

Part I – GENERAL

1.1 WORK INCLUDED

- A. Vertical In-Line Multi-Stage Centrifugal Pumps.

1.2 REFERENCE STANDARDS

The work in this section is subject to the requirements of applicable portions of the following standards:

- A. Hydraulic Institute
- B. ANSI – American National Standards Institute
- C. ASTM – American Society for Testing and Materials
- D. IEEE - Institute of Electrical and Electronics Engineers
- E. NEMA – National Electrical Manufacturers Association
- F. NEC – National Electrical Code
- G. ISO – International Standards Organization

Part 2 – PRODUCTS

2.1 VERTICAL IN-LINE MULTI-STAGE CENTRIFUGAL PUMPS

- A. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.
- B. All pump bearings shall be lubricated by the pumped liquid.
- C. Small Vertical In-Line Multi-Stage Pumps (Nominal flow from 3 to 125 gallons per minute) shall have the following features:
 - 1. Each pump shall be designed for in-line installation requiring no more than 1.5 square feet of floor space (including motor).
 - 2. The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement.
 - 3. The suction/discharge base shall have ANSI Class 250 flange or internal pipe thread (NPT) connections as indicated in the drawings or pump schedule.
 - 4. Pump Construction.

a. Suction/discharge base, pump head, motor stool:	Cast iron (Class 30)
b. Impellers, diffuser chambers, outer sleeve:	304 Stainless Steel
c. Shaft	316 or 431 Stainless Steel
d. Impeller wear rings:	304 Stainless Steel
e. Shaft journals and chamber bearings:	Silicon Carbide
f. O-rings:	EPDM

Shaft couplings for motor flange sizes 184TC and smaller shall be made of cast iron or sintered steel. Shaft couplings for motor flange sizes larger than 184TC shall be made of ductile iron (ASTM 60-40-18).

Optional materials for the suction/discharge base and pump head shall be cast 316 stainless steel (ASTM CF-8M) resulting in all wetted parts of stainless steel.

- 5. The shaft seal shall be a balanced o-ring cartridge type with the following features:

- a. Collar, Drivers, Spring: 316 Stainless Steel
- b. Shaft Sleeve, Gland Plate: 316 Stainless Steel
- c. Stationary Ring: Silicon Carbide
- d. Rotating Ring: Silicon Carbide
- e. O-rings: EPDM

The Silicon Carbide shall be imbedded with graphite.

- 6. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, shaft coupling and motor. Pumps with motors equal to or larger than 15 hp (fifteen horsepower) shall have adequate space within the motor stool so that shaft seal replacement is possible without motor removal.
- 7. The maximum working temperature shall be 250 degrees F. The maximum working pressure are as follows:

Connection Type	Maximum Working Pressure
1" or 1 1/4" Internal Thread (NPT)	232 psig
2" Internal Thread (NPT)	145 psig
ANSI Flange (Class 250)	362 psig

D. Large In-line Vertical Multi-Stage Pumps (Nominal flows from 130 to 500 gallons per minute) shall have the following features:

- 1. Each pump shall be designed for in-line installation requiring no more than 2.5 square feet of floor space (including motor).
- 2. The pump impellers shall be secured directly to the smooth pump shaft by means of a split cone and nut design.
- 3. The suction/discharge base shall have ANSI Class 125 or Class 250 flange connections in a slip ring (rotating flange) design as indicated in the drawings or pump schedule.
- 4. Pump Construction.

- a. Suction/discharge base, pump head: Ductile Iron (ASTM 65-45-12)
- b. Shaft couplings, flange rings: Ductile Iron (ASTM 65-45-12)
- b. Shaft: 431 Stainless Steel
- c. Motor Stool: Cast Iron (ASTM Class 30)
- d. Impellers, diffuser chambers, outer sleeve: 304 Stainless Steel
- e. Impeller wear rings: 304 Stainless Steel
- f. Intermediate Bearing Journals: Tungsten Carbide
- g. Intermediate Chamber Bearings: Leadless Tin Bronze
- h. Chamber Bushings: Graphite Filled PTFE
- i. O-rings: EPDM

5. The shaft seal shall be a single balanced metal bellows cartridge with the following construction:

- a. Bellows: 904L Stainless Steel
- b. Shaft Sleeve, Gland Plate, Drive Collar: 316 Stainless Steel
- c. Stationary Ring: Carbon
- d. Rotating Ring: Tungsten Carbide
- e. O-rings: EPDM

6. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, motor couplings, motor and seal cover. Pumps with motors equal to or larger than 15 hp (fifteen horsepower) shall have adequate space within the motor stool so that shaft seal replacement is possible without motor removal.

7. The maximum working temperature shall be 250 degrees F. The maximum working pressure shall be 232 psig or 362 psig as determined by the installation requirements.

2.2 MOTORS

- A. Motors are to be provided with the following basic features:
 1. Motors shall be designed for continuous duty operation, NEMA design B with a 1.15 S.F.
 2. Totally Enclosed Fan Cooled Motors are to be furnished with class "F" insulation. Open Drip Proof Motors are to be furnished with class "B" insulation.
 3. Motor nameplate shall be mounted on enclosure with stainless steel fastening pins. Nameplate shall have, as a minimum, all information as described in NEMA Standard MG 1-20.40.1.
 4. Open Drip Proof (ODP) motors shall have drip covers.
 5. Motors over 50 lbs shall having lifting provisions.
 6. Motors shall have a NEMA C-Flange for vertical mounting.
 7. Drive end bearings shall be adequately sized so that the minimum L10 bearing life is 17,500 hours at the minimum allowable continuous flow rate for the pump.

2.3 TESTING

- A. The pump manufacturer shall perform non-witnessed testing (in accordance with ISO9906 annex A) of pumps prior to shipment.
- B. The pump manufacturer shall be capable of providing certified testing of pumps prior to shipment.

2.4 WARRANTY

- A. The warranty period shall be a non-prorated period of 24 months from date of installation, not to exceed 30 months from date of manufacture.