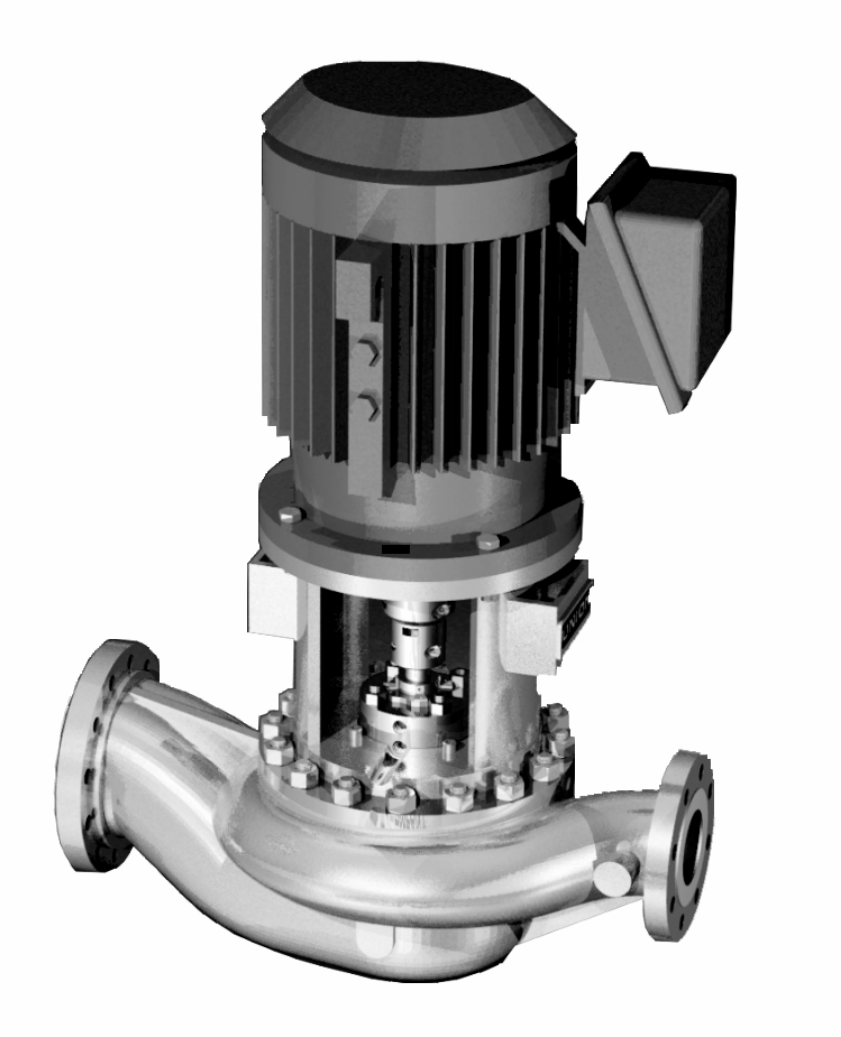
Model VLK *PRODUCT MANUAL*

Single Stage Vertical In-Line Centrifugal Pumps for General Service, Petroleum and Petrochemical Applications

API 610 Pump



Serving the World Since 1885...

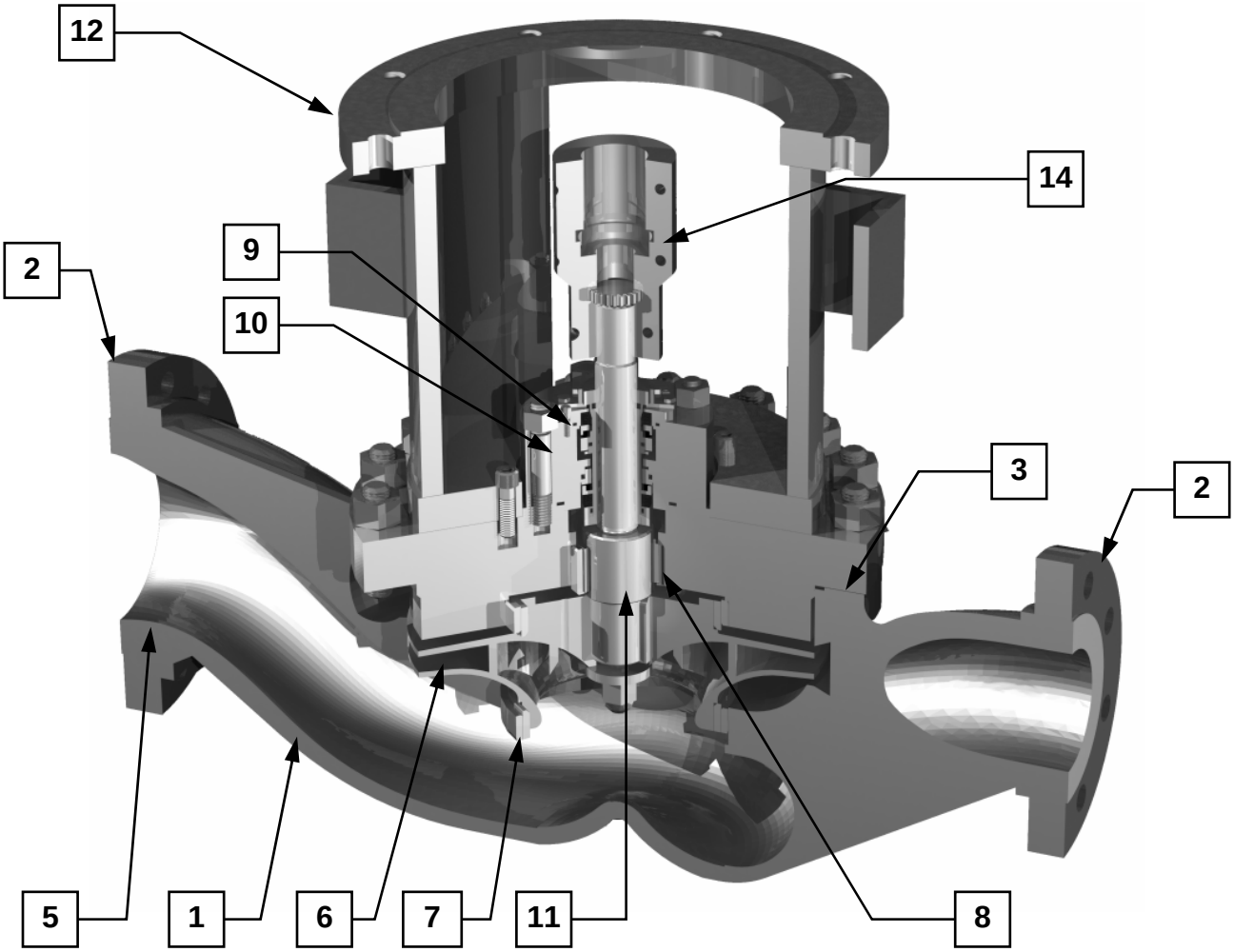
UNION Pump
A Textron Company

Document Number: **VLK-0000** Date: **October 25, 2007**

4600 West Dickman Road, Battle Creek, Michigan 49015 **Telephone: (269) 966-4600 Fax: (269) 962-5447**

GENERAL DESCRIPTION

VLK - an advanced design Single Stage Vertical In-Line Centrifugal Pump with exceptional flexibility and versatility to meet the requirements of a wide variety of pumping applications. The unit is ruggedly designed for minimum maintenance and to meet the heavy-duty requirements of continuous duty operation of general industry, as well as, API 610 applications.



STANDARD FEATURES

1 Pump Casing:

In-line mounted casings withstand API 610 nozzle loads. Double volute casings (3" nozzle size and larger) ensure low vibration and radial loads.

Latest 3-D modeling and mold flow techniques are used to ensure consistent high quality castings.

2 Flanges:

300 lb. RF per ANSI B16.5 and API 610 standards. Optional surface finish and ratings available.

3 Casing / Cover:

Casing to Cover register fit is a metal to metal fit with fully confined, controlled compression gasket ensures proper sealing and alignment. Spiral wound 300 Series stainless steel gasket standard. Alternate materials available to suit application.

4 Casing Drain: (not shown)

Casing can be completely drained. Drain valves optional.

5 Suction Nozzle:

Flow straightening vane reduces inlet swirl and ensures uniform flow to the impeller eye.

6 Impeller:

Closed, single suction Impeller designed to provide low suction specific speeds (Nss<11,000). Low NPSHR impellers available. Streamlined impeller locknut for improved suction performance.

Impellers are dynamically balanced to API 610 requirements for low vibration and smooth, trouble free operation.

Impeller secured to Shaft by Impeller Nut and Setscrew.

7 Wear Rings:

Renewable casing and impeller wear rings are held in place by locking pins or setscrews. No back wear ring design optional. Composite reduced clearance wear rings for improved efficiency are optional.

8 Throat Bushing:

Close clearance design carbon Throat Bushing provides additional Shaft support and helps provide optimum seal chamber environment.

9 Seal:

Available with reliable, low cost standard mechanical seals or cartridge type mechanical seals for precise seal face setting and ease of maintenance. Stainless steel shaft sleeve and gland plate are standard.

10 Seal Chamber:

Designed to API 610 and API 682 Table 2, Table 1 optional. Accepts all mechanical seal arrangements, Sealing system computer modeling and close coordination with seal manufacturers ensures optimum seal chamber environment.

Most Seals can be removed without disturbing the Driver.

11 Shaft Arrangement:

Gruop I and II VLK's use a soild 12% chrome shaft without a shaft sleeve. This design feature allows complete replacement at less cost than a shaft with sleeve. It also provides greater shaft stiffness than would be obtained if the shaft diameter were to be reduced for a sleeve. In addition to these advantages, elimination of the shaft sleeve also eliminates a potential leak path.

Maximum interchangeability is achieved by using only one shaft for the entire VLK mechanical group.

12 Motor Support Housing:

Heavy Duty Motor Support with register fits at the Casing Cover and Driver for precise alignment.

13 Soleplate: (not shown)

Optional soleplate provides mounting flexibility.

14 Coupling:

Three Coupling designs available:

VLK Standard Rigid design...

- Guaranteed repeatability - ensuring factory standard alignment and run-out.
- Proven two (2) piece design allows for simplicity of installation and removal. No special alignment or manual fitting procedures are required, as on other multiple-component couplings.
- Shaft run-out at Seal Chamber is maintained within API 610 tolerances, ensuring optimum Mechanical Seal performance.
- Lowest L^3/D^4 ratios provide maximum rotor stiffness and minimum Shaft deflection.
- AGMA 515 Class 8 balance for low vibration.
- Stainless Steel construction.
- Coupling guard fabricated from non-sparking materials.

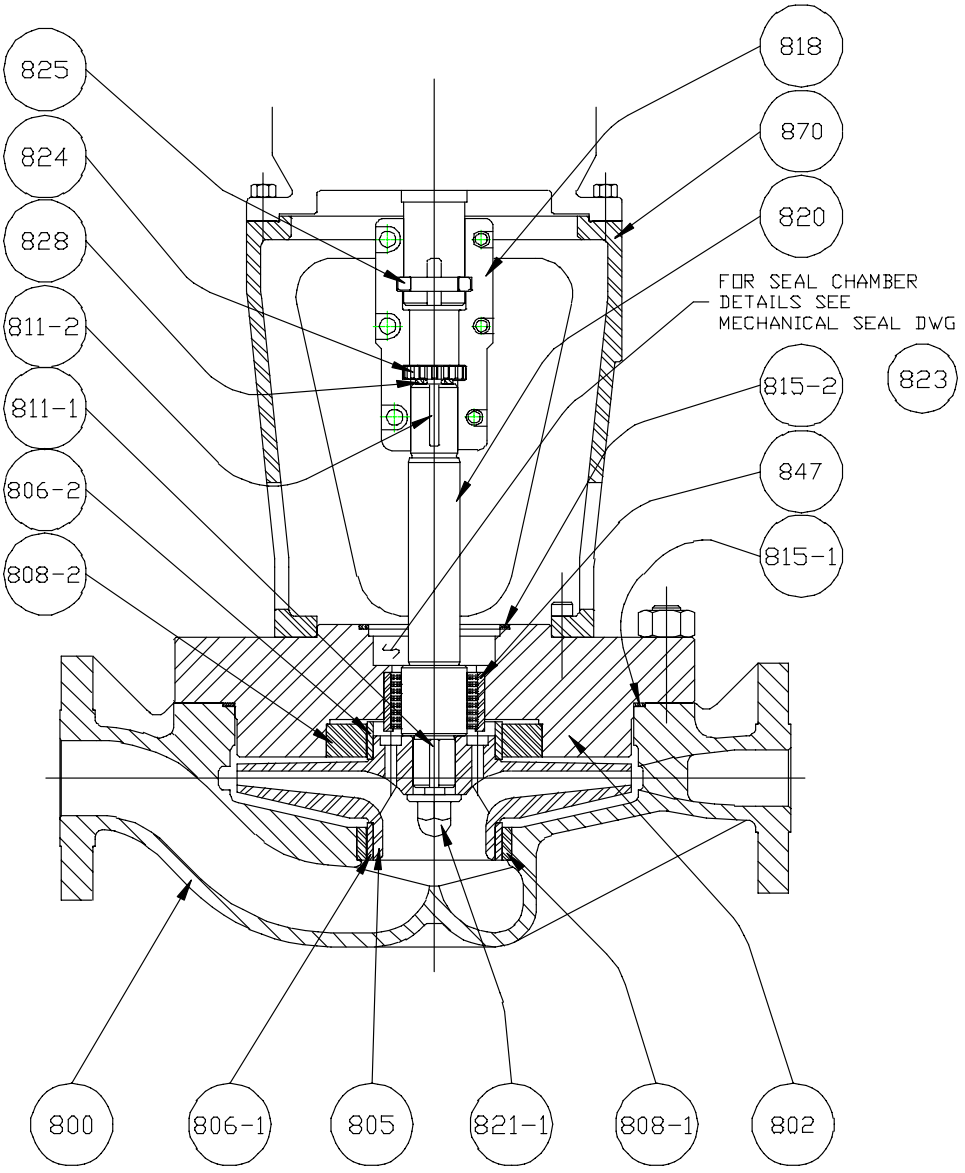
VLK-L Extended Rigid design...

- Same quality, reliability and repeatability as the VLK Standard Rigid design.
- Increases Shaft separation between motor shaft and pump shaft to allow cartridge type mechanical seal to be removed without disturbing the driver or piping.
- Maintains rotor stiffness that exceeds API 610 criteria.

VLK-X Back Pull-Out design...

- Same quality, reliability and repeatability as the VLK Standard Rigid design.
- Casing mounted Motor Support allows rotor (Cover, Impeller, Shaft and Seal) removal without disturbing the driver.
- Maintains rotor stiffness that exceeds API 610 criteria.

Cross Sectional Details



Reference Drawing # SEC-E0142015

Part Number	Description
800	Casing
802	Casing Cover
805	Impeller
806-1	Impeller Wear Ring - Eye Side (Front)
806-2	Impeller Wear Ring - Hub Side (Back)
808-1	Casing Wear Ring - Eye Side (Front)
808-2	Cover Wear Ring - Hub Side (Back)
811-1	Impeller Key
811-2	Shaft Key
815-1	Casing Gasket

Part Number	Description
815-2	Seal Gland “O” Ring
818	Coupling - Rigid Spacer Type
820	Shaft
821-1	Impeller Lock Nut
823	Mechanical Seal Assembly
824	Adjusting Stud
825	Locating Ring
828	Spacer Washers
847	Throat Bushing
870	Motor Support

Maximum Allowable Nozzle Loading - Side Suction / Side Discharge

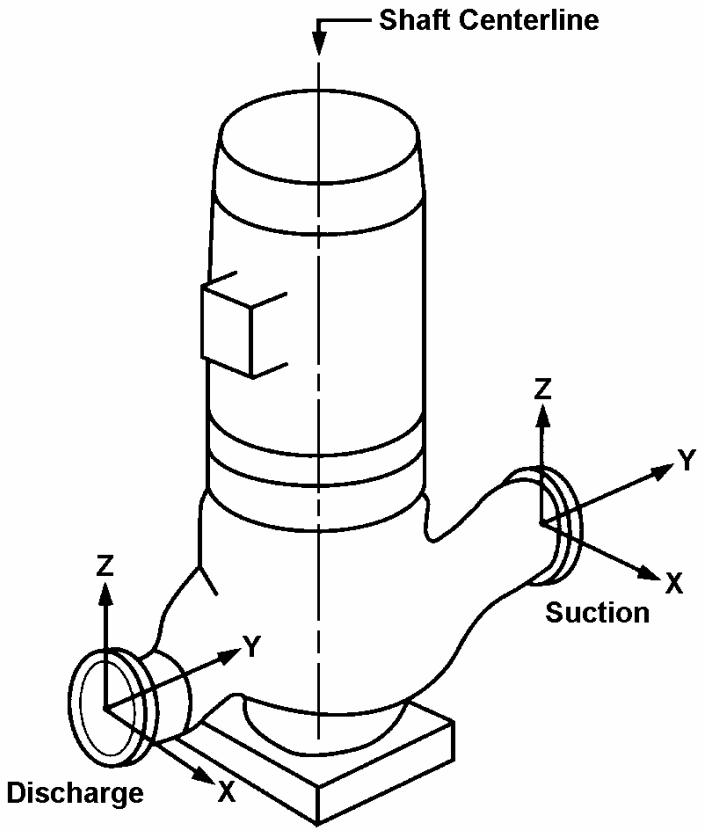
Both users and manufacturers are concerned with the amount of pipe loads a Centrifugal Pump can withstand without affecting it's operation.

The customer would, of course, be most pleased if Centrifugal Pumps would withstand unlimited pipe strains. As manufacturers, *we would like to see **no** external forces acting on our pumps at all.*

The following chart gives the maximum permissible Forces (*F*) and Moments (*M*) and their Resultants on the Pump based on Pump Suction and Discharge Nozzle (Flange) Sizes.

Caution:

Should these limits be exceeded a malfunction and shorter life of Pump may result.



U.S. Customary Units

Nominal Flange Size (Inches)								
Force / Moment	1-1/2	2	3	4	6	8	10	12
Suction and Discharge Nozzle Connections								
FX	160	320	480	640	1120	1700	2400	3000
FY	200	400	600	800	1400	2200	3000	3600
FZ	130	260	400	520	920	1400	2000	2400
FR	290	580	860	1140	2020	3120	4400	5200
Suction and Discharge Nozzle Connections								
MX	340	680	1400	1960	3400	5200	7400	9000
MY	170	340	700	1000	1740	2600	3600	4400
MZ	260	520	1060	1480	2600	3800	5600	6800
MR	460	920	1900	2660	4620	7000	10000	12200

Note:
1.) The above values apply to Carbon Steel and Stainless Steel Pump construction. Consult Union Pump Company for other Materials of Construction.
2.) Each value above indicates a range from minus to plus of that value; i.e. 160 indicates a range from -160 to +160.
3.) ***F*** = Force in Pounds; ***M*** = Moment in Foot Pounds; and ***R*** = Resultant.
4.) ***X***, ***Y***, and ***Z*** = Orientation of Nozzle (Flange) Loads, see illustration above.
5.) Coordinate system has been changed from API-610, 7th Edition Standard, conversion to ISO 1503 convention.

Maximum Allowable Nozzle Loading - Side Suction / Side Discharge

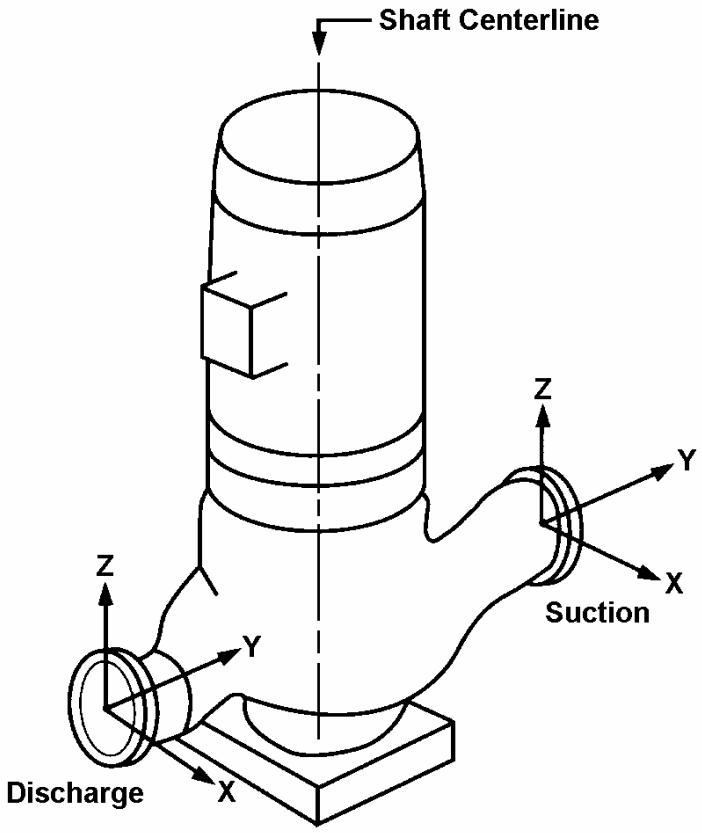
Both users and manufacturers are concerned with the amount of pipe loads a Centrifugal Pump can withstand without affecting it's operation.

The customer would, of course, be most pleased if Centrifugal Pumps would withstand unlimited pipe strains. As manufacturers, *we would like to see **no** external forces acting on our pumps at all.*

The following chart gives the maximum permissible Forces (*F*) and Moments (*M*) and their Resultants on the Pump based on Pump Suction and Discharge Nozzle (Flange) Sizes.

Caution:

Should these limits be exceeded a malfunction and shorter life of Pump may result.



S.I. Units

Nominal Flange Size (Inches)								
Force / Moment	1-1/2	2	3	4	6	8	10	12
Suction and Discharge Nozzle Connections								
FX	710	1420	2140	2840	4980	7560	10680	13340
FY	890	1780	2660	3560	6220	9780	13340	16000
FZ	580	1160	1780	2320	4100	6220	8900	10680
FR	1280	2560	3860	5120	8960	11840	17260	23400
Suction and Discharge Nozzle Connections								
MX	460	920	1900	2660	4600	7060	10040	12200
MY	230	460	940	1360	2360	3520	4880	5960
MZ	350	700	1440	2000	3520	5160	7600	9220
MR	620	1240	2560	3600	6260	9420	13500	16420

Note:
1.) The above values apply to Carbon Steel and Stainless Steel Pump construction. Consult Union Pump Company for other Materials of Construction.
2.) Each value above indicates a range from minus to plus of that value; i.e. 710 indicates a range from -710 to +710.
3.) ***F*** = Force in Newtons; ***M*** = Moment in Newton Meters; and ***R*** = Resultant.
4.) ***X***, ***Y***, and ***Z*** = Orientation of Nozzle (Flange) Loads, see illustration above.
5.) Coordinate system has been changed from API-610, 7th Edition Standard, conversion to ISO 1503 convention.

Standard Materials of Construction

The ASTM number (when applicable) is shown on the top, the generic material term is shown on the bottom left and the Union Pump Company material code on the bottom right

API MATERIAL CLASS	S-1	S-3	S-4	S-5	S-6
CASE	A216 WCB Steel (B44400)	A216 WCB Steel (B44400)	A216 WCB Steel (B44400)	A216 WCB Steel (B44400)	A216 WCB Steel (B44400)
COVER	A516 Gr70 Steel (B21100)	A516 Gr70 Steel (B21100)	A516 Gr70 Steel (B21100)	A516 Gr70 Steel (B21100)	A516 Gr70 Steel (B21100)
IMPELLER[1]	A48 CL30 Cast Iron (A11100)	A436 TP 2 Ni Resist (A41400)	A216 WCB Steel (B44500)	A216 WCB Steel (B44500)	A743 CA6NM 12% Cr (E11200)
IMPELLER CAPNUT	A747 CB7CU-1 17-4 PH (F11513)	A747 CB7CU-1 17-4 PH (F11513)	A747 CB7CU-1 17-4 PH (F11513)	A747 CB7CU-1 17-4 PH (F11513)	A747 CB7CU-1 17-4 PH (F11513)
IMPELLER KEY	A276 TP 316 316 SS (D21400)	A276 TP 316 316 SS (D21400)	A276 TP 316 316 SS (D21400)	A276 TP 316 316 SS (D21400)	A276 TP 316 316 SS (D21400)
CASE RINGS	A48 CL 30 Cast Iron (A11100)	A436 TP 2 Ni Resist (A41400)	A48 CL 30 Cast Iron (A11100)	A743 CA15 HT403 12% Cr (E11501)	A743 CA15 HT403 12% Cr (E11501)
IMPELLER RINGS	A48 CL 30 Cast Iron (A11100)	A436 TP 2 Ni Resist (A41400)	A48 CL 30 Cast Iron (A11100)	A743 CA15 12% Cr (E11500)	A743 CA15 12% Cr (E11500)
SHAFT[2]	A276 410 Cond T 12% Cr (E21101)	A276 410 Cond T 12% Cr (E21101)	A276 410 Cond T 12% Cr (E21101)	A276 410 Cond T 12% Cr (E21101)	A276 410 Cond T 12% Cr (E21101)
SHAFT SLEEVE[3,5]	12% Chrome (NA)	12% Chrome (NA)	12% Chrome (NA)	12% Chrome (NA)	12% Chrome (NA)
THROAT BUSHING[4]	A108 GR 1215 CF Steel (B22300)	A436 TP 2 Ni Resist (A41400)	A108 GR 1215 CF Steel (B22300)	A582-80 TP 416 A 12% Cr (E22100)	A582-80 TP 416 A 12% Cr (E22100)
SEAL GLAND[5]	A108 GR 1018 CF Steel (B22100)	A108 GR 1018 CF Steel (B22100)	A108 GR 1018 CF Steel (B22100)	A108 GR 1018 CF Steel (B22100)	A108 GR 1018 CF Steel (B22100)
GLAND SPACER	A108 GR 1215 CF Steel (B22300)	A108 GR 1215 CF Steel (B22300)	A108 GR 1215 CF Steel (B22300)	A108 GR 1215 CF Steel (B22300)	A108 GR 1215 CF Steel (B22300)
THROTTLE BUSHING[5]	Bronze or Carbon (J11600) (U21100)	Bronze or Carbon (J11600) (U21100)	Bronze or Carbon (J11600) (U21100)	Bronze or Carbon (J11600) (U21100)	Bronze or Carbon (J11600) (U21100)
GLAND STUDS	A193 B7M Cad Pltd 4140 Stl (C42305)	A193 B7M Cad Pltd 4140 Stl (C42305)	A193 B7M Cad Pltd 4140 Stl (C42305)	A193 B7M Cad Pltd 4140 Stl (C42305)	A193 B7M Cad Pltd 4140 Stl (C42305)
CASE STUDS	A193 B7M 4140 Stl (C42301)	A193 B7M 4140 Stl (C42301)	A193 B7M 4140 Stl (C42301)	A193 B7M 4140 Stl (C42301)	A193 B7M 4140 Stl (C42301)
CASE NUTS	A194 2HM Steel (..G7)	A194 2HM Steel (..G7)	A194 2HM Steel (..G7)	A194 2HM Steel (..G7)	A194 2HM Steel (..G7)
CASE GASKET (SPIRAL WOUND)	304 SS w/ Graphite filler (R19400)	304 SS w/ Graphite filler (R19400)	304 SS w/ Graphite filler (R19400)	304 SS w/ Graphite filler (R19400)	304 SS w/ Graphite filler (R19400)
GLAND GASKET (SPIRAL WOUND)	304 SS w/ Graphite filler (R19400)	304 SS w/ Graphite filler (R19400)	304 SS w/ Graphite filler (R19400)	304 SS w/ Graphite filler (R19400)	304 SS w/ Graphite filler (R19400)

Notes:

1. For 1.5x2x10B, 4x6x8A/B, 6x6x10, and 10x10x15B minimum material available is A216-WCB. For 2x3x13C, minimum material available is A743 CA6NM. Cast Iron and Ni-Resist impellers are limited to 12" diameter at 3600 rpm. Upgrade to steel or other material is made when this condition exists.

2. For Group II, Drive Group A design, and ANY application in intermittent service, recommended material is A564-630 Cond H1150-M (F21502).

3. Furnished with cartridge seals only. Note: Removal of cartridge seals may require removal of driver from support.

4. Material shown is for throat holder. Bushing material is carbon/graphite with antimony binder (U21500).

5. Gland, sleeve and bushing material subject to change when recommended by seal manufacturer.

Standard Materials of Construction

The ASTM number (when applicable) is shown on the top, the generic material term is shown on the bottom left and the Union Pump Company material code on the bottom right

API MATERIAL CLASS	S-9	C-6	A-7	A-8
CASE	A216 WCB [1] Steel (B44400)	A487 CA6NM 12% Cr (E12101)	A351 CF8 304 SS (D11007)	A351 CF8M 316 SS (D11200)
COVER	A516 Gr. 70 Steel (B21100)	A487 CA6NM 12% Cr (E12101)	A351 CF8 304 SS (D11007)	A351 CF8M 316 SS (D11200)
IMPELLER	A494 GR M-35-1 Monel (G11500)	A743 CA6NM 12% Cr (E11200)	A743 CF8 304 SS (D12000)	A743 CF8M 316 SS (D12200)
IMPELLER CAPNUT	Monel 400 (G21800)	A747 CB7CU-1 17-4 PH (F11513)	A747 CB7CU-1 17-4 PH (F11513)	A747 CB7CU-1 17-4 PH (F11513)
IMPELLER KEY	Monel 400 (G21800)	A276 TP 316 316 SS (D21400)	A276 TP 316 316 SS (D21400)	A276 TP 316 316 SS (D21400)
CASE RINGS	Monel 400 (G21800)	A743 CA15 HT403 12% Cr (E11501)	A276 316L or [2] A743 CF3M (R51200)	A276 316L or [2] A743 CF3M (R51200)
IMPELLER RINGS	Monel 400 (G21800)	A743 CA15 12% Cr (E11500)	A276 316L or [2] A743 CF3M (R51200)	A276 316L or [2] A743 CF3M (R51200)
SHAFT	Monel K-500 (G22100)	A276 410 Cond T [3] 12% Cr (E21101)	A276 TP 316 A[3] 316 SS (D21400)	A276 TP 316 A[3] 316 SS (D21400)
SHAFT SLEEVE[4]	Monel K-500 (NA)	12% Chrome. (NA)	Austenitic SS (NA)	316 SS (NA)
THROAT BUSHING[5]	Monel 400 (G21800)	A582-80 TP 416 A 12% Cr (E22100)	A276 TP 316 A 316 SS (D21400)	A276 TP 316 A 316 SS (D21400)
SEAL GLAND	A108 GR 1018 CF Steel (B22300)	A276 316 316 SS (D21400)	A276 316 316 SS (D21400)	A276 316 316 SS (D21400)
GLAND SPACER	Monel K-500 (G22100)	A276 316 A 316 SS (D21400)	A276 304 A 304 SS (D21200)	A276 316 A 316 SS (D21400)
THROTTLE BUSHING	Bronze or Carbon (J11600) (U21100)	Bronze or Carbon (J11600) (U21100)	Carbon or Teflon (U21100) or (T50600)	Carbon or Teflon (U21100) or (T50600)
GLAND STUDS	Monel K-500 (G22103)	A193 B7M Cad Pltd 4140 Stl (C42305)	A193 B7M Cad Pltd 4140 Stl (C42305)	A193 B8M 316 SS (D41300)
CASE STUDS	Monel K-500 (G22103)	A193 B7M 4140 Stl. (C42301)	A193 B7M 4140 Stl. (C42301)	A193 B7M 4140 Stl. (C42301)
CASE NUTS	Monel (..P5)	A194 GR 2HM Steel (..G7)	A194 GR 2HM Steel (..G7)	A194 GR 2HM Steel (..G7)
CASE GASKET (SPIRAL WOUND)	Monel / Teflon filled (R17500)	304 SS w/ Graphite filler (R19400)	304 SS w/ Graphite filler (R19400)	316 SS with filler (R19200)
GLAND GASKET (SPIRAL WOUND)	Monel / Teflon filled (R17500)	304 SS w/ Graphite filler (R19400)	304 SS w/ Graphite filler (R19400)	316 SS with filler (R19200)

Notes:

1. Case and cover are Monel lined at gasket surfaces and under wear parts.
2. Hard faced with No. 6 Colmonoy as standard.
3. For Group II, Drive Group A design, and ANY application in intermittent service, recommended material is A564-630 Cond H1150-M (F21502).
4. Furnished with cartridge seals only. Note: Removal of cartridge seals may require removal of driver from support.
5. Material shown is for throat holder. Bushing material is carbon/graphite with antimony binder (U21500).
6. Gland, sleeve and bushing material subject to change when recommended by seal manufacturer.