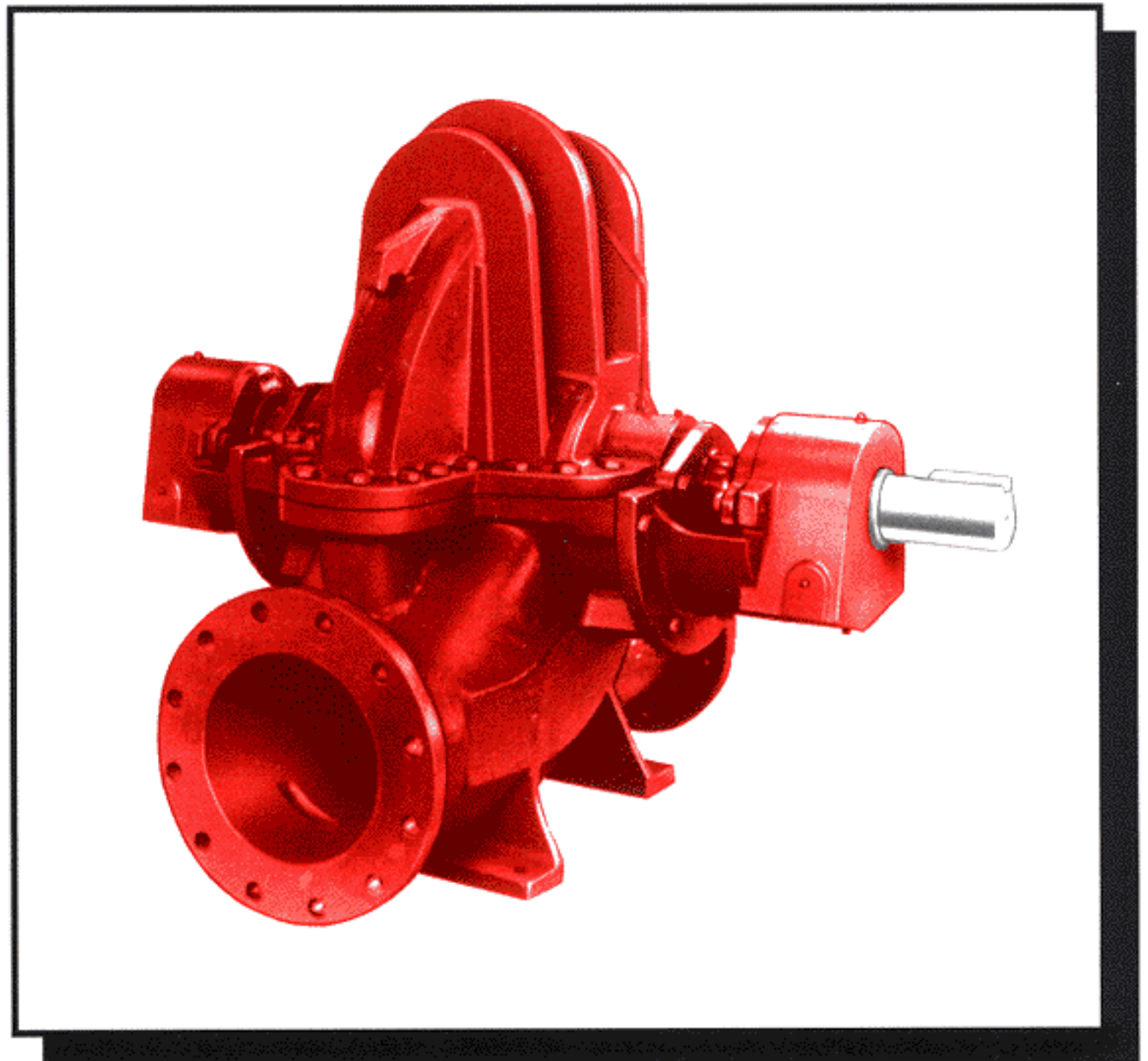




Bulletin B-516D

Bell & Gossett



Series HSCS Pumps – Technical Bulletin

Part of the

ESP PLUS
Equipment Selection Program

Bell & Gossett

 **ITT Industries**
Engineered for life

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Useful Pump Formulas

$$\begin{aligned} \text{Pressure (PSI)} &= \frac{\text{Head (Feet)} \times \text{Specific Gravity}}{2.31} \\ \text{Head (Feet)} &= \frac{\text{Pressure (PSI)} \times 2.31}{\text{Specific Gravity}} \\ \text{Vacuum (Inches of Mercury)} &= \frac{\text{Dynamic Suction Lift (Feet)} \times .883}{\text{Specific Gravity}} \\ \text{Horsepower (Brake)} &= \frac{\text{GPM} \times \text{Head (Feet)} \times \text{Specific Gravity}}{3960 \times \text{Pump Efficiency}} \\ \text{Horsepower (Water)} &= \frac{\text{GPM} \times \text{Head (Feet)} \times \text{Specific Gravity}}{3960} \\ \text{Efficiency (Pump)} &= \frac{\text{Horsepower (Water)}}{\text{Horsepower (Brake)}} \times 100 \text{ Per Cent} \\ \text{NPSH (Available)} &= \text{Positive Factors} - \text{Negative Factors} \end{aligned}$$

Affinity Laws: Effect of change of speed or impeller diameter on centrifugal pumps.

	GPM Capacity	Ft. Head	BHP
Impeller Diameter Change	$Q_2 = \frac{D_2}{D_1} Q_1$	$H_2 = \left(\frac{D_2}{D_1}\right)^2 H_1$	$P_2 = \left(\frac{D_2}{D_1}\right)^3 P_1$
Speed Change	$Q_2 = \frac{\text{RPM}_2}{\text{RPM}_1} Q_1$	$H_2 = \left(\frac{\text{RPM}_2}{\text{RPM}_1}\right)^2 H_1$	$P_2 = \left(\frac{\text{RPM}_2}{\text{RPM}_1}\right)^3 P_1$

Where Q = GPM, H = Head, P = BHP, D = Impeller Dia., RPM = Pump Speed

Engineering Data

Series HSCS Large Split Case Pumps

SINGLE STAGE – DOUBLE SUCTION

Pump Size	④ 8x12x22M	④ 8x12x22L	10x14x20S	10x14x20L	12x16x23	14x16x17	14x18x23
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CASING DATA

All Dimensions in Inches (mm)

① 125# FF Std ASA Flanges (Standard)	Max. Suction Pressure PSIG (bar)	75 (5)	75 (5)	75 (5)	75 (5)	75 (5)	75 (5)	75 (5)
	Max. Working Pressure PSIG (bar)	300 (21)	300 (21)	175 (12)	175 (12)	175 (12)	175 (12)	175 (12)
	Max. Hydrostatic Test Pressure PSIG (bar) ③	450 (31)	450 (31)	262 (18)	262 (18)	262 (18)	262 (18)	262 (18)
	Casing Material	Cast Iron	Cast Iron	Cast Iron	Cast Iron	Cast Iron	Cast Iron	Cast Iron
② 250# FF ASA Flanges (Optional)	Max. Suction Pressure PSIG (bar)	200 (14)	200 (14)	200 (14)	200 (14)	200 (14)	200 (14)	200 (14)
	Max. Working Pressure PSIG (bar)	400 (27)	400 (27)	300 (21)	300 (21)	300 (21)	300 (21)	300 (21)
	Max. Hydrostatic Test Pressure PSIG (bar) ③	600 (41)	600 (41)	450 (31)	450 (31)	450 (31)	450 (31)	450 (31)
	Casing Material	Ductile Iron	Ductile Iron	Ductile Iron	Ductile Iron	Ductile Iron	Ductile Iron	Ductile Iron
	Casing Wall Thickness	.625 (16)	.625 (16)	.625 (16)	.625 (16)	.625 (16)	.625 (16)	.625 (16)

STUFF BOX DATA

All Dimensions in Inches (mm)

Bore	5.125 (130)	5.125 (130)	5.125 (130)	5.125 (130)	5.125 (130)	5.125 (130)	5.125 (130)
Depth	4.812 (122)	4.812 (122)	4.812 (122)	4.812 (122)	4.812 (122)	4.812 (122)	4.812 (122)
Seal Cage Width	.75 (19)	.75 (19)	.75 (19)	.75 (19)	.75 (19)	.75 (19)	.75 (19)
Packing No. Rings/Size Sq. With Seal Cage	6/.625	6/.625	6/.625	6/.625	6/.625	6/.625	6/.625
Shaft Sleeve O.D.	3.875 (98)	3.875 (98)	3.875 (98)	3.875 (98)	3.875 (98)	3.875 (98)	4.625 (117)
Mechanical Seal Size Type 8-1	3.875 (98)	3.875 (98)	3.875 (98)	3.875 (98)	3.875 (98)	3.875 (98)	4.625 (117)
⑤ { Mechanical Seal Size (Type 8B1)	{ Major Dia. Minor Dia.	4.125 (105)	4.125 (105)	4.125 (105)	4.125 (105)	4.125 (105)	4.75 (121)
		3.875 (98)	3.875 (98)	3.875 (98)	3.875 (98)	3.875 (98)	3.875 (98)

IMPELLER DESIGN DATA

All Dimensions in Inches (mm)

No. of Vanes	5	6	6	5	6	6	6
Inlet Area (Sq. Inches)	68	80	112	128	150	171	212
Inlet Velocity per 100 GPM (Ft/Sec)	.47	.40	.29	.25	.21	.19	.15
Maximum Diameter	21.0 (533)	23.0 (584)	19.8 (503)	19.8 (503)	23.0 (584)	17.5 (445)	23.0 (584)
Minimum Diameter	12.0 (305)	12.0 (305)	9.4 (239)	14.0 (356)	13.0 (330)	11.0 (279)	14.0 (356)
Maximum Sphere	1.4 (36)	1.6 (41)	1.63 (41)	1.56 (40)	1.63 (42)	1.2 (30)	2.1 (53)
VR ² for Maximum Diameter (Lbs-Ft ²)	52	58.5	46.6	52.0	108.9	45.5	120.1
Wear Ring Clearance — Diam. BRZ Impellers	.016-.019 (.40-.48)	.016-.019 (.40-.48)	.016-.019 (.40-.48)	.016-.019 (.40-.48)	.016-.019 (.40-.48)	.016-.019 (.40-.48)	.016-.019 (.40-.48)

SHAFT AND BEARING DATA

All Dimensions in Inches (mm)

At Coupling	3.125 (79)	3.125 (79)	3.125 (79)	3.125 (79)	3.125 (79)	3.125 (79)	3.125 (79)
Thru Impeller and Sleeves	3.311 (84)	3.311 (84)	3.311 (84)	3.311 (84)	3.311 (84)	3.311 (84)	4.061 (103)
Shaft Span	35.8 (909)	35.8 (909)	40.5 (1029)	40.5 (1029)	40.5 (1029)	40.5 (1029)	41.375 (1050)
Ball Bearings	Inboard	6316	6316	6316	6316	6316	6316
	Outboard	21316	21316	21316	21316	21316	21316
Frame Designation	F21-D4	F21-E4	F21-E4	F21-E4	F21-E4	F21-E4	F21-F4

① Flange dimensions are in accordance with ANSI A21.10, AWWA C110 and ANSI B16.1 Class 125.

② Flange dimensions in accordance with ANSI B16.1 Class 250 except flanges are flat faced, i.e. FF.

③ The hydrostatic test will be in accordance with the latest edition of the Hydraulic Institute Standards, test will be maintained for a minimum of 10 minutes.

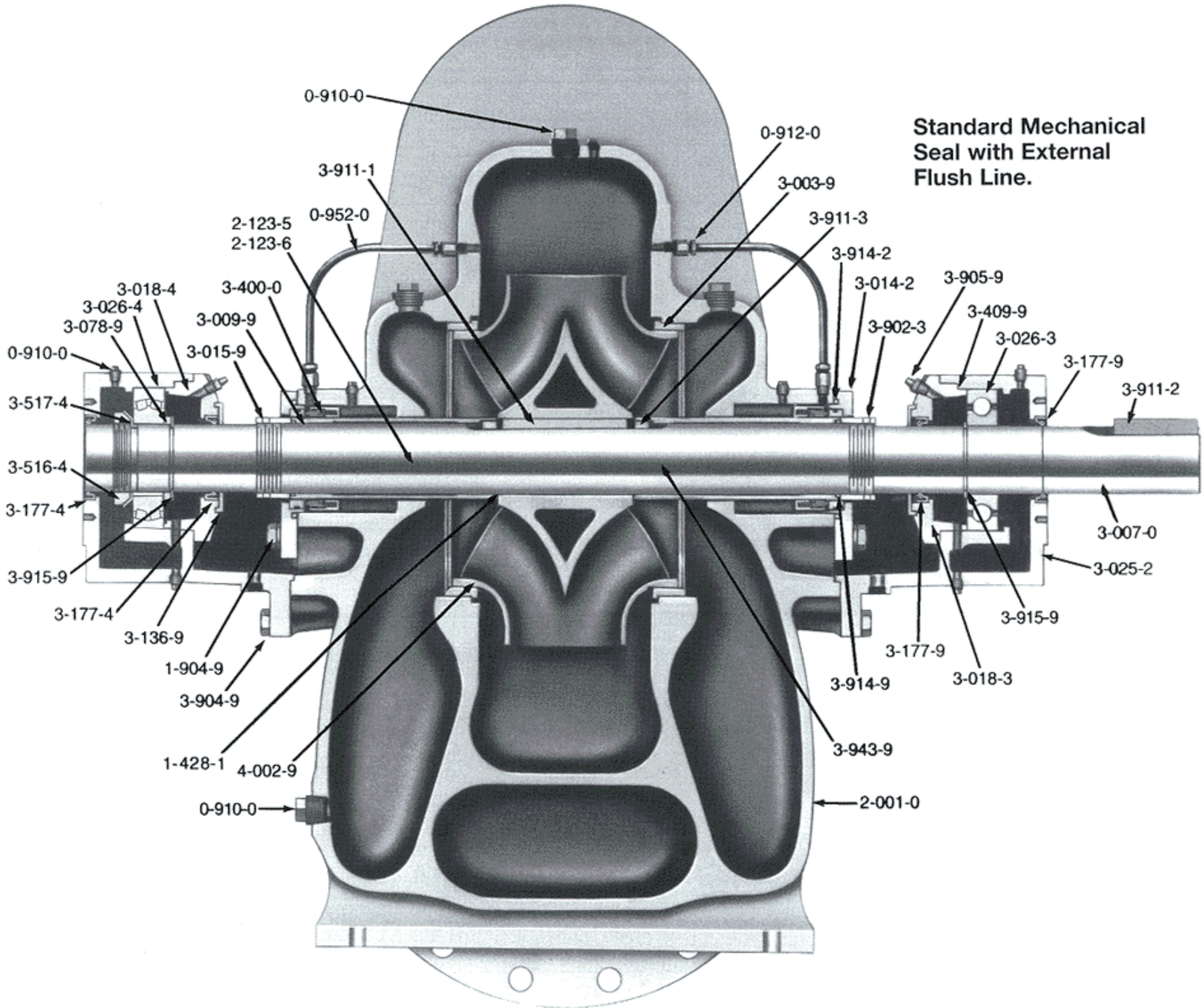
④ 8x12x22M and 8x12x22L are standard with 125 PSI ASA FF suction and 250 PSI ASA FF discharge flanges.

⑤ Balanced mechanical seals have a major and a minor diameter as listed.

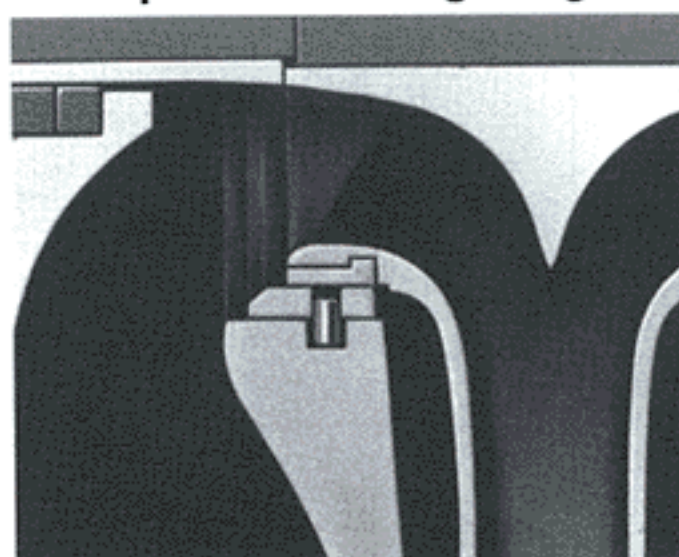
Construction Materials

Series HSCS Large Split Case Pumps

MECHANICAL SEALS MOUNTED ON SLEEVE



Impeller Wearing Rings



Impeller rings can be added - Optional Extra

Construction Materials

Series HSCS Large Split Case Pumps

MECHANICAL SEALS MOUNTED ON SLEEVE

Catalog No.	Part Name	Standard Materials	Optional Materials
0-910-0	Pipe Plugs (Casing, Bearing Hsgs)	Steel	
0-912-0	Male Connectors	Brass	
0-952-0	Flush Line	Copper	
1-428-1	Gaskets (Sleeve)	Synthetic (Non-Asbestos)	
1-904-9	Bolts (Gland)	Stainless Steel (AISI 316)	
2-001-0	Casing	Cast Iron (ASTM A48 Class 35)	Ductile Iron (ASTM A536, Grade 65-45-12)
2-123-5	Casing Joint Gasket (Suction)	Paper (Vellumoid 505)	
2-123-6	Casing Joint Gasket (Discharge)	Paper (Vellumoid 505)	
2-904-1	Bolts (Casing)	Steel (Grade 8)	
3-400-0	Mechanical Seal (Type 8 or equal)	Viton / Carbon vs. Ceramic	
3-014-2	Glands (Mechanical Seal)	Cast Iron (ASTM A48 Class 25A)	
3-003-9	Casing Rings	Bronze (ASTM B584 Alloy 932)	
3-007-0	Shaft	Steel (SAE 1045) ①	316SS A276 UNS S31600 ②
3-009-9	Shaft Sleeves	Bronze (ASTM B584 Alloy 932)	
3-015-9	Shaft Sleeve Nuts	Bronze (ASTM B594 Alloy 932)	
3-018-3	Bearing Housing Cover (Inboard)	Cast Iron (ASTM A48 Class 30B)	
3-018-4	Bearing Housing Cover (Outboard)	Cast Iron (ASTM A48 Class 30B)	
3-025-2	Bearing Housings	Cast Iron (ASTM A48 Class 30B)	
3-026-3	Bearing (Inboard)	Steel	
3-026-4	Bearing (Outboard)	Steel	
3-078-9	Thrust Washer (Outboard)	Steel	
3-136-9	Deflectors	Rubber (Buna "N")	
3-177-4	Lip Seal (Outboard Bearing)	Rubber (Buna "N")	
3-177-9	Lip Seals (Bearing)	Rubber (Buna "N")	
3-409-9	Gaskets (Bearing Housing Covers)	Paper (Vellumoid 505)	
3-516-4	Locknut (Bearing)	Steel	
3-517-4	Lockwasher (Bearing)	Steel	
3-902-9	Set Screws	316 Stainless Steel	
3-904-9	Bolts (Bearing Covers)	Steel	
3-905-9	Grease Fittings	Steel	
3-911-1	Key (Impeller)	316 Stainless Steel	
3-911-2	Key (Coupling)	Steel	
3-911-3	Keys (Shaft Sleeves)	316 Stainless Steel	
3-914-2	O-Ring (Gland)	Rubber (Buna "N")	
3-914-9	O-Rings (Shaft Sleeves)	Rubber (Buna "N")	
3-915-9	Snap Rings	Steel	
3-943-9	Spirol Pins (Casing Rings)	302 Stainless Steel	
4-002-9	Impeller	Bronze (ASTM B594 Alloy 875)	

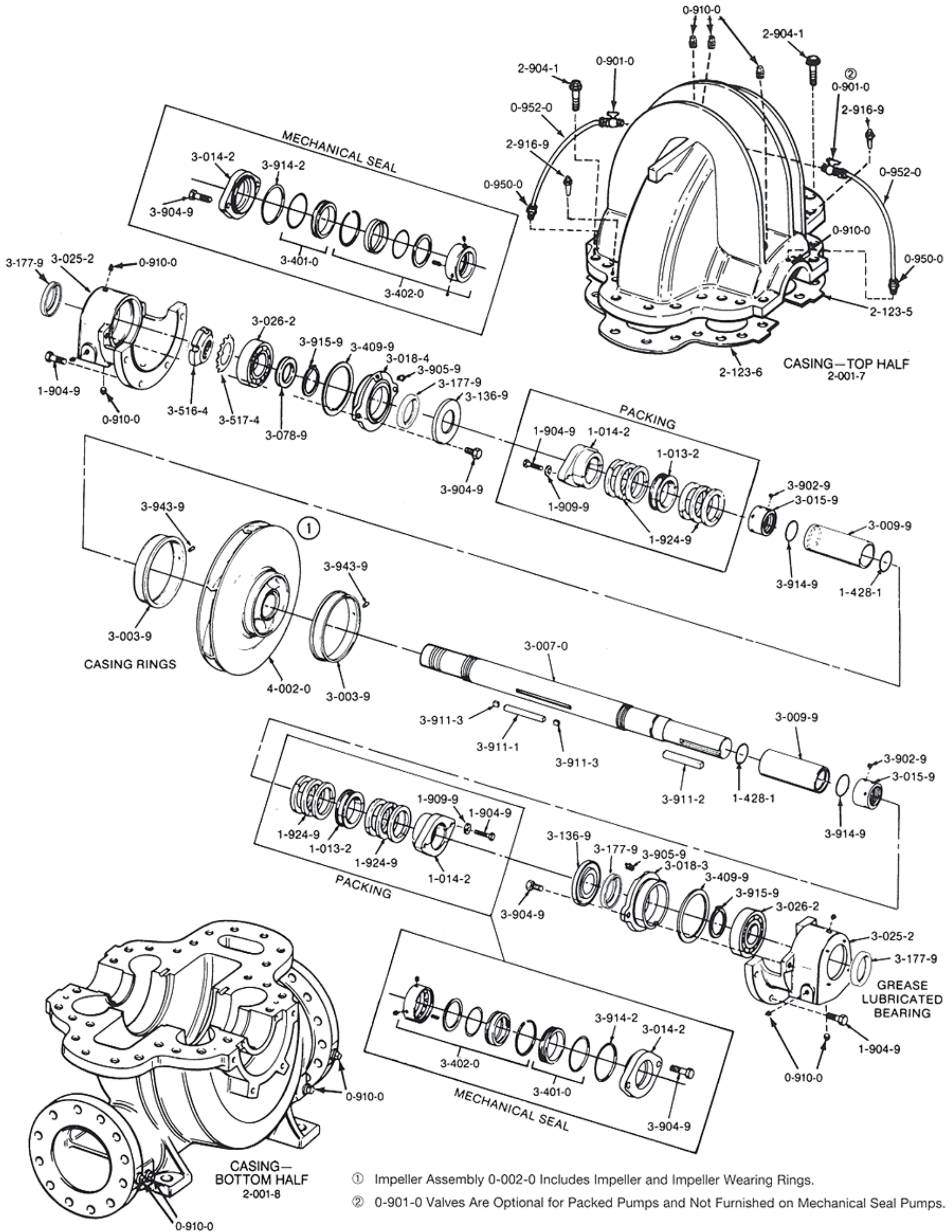
OPTIONAL COMPONENTS

4-004-9	Impeller Rings	Bronze (CDA 925)	
3-400-0	Balanced Mechanical Seal (Type 8B)	Viton / Carbon vs. Ceramic	

① Standard shaft material for size 10x14x20L is 4140.
For speeds greater than 1200 RPM, the standard shaft material is 17-4 PH condition H1150 for sizes 12x16x23 and 14x16x17.

② Shaft material option is 17-4 PH condition H1150 for sizes 10x14x20L, 12x16x23 and 14x16x17.

Exploded View Series HSCS Large Split Case Pumps



① Impeller Assembly 0-002-0 Includes Impeller and Impeller Wearing Rings.
 ② 0-901-0 Valves Are Optional for Packed Pumps and Not Furnished on Mechanical Seal Pumps.

Typical Specifications for Series HSCS Large Horizontal Split Case Pumps

DIVISION 15- MECHANICAL Section 15540 - HVAC Pumps and Specialties

1.00 PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

Provide pumps for heating, chilled water, and dual temperature water systems including all related appurtenances for a complete and operating systems.

1.02 SECTION INCLUDES:

Double Suction, Horizontal Split Case Pumps (Base Mounted)

1.03 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and supplementary Conditions and Division 1 Specification Sections, apply to these Sections.

Section *** - Alignment of Rotating Equipment
Section *** - Cast-in-Place Concrete
Section *** - Mechanical General Requirements
Section *** - Supports, Anchors, and Sleeves
Section *** - Motors and Starters
Section *** - Drives
Section *** - Mechanical Identification
Section *** - Vibration Isolation
Section *** - Piping Insulation
Section *** - Equipment Installation
Section *** - Hydronic Piping and Specialties
Section *** - Testing, Adjusting, and Balancing
Section *** - Meters and Gauges
Section *** - Electrical

1.04 QUALITY ASSURANCE:

- All equipment or components of this specification section shall meet or exceed the requirements and quality of the items herein specified, or as denoted on the drawings.
- Ensure pump operation at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate to ANSI/HI 9.6.3.1 - 1997 standards for Preferred Operating Region (POR) unless otherwise approved by the engineer. The pump NPSH shall conform to the ANSI/HI 9.6.1 - 1998 standards for *Centrifugal and Vertical Pumps for NPSH Margin*.
- Ensure pump pressure ratings are at least equal to system's maximum operating pressure at point where installed, but not less than specified.
- Equipment manufacturer shall be a company specializing in manufacture, assembly, and field performance of provided equipment with a minimum of five- (5) years experience.
- Equipment provider shall be responsible for providing certified equipment start-up and, when noted, an in the field certified training session. New pump start-up shall be for the purpose of determining pump alignment, lubrication, voltage, and amperage readings. All proper electrical connections, pump's balance, discharge and suction gauge readings, and adjustment of head, if required. A copy of the start-up report shall be made and sent to both the contractor and to the Engineer.

1.05 PRODUCT HANDLING:

- Protection: Use all means necessary to protect equipment before, during, and after installation.
- Replacement and Repair: All scratched, dented, and otherwise damaged units shall be repaired or replaced as directed by the Architect Engineer.

1.06 REGULATORY REQUIREMENTS:

- Conform to Health/Life Safety Code for Public Schools
- Conform to International Mechanical Code
- Conform to BOCA National Building Code
- Conform to State Plumbing Code
- Conform to National Electric Code NFPA 70
- Conform to Accessibility Code
- Conform to applicable ANSI/HI standards
- Products: Listed and classified motors by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.07 SUBMITTAL:

- Submit each item in this article according to the Conditions of the Contract and Division 1 Specification Sections.
- Submit manufacturer's installation instructions under provisions of General Conditions and Division 1.
- Product Data including certified performance curves and rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties, and accessories. Indicate pump's operating point on curves.
- Hanging and support requirements should follow the recommendations in the manufacturer's installation instructions.

1.08 OPERATION AND MAINTENANCE DATA:

- Submit Operation and Maintenance information under provisions of Division 15 "Mechanical General Requirements" and the provisions of the General Conditions and Division 1.
- Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts lists.
- Under provisions of commissioning documentation; testing of pumps, as well as training of owner's operation and maintenance personnel may be required in cooperation with the commissioning consultant.

1.09 DELIVERY, STORAGE, AND HANDLING:

Store materials in clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage.

1.10 WARRANTY:

Provide a minimum one- (1) year warranty on materials and installation under provision of Section 15010.

1.11 EXTRA MATERIALS:

Provide one (1) set of mechanical seals for each model type of primary pump scheduled.

2.00 PART 2- PRODUCTS

The specifying engineer reserves the right to specify a primary supplier / lead spec manufacturer on all supplied schedule and specification documents. These primary suppliers have lead their respective industry in research and development and their products have had proven track records in the field. These primary suppliers, in the opinion of this engineering firm, produce a superior product to the alternately listed manufacturers. The contractor may choose to supply equivalent equipment as manufactured by the alternately specified manufacturer. This alternately specified equipment will be supplied on a deduct alternate basis and based on the approval of the supplied alternate manufacturer's submittals.

The use of a primary supplier and deduct alternates protects the specifying engineer's design concept, but allows for a check-and-balance system to protect the post-commissioning owner.

2.01 DOUBLE SUCTION, HORIZONTAL SPLIT CASE PUMPS (BASE MOUNTED):

A. Manufacturer:

Contractor shall furnish and install new double suction horizontal split case pumps for chilled water and hot water heating systems as indicated on the drawings. Pumps shall be model HSCS as manufactured by Bell & Gossett under base bid. Equivalent units manufactured by the Aurora Pump company or Paco Pumps Incorporated may be substituted as deduct alternates. Pumps shall meet types, sizes, capacities, and characteristics as scheduled on the Equipment Schedule drawings.

B. Double Suction Horizontal Split Case Pump (Base Mounted):

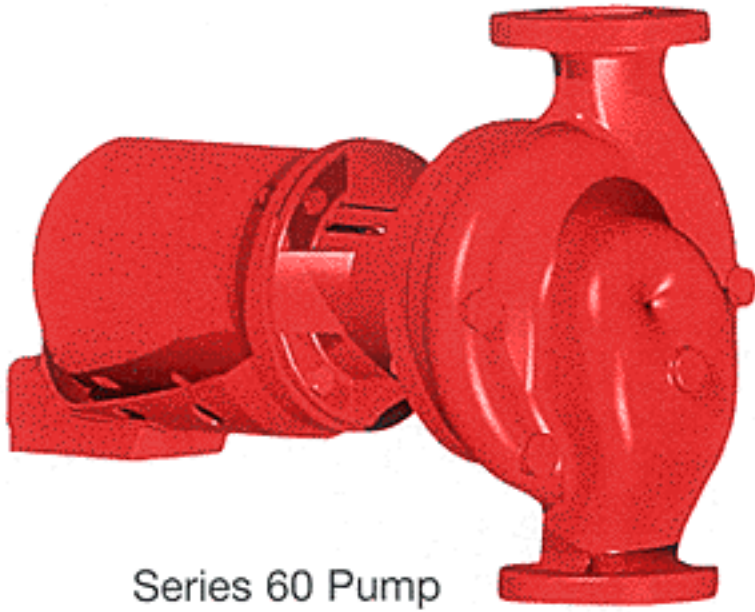
- The pumps shall be long coupled, base mounted, single stage, double suction, horizontally split case design, in cast iron bronze fitted construction specifically designed and guaranteed for quiet operation. Suitable standard operations at 220°F and 175 psig maximum working pressure, or optional 300 or 400 psig working pressures. The pump internals shall be capable of being serviced without disturbing piping connections or electrical motor connections.
- A cast iron housing shall supply support for anti-friction type bearings, with provisions for purging or flushing through the bearing surface. An inboard single row bearing will absorb thermal expansive forces while an outboard double row bearing will be clamped in place to absorb both radial and thrust loads, and keep the rotating element in proper axial alignment. Bearings shall be replaceable without disturbing the system piping and shall be regreaseable without removal of the bearings from the bearing housing. Lip seals and deflectors shall be used for bearing protection.
- The impeller shaft material shall be carbon steel* or equivalent, with bronze shaft sleeves for corrosion and wear prevention.
- Pump shall be equipped with a pair of externally flushed mechanical seal assemblies mounted on the pumps' shaft sleeves. Seal assemblies shall be John Crane Type 8 or equal, with viton elastomers, stainless steel hardware, carbon primary ring and a stationary ceramic mating ring.
- Impeller shall be of the enclosed double suction type made of bronze, hydraulically balanced to ANSI/HI 9.6.4.5 - 2000, figure 9.6.4.15B, balance grade G6.3, keyed to the shaft and positioned axially by shaft sleeves.
- An all-metal gear type coupling, capable of absorbing torsional vibration, shall be employed between the pump and motor.
- The coupling shall be shielded by a dual rated ANSI B15.1, Section 8 and OSHA 1910.219 compliant coupling guard and contain viewing windows for inspection of the coupling.
- Pump volute shall be of a cast iron (rated for 175** psig MWP) or ductile iron (rated for 300 or 400 psig MWP), axially-split design with flanges and mounting feet cast integral with the lower casing. Flanges are drilled for 125# ANSI FF for 175** psig MWP pumps, or 250# ANSI FF for optional 300 and 400 psig MWP pumps. Suction and discharge flanges shall be on a common centerline in both the horizontal and vertical planes, and the volute shall include Bronze Casing Wear Rings, priming port, gauge ports at nozzles, and vent and drain ports. The upper half casing shall be capable of being removed without disturbing piping connections or electrical motor connections.
- Pump seal flushing lines shall be mounted on the upper half pump casing. Sealing from an external source shall be possible for lubrication an/or cooling.
- Motors shall meet scheduled horsepower, speed, voltage, and enclosure design. Pump and motors shall be aligned after installation. Motors shall be non-overloading at any point on the pump curve and shall meet NEMA specifications and conform to the standards outlined in EPACT 92.
- Base plate shall be of structural steel or fabricated steel channel configuration fully enclosed at sides and ends, with securely welded cross members and fully open grouting area (for field grouting). The minimum base plate stiffness shall conform to ANSI/HI 1.3.5 - 2000 for Horizontal Baseplate Design standards.
- Pump rotation shall be right-hand or left-hand as viewed from the pump end and in respect to the discharge flange.
- Pump manufacturer shall be ISO-9001 certified.
- The pump(s) vibration limits shall conform to Hydraulic Institute ANSI/HI 9.6.4.4 - 2000 for recommend acceptable unfiltered field vibration limits (as measured per ANSI/H.I. 9.6.4.4 - 2000, Figure 9.6.4.12) for pumps with rolling contact bearings.
- The seismic capability of the pump shall allow it to withstand a horizontal load of 0.5g, excluding piping and/or fasteners used to anchor the pump to mounting pads or to the floor, without adversely affecting pump operation.
- Each pump shall be factory tested and name-plated before shipment.

* Standard shaft material for size 10x14x20L is 4140. For speeds greater than 1200 RPM, the standard shaft material is 17-4 PH condition H1150 for sizes 12x16x23 and 14x16 x17.

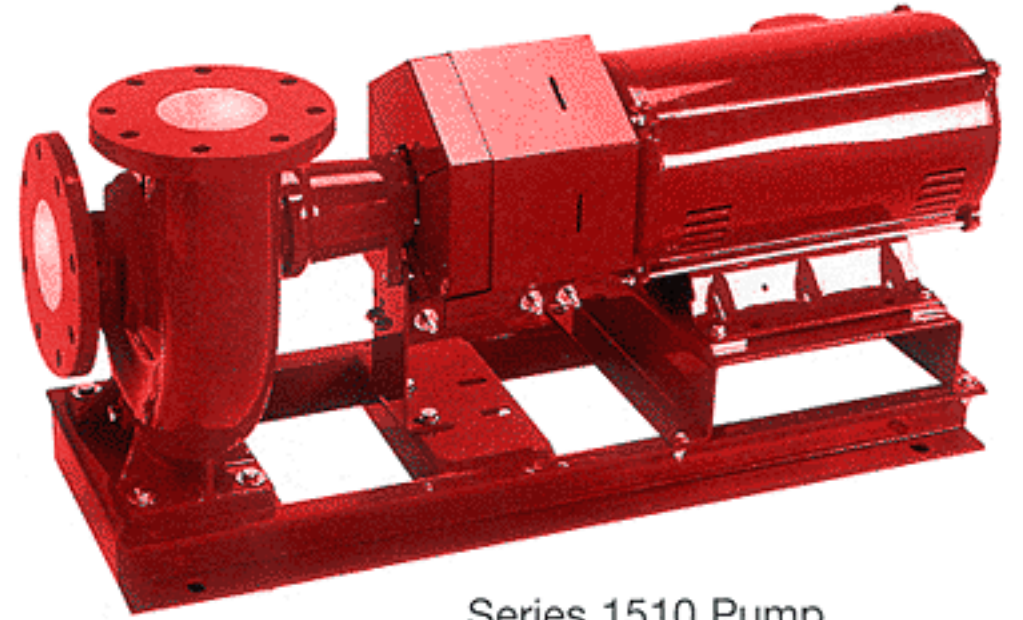
** 8x12x22M and 8x12x22L standard configurations are rated for 300 psi MWP, and have 125# ANSI FF suction and 250# ANSI FF discharge flanges.

Equivalent units manufactured by the Aurora Pump company or Paco Pumps Incorporated may be substituted as deduct alternates.

A Complete Line of Centrifugal Pumps



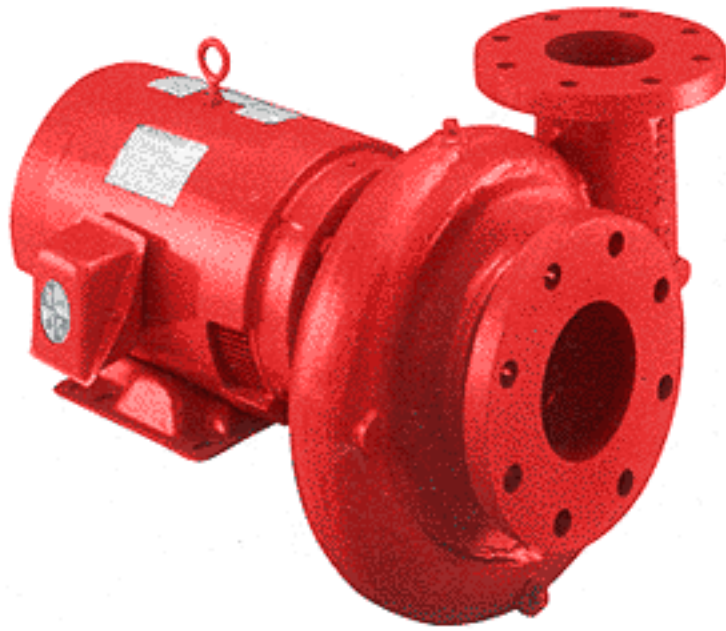
Series 60 Pump



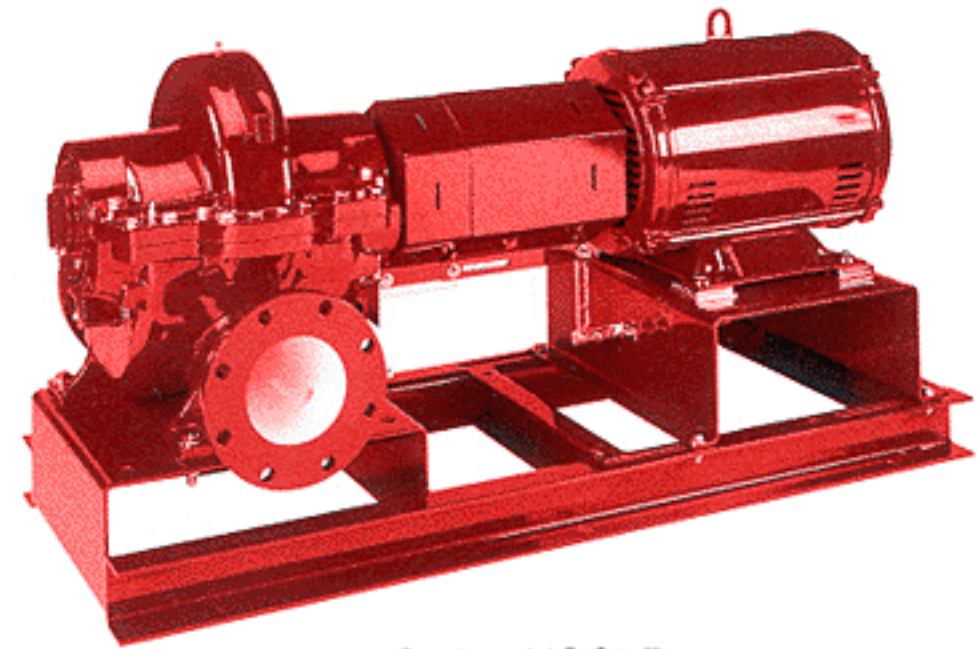
Series 1510 Pump



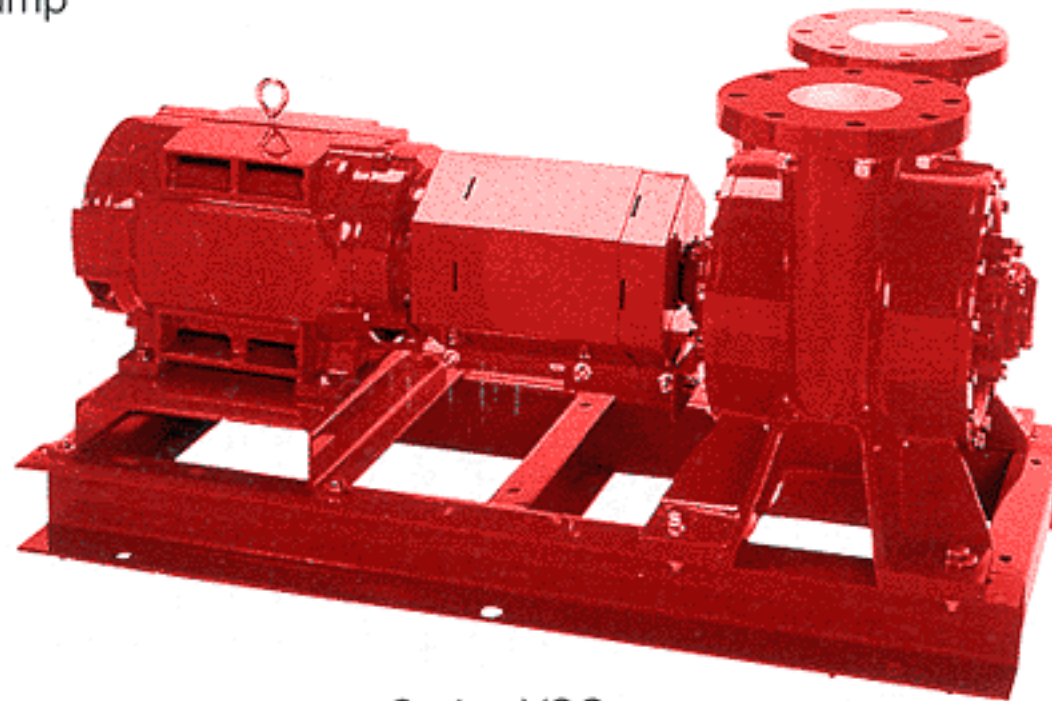
Series 90 Pump



Series 1531 Pump



Series HSC³ Pump



Series VSC



Bell & Gossett

USA
Bell & Gossett
8200 N. Austin Avenue
Morton Grove, IL 60053
Phone: (847) 966-3700
Facsimile: (847) 966-9052
www.bellgossett.com



INTL.
Bell & Gossett / Export Dept.
8200 N. Austin Avenue
Morton Grove, IL 60053
Phone: (847) 966-3700
Facsimile: (847) 966-8366
www.bellgossett.com

CANADA
Fluid Products Canada
55 Royal Road
Guelph, Ontario,
N1H 1T1, Canada
Phone: (519) 821-1900
www.ittfpc.ca