and control sequence. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall as specified above for the wiring and control diagrams.

#### Training Period; G

Training course curriculum and training instructions shall be furnished 14 days prior to the start of training.

### SD-06 Test Reports

#### Field Tests; G

Test reports in booklet form showing all factory performance testing and field tests performed to demonstrate compliance with the specified performance criteria. Each test report shall indicate the final position of controls.

### SD-07 Certificates

#### Manufacturer's Representative

The names and qualifications of the manufacturer's representative and training engineers and written certification from the manufacturer that the representative and trainers are technically qualified.

### SD-10 Operation and Maintenance Data

#### Operation and Maintenance Manuals; G

Six complete sets of instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment. Instructions shall include, but not be limited to, the following:

- a. Service manual, parts list, and complete product data.
- b. Assembly drawings.

- c. Approved wiring and control diagrams.
- d. A control sequence describing startup, operation, and shutdown.
- e. Operating and maintenance instructions for each piece of equipment, including lubrication instructions and troubleshooting guide.
- f. Manufacturer's bulletins, cuts, and descriptive data; and parts list and recommended spare parts.

#### 1.4 QUALITY ASSURANCE

Provide the services of a [manufacturer's representative](#) experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installation, adjustment, and testing of the equipment.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Protect all equipment, delivered and designated for storage, from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

### PART 2 PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

Provide materials and equipment which are as specified below, as shown, and are suitable for the service intended. Provide materials and equipment which are new and unused, except for tests. Where two or more pieces of equipment performing the same function are required, they shall be duplicate products of the same manufacturer.

##### 2.1.1 Standard Products

Provide material and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of such products and that essentially duplicate equipment that has been in satisfactory waterworks operation at least 2 years. Equipment shall be supported by a service organization that is reasonably convenient to the jobsite. Pumps and motors of the same types shall each be the product of one manufacturer.

##### 2.1.2 Description

The pumps shall be horizontal centrifugal water pumps of the types indicated and specified. The single driving units for the pumps shall be electric motors as indicated and specified.

##### 2.1.3 Nameplates

Pumps and motors shall have a standard nameplate securely affixed in a conspicuous place showing the manufacturer's name, address, type or style, model, serial number, and catalog number. In addition, the nameplate for each pump shall show the capacity in [gpm](#) at rated speed in rpm and head in [feet](#) of water. Nameplate for each electric motor shall show at least the minimum information required by 10.38 [NEMA MG 1](#). Such other information as the manufacturer may consider necessary to complete identification shall be shown on the nameplate.

2.2 CENTRIFUGAL WATER PUMPS

The pumps shall be the centrifugal, single-stage, horizontal end suction pumps designed for the following water treatment plant service:

Pump No.	Service
P-95110	Backwash Reclaim Pump
P-95120	Backwash Reclaim Pump
P-95130	Backwash Reclaim Pump
P-94110	Backwash Pump
P-94120	Backwash Pump
P-50020	Cleaning Pump
P-55020	RO Flush Pump

2.2.1 Pump Drives

The pumps shall have the following driving units and shall be directly connected to the driving units through solid shafts, or flexible couplings:

	Pump No.
Electric motor drive	P-95110
	P-95120
	P-95130
	P-94110
	P-94120
	P-50020
	P-55020
Inverter duty rated motor	P-95110
	P-95120
	P-95130
	P-50020
	P-55020

2.2.2 Pump Construction

Except as below specified, centrifugal water pumps shall be constructed in accordance with the Hydraulic Institute [HI 1.1-1.2](#) and [ASME B73.1](#).

2.2.3 Pump Characteristics

Pumps shall operate at optimum efficiencies to produce the most economical pumping system under the conditions encountered. Pumps shall furnish not less than 150 percent of rated capacity at a total discharge head of not less than 65 percent of total rated head. The shutoff total head shall be not less than 120 percent and not greater than 130 percent of total rated head or as specified.

2.2.4 Pump Casings

Pump casings for P-94110, P-94120, P-95110, P-95120, and P-95130 shall be [ASTM A 995/A 995M](#) CD4Mcu Grade 1B including heat treatment. Pump casings for P-50020 and P-55020 shall [ASTM A 743/A 743M](#) CF8M be stainless steel.

The casings shall be designed to permit replacement of wearing parts. Pump casings shall be of uniform quality and free from blowholes, porosity,

hard spots, shrinkage defects, cracks and other injurious defects. Defects in casings shall not be repaired except when such work is approved and is done by or under the supervision of the pump manufacturer, and then only when the defects are small and do not adversely affect the strength or use of the casing. Casings shall be single or double volute with flanged piping connections conforming to [ASME B16.1](#), Class 125. The direction of shaft rotation shall be conspicuously indicated. The casing shall have tapped openings for air venting, priming, draining, and suction and discharge gauges. Drain openings in the volute, intake, or other passages capable of retaining trapped water shall be located in the low point of such passages.

#### 2.2.5 Impellers

Impellers for P-94110, P-94120, P-95110, P-95120, and P-95130 shall be constructed [ASTM A 995/A 995M](#) CD4Mcu Grade 1B including heat treatment, carefully finished with smooth water passageways, and shall be statically and dynamically balanced. Impellers shall be securely keyed to the pump shaft. Impellers for P-50020 and P-55020 shall be constructed of [ASTM A 743/A 743M](#) CF8M stainless steel, carefully finished with smooth passageways, and shall be statically and dynamically balanced. Impellers shall be securely keyed to the pump shaft.

#### 2.2.6 Wearing Rings

Wearing rings shall be provided for impellers as specified. Wearing rings shall be provided for pump casings and shall be of the same materials of construction as that of the casing. Casing rings shall be securely fixed in position to prevent rotation. Rings shall be renewable and designed to ensure ease of maintenance.

#### 2.2.7 Shaft

For P-94110, P-94120, P-95110, P-95120, and P-95130, shaft shall be of [ASTM A 276](#), S31803 accurately machined, and shall be of sufficient size and strength to perform the work required. Shaft sleeves shall be [ASTM A 276](#), S31803 and shall be keyed to the pump shaft.

For P-50020 and P-55020, shaft shall be type 316 stainless steel accurately machined, and shall be of sufficient size and strength to perform the work required unless specified otherwise. Shaft sleeves shall be Type 316 stainless steel and shall be keyed to the pump shaft.

#### 2.2.8 Mechanical Seals

Mechanical seals shall be constructed in a manner and of materials particularly suitable for the temperature service range and liquid being pumped. Seal construction shall not require external source cooling for pumped-fluid service temperatures up to [250 degrees F](#). Seal pressure rating shall be suitable for maximum system hydraulic conditions. Materials of construction shall include Type 316 stainless steel, solid tungsten-carbide rotating-seal face, and Buna-N vinylidene-fluoride-hexafluoropropylene, EPT, or tetrafluoroethylene seals or other materials of construction determined to be suitable for the liquid as determined by the manufacturer.

#### 2.2.9 Couplings

Couplings shall be of the heavy-duty flexible type, keyed and locked to the

shaft. The outside surface of the couplings for horizontal pumps shall be machined parallel to the axis of the shaft. The faces of the couplings shall be machined perpendicular to the axis of the shaft. Disconnecting the couplings shall be accomplished without removing the driver half or the pump half of the couplings from the shaft. Flexible couplings shall not be used to compensate for misalignment of pump.

#### 2.2.10 Balance

All rotating parts of the equipment shall operate throughout the required range without excessive end thrust, vibration, or noise. Defects of this type that cannot be eliminated by installation adjustments will be sufficient cause for rejection of the equipment. Pump impeller assemblies shall be statically and dynamically balanced to within 1/2 percent of  $W$  times  $R$  squared, where  $W$  equals weight and  $R$  equals impeller radius. Shaft construction shall be substantial to prevent seal or bearing failure due to vibration. Total shaft peak-to-peak dynamic deflection measured by vibrometer at pump-seal face shall not exceed 2.0 mils under shutoff-head operating conditions.

#### 2.2.11 Bearings

Bearings shall be ball or roller type, and the main bearings shall take all radial and end thrust. Pumps that depend only on hydraulic balance to overcome end thrust will not be acceptable.

#### 2.2.12 Lubrication

Bearings on horizontal-shaft pumps shall be either oil-bath type or grease type. Each oil reservoir shall be liberal in size and provided with an opening for filling, an overflow opening at the proper location to prevent overfilling, an oil-level sight glass, and a drain at the lowest point. Grease type bearings shall be provided with fittings for a grease gun and, if the bearings are not easily accessible, with grease tubing extending to convenient locations. The grease fittings shall be of a type that prevent over lubrication and the buildup of pressure injurious to the bearings.

#### 2.2.13 Base Plates

Horizontal-shaft centrifugal pumps shall be provided with a common base for mounting each pump and driving unit of the pump on the same base. Each base shall be constructed of cast iron with a raised lip tapped for drainage, or of welded steel shapes with suitable drainage pan. Horizontal-shaft end suction pumps shall be mounted on a factory furnished channel steel frame. With the exception of close-coupled pumps, horizontal-shaft end suction pumps shall be frame mounted. The drainage structure shall collect the packing box leakage and shall have a 1/2 inch NPT connection to connect it to a drain.

#### 2.2.14 Cocks, Plugs, and Accessories

The pumps shall be equipped with air cocks, and drain plugs with materials of construction matching the casing.

#### 2.2.15 Piping Connections

The pump suction and discharge shall be provided with flanged connections of suitable size and suitably arranged for piping shown. Pipe flanges shall conform to ASME B16.1 and ASME B16.5. Piping shall be installed to

preclude the formation of air pockets.

#### 2.2.16 Finish

Finish equipment as specified in Section 09 90 00.00 40, PAINTING AND COATING.

### 2.3 ELECTRICAL WORK

Electrical motor driven equipment specified herein shall be provided complete with motors. Electric equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Electrical characteristics shall be as indicated. Each motor shall be of sufficient capacity to drive the equipment at the specified capacity without exceeding 87 percent of the nameplate rating of the motor exclusive of service factor when operating at proper electrical system voltage and frequency.

### 2.4 ELECTRICAL EQUIPMENT

Electrical equipment shall conform to Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Electrical motor driven equipment herein specified shall be provided complete with motors and shall be in accordance with NFPA 70.

#### 2.4.1 Electric Motors

Each electric motor-driven pump shall be driven by a totally-enclosed fan cooled continuous-duty electric motor. Motor shall have a 1.15 service factor for non-inverter rated and 1.0 for inverter duty. Motors shall be squirrel-cage induction motors having normal-starting-torque and low-starting-current characteristics, and shall be of sufficient size so that the nameplate horsepower exclusive of service factor, rating will not be exceeded throughout the entire published pump characteristic curve. Integral size motors shall be the premium efficiency type in accordance with NEMA MG 1. Motor bearings shall provide smooth operations under the conditions encountered for the life of the motor. Adequate thrust bearing shall be provided in the motor to carry the weight of all rotating parts plus the hydraulic thrust and shall be capable of withstanding thrust imposed during pump starting and under variable pumping head conditions specified. Provide thermal protection for motors as shown on the Drawings. Motors shall be rated 460 volts, 3 phase, 60 Hz and such rating shall be stamped on the nameplate. Motors shall conform to NEMA MG 1.

### 2.5 EQUIPMENT APPURTENANCES

#### 2.5.1 Attachments

All necessary bolts, nuts, washers, bolt sleeves, and other types of attachments for the installation of the equipment shall be furnished with the equipment. For pumps P-94110, P-94120, P-95110, P-95120, and P-95130 all bolts, nuts, washers, bolt sleeves and other attachments shall be ASTM A 276, S31803 stainless steel. For pumps P-50020 and P-55020 all bolts, nuts, washers, bolt sleeves, and other types of attachments shall be Type 316 stainless steel.

#### 2.5.2 Equipment Guards

Equipment driven by open shafts, belts, chains, or gears shall be provided with all-metal guards enclosing the drive mechanism. Guard shall be

constructed of galvanized sheet steel or galvanized woven wire or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment. The guards shall conform in all respects to all applicable safety codes and regulations.

### 2.5.3 Tools

A complete set of all special tools which may be necessary for the adjustment, operation, maintenance, and disassembly of all equipment shall be furnished. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment. Special tools shall be high-grade, smooth, forged, alloy, tool steel. One pressure grease gun for each type of grease required for motors shall also be furnished. All tools shall be delivered at the same time as the equipment to which they pertain. Properly store and safeguard such tools until completion of the work, at which time they shall be delivered to the Contracting Officer.

### 2.5.4 Shop Painting

All motors, pump casings, and similar parts of equipment shall be thoroughly cleaned, primed, and given finish coat in accordance with Section 09 90 00.00 40, PAINTING AND COATING.

## 2.6 FACTORY TESTS

Pumps shall be tested by the manufacturer or a nationally recognized testing agency in compliance with Hydraulic Institute Standards Section 1.6. Performance test acceptance tolerances shall be Acceptance Level A. Where two or more identical pumps are specified, only one representative pump shall be tested. For adjustable speed pumps perform testing at a minimum of three reduced speed conditions. A minimum of five performance test points shall be conducted on each pump at each speed which shall include shut-off, rated, and runout performance conditions.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Foundations shall be as specified in Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE and as indicated in the Drawings. Anchor bolts, as required, shall be sized and furnished by the pump manufacturer.

### 3.2 FIELD TESTS

After installation of the pumping units and appurtenances is complete, operating tests shall be carried out to assure that the pumping installation operates properly. Make arrangements to have the manufacturer's representatives present when field equipment tests are made. Tests shall assure that the units and appurtenances have been installed correctly, that there is no objectionable heating, vibration, or noise from any parts, and that all manual and automatic controls function properly. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted.

#### 3.2.1 Functional Tests

- a. Conduct on each pump.

1. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
2. Vibration Test: Conduct on each pump 75 hp or larger.
  - a). Test with unit installed and in normal operation, and discharging to the connected piping systems at rates shall not develop vibration exceeding 80 percent of the limits specified in HIS 9.6.4.
  - b). If units exhibit vibration in excess of the limits specified adjust or modify as necessary. Units which cannot be adjusted or modified to conform as specified shall be replaced.
3. Flow Output: Measured by plant instrumentation and storage volumes.

### 3.2.2 Operating Temperatures

Monitor bearing areas on pump and motor for abnormally high temperatures.

### 3.2.3 Performance Test

- a. Conduct on each pump 50 hp or larger.
- b. Perform under simulated operating conditions.
- c. Test for a continuous 3 hour period without malfunction.
- d. Test Log: Record the following:
  1. Total head.
  2. Capacity.
  3. Horsepower requirements.
  4. Flow measured by factory instrumentation and storage volumes.
  5. Average distance from suction well water surface to pump discharge centerline for duration of test.
  6. Pump discharge pressure converted to feet of liquid pumped and corrected to pump discharge centerline.
  7. Calculated velocity head at the discharge flange.
  8. Field head.
  9. Driving motor voltage, amperage and kilowatts measured for each phase.

### 3.3 FIELD PAINTING

Do not paint stainless steel, galvanized steel, and nonferrous surfaces.

#### 3.3.1 Touch-Up Painting

Factory painted items requiring touching up in the field shall be thoroughly cleaned of all foreign material and shall be primed and

topcoated with the manufacturer's standard factory finish.

### 3.3.2 Exposed Ferrous Surfaces

Exposed ferrous surfaces shall be painted in accordance with Section 09 90 00.00 40, PAINTING AND COATING. Factory primed surfaces shall be solvent-cleaned before painting. Surfaces that have not been factory primed shall be prepared and primed in accordance with Section 09 90 00.00 40, PAINTING AND COATING.

### 3.4 DEMONSTRATION

Upon completion of the work the services of one or more competent engineers shall be provided for a training period of not less than 8 hours to instruct the contents of the operation and maintenance manuals for the equipment furnished under these specifications. These field instructions shall cover all the items contained in the bound instructions.

### 3.5 HORIZONTAL END SUCTION CENTRIFUGAL PUMP DATA - P-50020

Tag Numbers: P-50020

Pump Name: Cleaning Pump

Manufacturer and Model Number:

1. American Marsh 6x8 - 13 REF
2. Or approved equal

#### 3.5.1 Service Conditions

Liquid Pumped (Material and Percent): Membrane Cleaning Solution

Pumping Temperature (Fahrenheit):

Normal: 104

Max: 104

Min: 40

Specific Gravity at 60 Degrees F: 1.1 - 1.2

Viscosity Range: 1 - 10 centipoise

pH: 2 - 12

Abrasive: No

Possible Scale Buildup: N

Min. NPSH Available (Ft. Absolute): 33

#### 3.5.2 Performance Requirements at Primary Design Point

Capacity (US gpm): Rated: 1200

Total Dynamic Head (Ft): Rated: 150'

Min. Hydraulic Efficiency (%): 77

Maximum Shutoff Pressure (Ft): 155'

Max. Pump Speed at Design Point (rpm): 1760

Constant: No

Adjustable: Yes

3.5.3 Performance Requirements at Secondary Design Points

Capacity (US gpm): N/A

3.5.4 Performance Requirements at 50 Percent Rated Speed

Capacity (US gpm): N/A

3.5.5 Design and Materials

Design: Frame mounted: Yes

Close-Coupled Casing: NO

Back Pullout: Yes

Discharge Orientation: UP

Case Wear Ring: Yes Material: 316 stainless steel

Impeller: Type: Enclosed

Impeller Wear Ring: Yes Material: Nitronic 60

Shaft Material: Duplex 2205 Shaft Sleeve Material: 316 stainless steel

Shaft Seal: Mechanical Material: 316 stainless steel

Lubrication: Product

ABMA L 10 Bearing Life (Hrs): 100,000 HR Lubrication: Oil

Coupling: Flexible heavy duty spacer shaft coupling with guard

Baseplate: Design: Non-Drip Material: Steel

Drive Type: Direct-Coupled: Belt Adjustable Speed

Other:

Adjustable Speed Drive See Section 26 29 23, VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS.

3.5.6 Drive Motor

See Section 26 20 00, Low-Voltage AC Induction Motors.

Horsepower: 75

Voltage: 460

Phase: 3

Synchronous Speed (rpm): 1800

Service Factor: 1.0

Inverter Duty: Yes

Motor nameplate horsepower shall not be exceeded at any head-capacity point on the pump curve.

Enclosure: TEFC

Mounting Type: Horizontal

Nonreverse Ratchet: No

3.6 DATA SHEET HORIZONTAL END SUCTION CENTRIFUGAL PUMP DATA - P-55020

Tag Numbers: P-55020

Pump Name: RO Flush Pump

Manufacturer and Model Number:

1. Goulds Pumps, 3196 MT; 3X4-8G.
2. Or approved equal

3.6.1 Service Conditions

Liquid Pumped (Material and Percent): Permeate Water

Pumping Temperature (Fahrenheit):

Normal: 70

Max: 100

Min: 40

Specific Gravity at 60 Degrees F:

Viscosity Range: 1.14 centipoise at 70 degrees F.

pH: 5 - 6

Abrasive: No

Possible Scale Buildup: No

Min. NPSH Available (Ft. Absolute): 33

3.6.2 Performance Requirements at Primary Design Point

Capacity (US gpm): Rated: 400

Total Dynamic Head (Ft): Rated: 150'

Min. Hydraulic Efficiency (%): 65

Maximum Shutoff Pressure (Ft): 180'

Max. Pump Speed at Design Point (rpm): 3600

Constant: No

Adjustable: Yes

### 3.6.3 Performance Requirements at Secondary Design Points

Capacity (US gpm): N/A

### 3.6.4 Performance Requirements at 50 Percent Rated Speed

Capacity (US gpm): N/A

### 3.6.5 Design and Materials

Design: Frame mounted: Yes

Close-Coupled Casing: NO

Back Pullout: Yes

Discharge Orientation: UP

Casing Materials: CF8M (316 stainless steel)

Case Wear Ring: Yes Material: 316 stainless steel

Impeller: Type: Enclosed Material: CF8M (316 stainless steel)

Impeller Wear Ring: Yes Material: Nitronic 60

Shaft Material: Duplex 2205 Shaft Sleeve Material: 316 stainless steel

Shaft Seal: Mechanical Material: 316 stainless steel

Lubrication: Product

ABMA L 10 Bearing Life (Hrs): 100,000 HR Lubrication: Oil

Coupling: Flexible heavy duty spacer shaft coupling with guard

Baseplate: Design: Non-Drip Material: Steel

Drive Type: Direct-Coupled: Belt: Adjustable Speed:

Other:

Adjustable Speed Drive See Section 26 29 23, VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS.

3.6.6 Drive Motor

See Section 26 20 00, Low-Voltage AC Induction Motors.

Horsepower: 30

Voltage: 460

Phase: 3

Synchronous Speed (rpm): 1800

Service Factor: 1.0

Inverter Duty: Yes

Motor nameplate horsepower shall not be exceeded at any head-capacity point on the pump curve.

Enclosure: TEFC

Mounting Type: Horizontal

Nonreverse Ratchet: No

3.7 HORIZONTAL END SUCTION CENTRIFUGAL PUMP DATA - P-94110, P94120

Tag Numbers: P-94110, P94120

Pump Name: Backwash Pumps

Manufacturer and Model Number:

1. Goulds Pumps, ITT Flyst Corporation, Model 3196 size 8x10-17
2. Or approved equal

3.7.1 Service Conditions

Liquid Pumped (Material and Percent):

Pumping Temperature (Fahrenheit):

Normal: 70

Max: 100

Min: 40

Specific Gravity at 60 Degrees F: 1.0

Viscosity: 1.14 centipoises at 60 degrees F

pH: 6.8 - 7.5

Abrasive: No

Possible Scale Buildup: No

Min. NPSH Available (Ft. Absolute): 32

3.7.2 Performance Requirements at Primary Design Point

Capacity (US gpm): Rated: 2500

Total Dynamic Head (Ft): Rated: 85'

Min. Hydraulic Efficiency (%): 83

Maximum Shutoff Pressure (Ft): 106'

Max. Pump Speed at Design Point (rpm): 1180

Constant: Yes

Adjustable: No

3.7.3 Performance Requirements at Secondary Design Points

Capacity (US gpm): N/A

3.7.4 Performance Requirements at 50 Percent Rated Speed

Capacity (US gpm): N/A

3.7.5 Design and Materials

Design: Frame mounted: Yes

Close-Coupled Casing: NO

Back Pullout: Yes

Discharge Orientation: UP

Impeller: Type: Open

Shaft Seal: Mechanical      Material: 316 stainless steel

Lubrication: Product

ABMA L 10 Bearing Life (Hrs): 100,000 HR      Lubrication: Oil

Coupling: Flexible heavy duty spacer shaft coupling with guard

Baseplate: Design: Non-Drip      Material: Steel

Drive Type: Direct-Coupled:      Belt:      Adjustable Speed:

Other:

3.7.6 Drive Motor

See Section 26 20 00, Low-Voltage AC Induction Motors.

Horsepower: 75

Voltage: 460

Phase: 3

Synchronous Speed (rpm): 1200

Service Factor: 1.15

Inverter Duty: No

Motor nameplate horsepower shall not be exceeded at any head-capacity point on the pump curve.

Enclosure: TEFC

Mounting Type: Horizontal

Nonreverse Ratchet: No

3.8 HORIZONTAL END SUCTION CENTRIFUGAL PUMP DATA - P-95110, P95120, P-95130

Tag Numbers: P-95110, P95120, P-95130

Pump Name: Backwash Reclaim Pumps

Manufacturer and Model Number:

1. Goulds Pumps ITT Flyst Corporation, Model 3196 MT; size 2x3-8
2. Or approved equal

3.8.1 Service Conditions

Liquid Pumped (Material and Percent):

Pumping Temperature (Fahrenheit):

Normal: 70

Max: 100

Min: 40

Specific Gravity at 60 Degrees F: 1.0

Viscosity Range: 1.14 centipoises at 60 degrees F  
pH: 6.8 - 7.5

Abrasive: No

Possible Scale Buildup: No

Min. NPSH Available (Ft. Absolute): 32

3.8.2 Performance Requirements at Primary Design Point

Capacity (US gpm): Rated: 250

Total Dynamic Head (Ft): Rated: 210'

Min. Hydraulic Efficiency (%): 62

Maximum Shutoff Pressure (Ft): 260'

Max. Pump Speed at Design Point (rpm): 3560

Constant: No

Adjustable: Yes

3.8.3 Performance Requirements at Secondary Design Points

Capacity (US gpm): N/A

3.8.4 Performance Requirements at 50 Percent Rated Speed

Capacity (US gpm): N/A

3.8.5 Design and Materials

Design: Frame mounted: Yes

Close-Coupled Casing: NO

Back Pullout: Yes

Discharge Orientation: UP

Impeller: Type: Open

Shaft Seal: Mechanical Material: 316 stainless steel

Lubrication: Product

ABMA L 10 Bearing Life (Hrs): 100,000 HR Lubrication: Oil

Coupling: Flexible heavy duty spacer shafter coupling with guard.

Baseplate: Design: Non-Drip Material: Steel

Drive Type: Direct-Coupled: Belt: Adjustable Speed:

Other:

Adjustable Speed Drive See Section 26 29 23, VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS.

3.8.6 Drive Motor

See Section 26 20 00, Low-Voltage AC Induction Motors.

Horsepower: 25

Voltage: 460

Phase: 3

Synchronous Speed (rpm): 3600

Service Factor: 1.0

Inverter Duty: Yes

Motor nameplate horsepower shall not be exceeded at any head-capacity point on the pump curve.

Enclosure: TEFC

Mounting Type: Horizontal

Nonreverse Ratchet: No

-- End of Section --