

IMPELLERS & RINGS

Impellers and rings are accurately machined to close tolerances for close clearance operation.

Impellers are accurately machined and have many buckets on both sides. The impellers are double suction with pressure balancing holes drilled near the mounting hub. This equalizes pressure on both sides of the impeller and balances axial thrust. The impeller(s) are precision bored and are keyed to the shaft sleeve.

A turbine pump of stainless steel construction tends to gall in the event the impeller comes in contact with the channel rings. One way to overcome this is locking the impeller in place between the channel ring and increasing the clearance between the impeller and channel rings.

A locked impeller design prevents the impeller from touching the channel rings, but is difficult to adjust. Increased clearances reduce the operating pressures of the pump and require separate performance curves.

APCO-CHEM utilizes a chromium oxide ceramic coating, developed by Union Carbide Corporation which is applied to the sealing surfaces of stainless steel and alloy 20 channel rings. The coating is resistant to acids, caustics and temperatures within the range of the APCO-CHEM pump. A bearing surface is provided by the coating that completely eliminates the possibility of galling. Metal to metal contact is eliminated.

Ceramic coating on stainless steel and alloy constructions allows the impellers to float and center themselves on all APCO-CHEM pumps, and eliminates the need for impeller adjustments. Pumps with the ceramic coating also operate on the same tolerances as the standard ductile iron pump and provide identical performance.

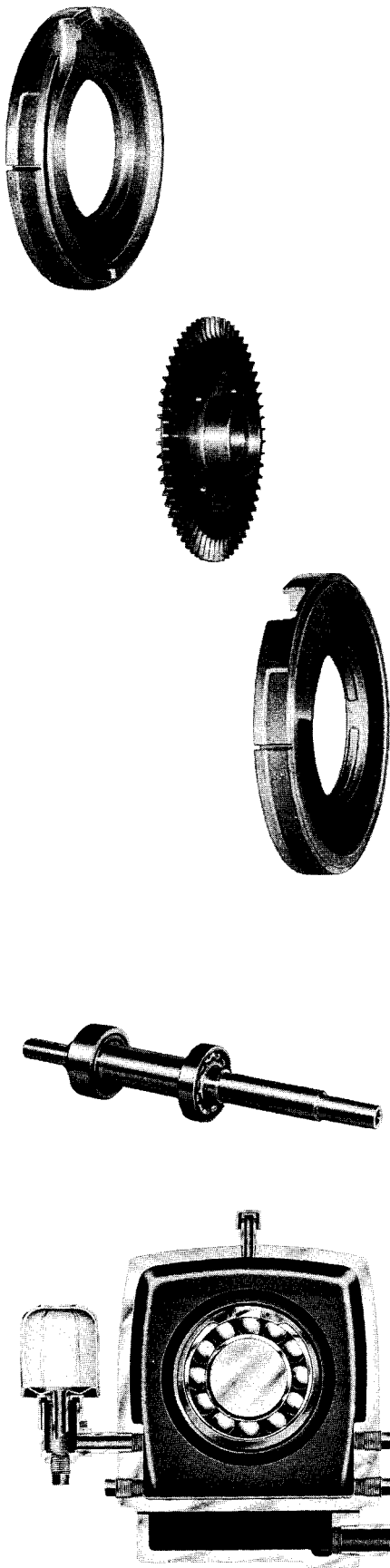
Discharge ports of channel rings on two stage and duplex pumps are OP-POSED 180°, equalizing radial loads and greatly reducing shaft deflection. Impellers and channel rings are interchangeable between single, two stage and duplex pumps.

BEARINGS & SHAFTS

Vacuum degassed ball bearings are precision made and give 2 YEAR MINIMUM B₁₀ LIFE under worst condition of allowable pump load. Outboard thrust bearings are double row deep groove angular contact to handle radial and thrust loads. End play is less than .001" for longer mechanical seal life to restrict seal leakage. The use of beveled type retaining rings assures that no additional end play is caused by movement axially of the thrust bearing on the shaft. Inboard bearings are single row deep groove and handle radial loads only. The radial bearing outer race is slip fit into the bearing frame and is free to float axially. Precision ground (32 micro-inches) and polished shafts are designed for a MAXIMUM DEFLECTION OF .002" at the mechanical seal faces at maximum recommended load.

OIL LUBRICATION

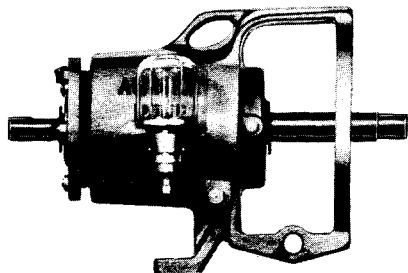
Oil lubrication is furnished as standard with grease lubrication optionally available. A constant level oiler with a clear plexiglass oil reservoir indicates the oil reserve. The oiler accurately maintains a fixed oil level at the center-line of the lower ball in both ball bearings. The power frame reservoir for model 151 will hold approximately 3/4 pint and approximately 1-1/2 pints in models 152-3 & 4. The oiler capacity is 4 oz. A breather tube vents the power frame. Drain plugs are provided at the low point of the reservoir. The frame can be field converted to grease by merely replacing the oiler and vent tube with pipe plugs and inserting grease fittings in pipe taps already provided for at both bearings.



150 SERIES ENGINEERING DATA INTERCHANGEABILITY

APCO-CHEM offers for standard construction, 2 power frames, 3 shafts, 2 stuffing box covers, 10 impeller and channel ring sets and 4 casings for maximum interchangeability.

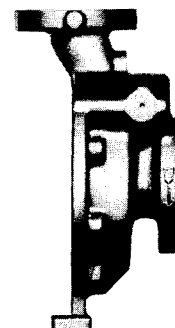
MODEL 151 SINGLE STAGE



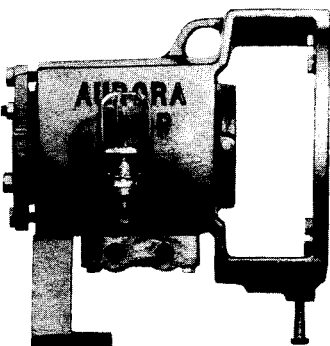
CT111
CT211
CT212



- 1 FRAME
- 1 STUFFING BOX
- 3 L.H. RINGS
- 3 IMPELLERS
- 3 R.H. RINGS
- 1 CASING
- 1 SHAFT

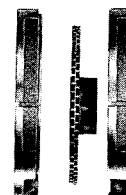


MODEL 152 SINGLE STAGE

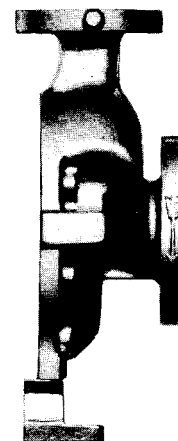


CT713
CT715
CT811
CT911
CT912
CT913
CT914

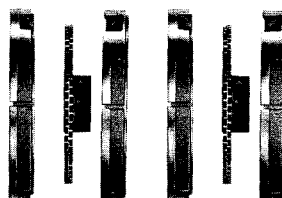
CT723
CT725
CT821
CT921
CT922
CT923
CT924



- 1 FRAME
- 1 STUFFING BOX
- 7 L.H. RINGS
- 7 IMPELLERS
- 7 R.H. RINGS
- 3 CASINGS
- 2 SHAFTS

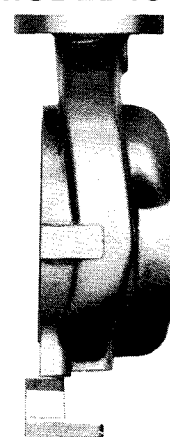


MODEL 153 TWO STAGE



MODEL 153

MODEL 154



MODEL 154 DUPLEX

CT991 CT993
CT992 CT994

Two stage utilizes single stage parts with exception of shaft and casing.
Duplex utilizes two stage parts with exception of the casing.

150 SERIES ENGINEERING DATA MATERIALS

SECTION 150 PAGE 73
DATED FEBRUARY 1983

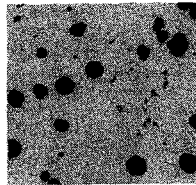
Ductile iron is furnished as a standard material for all cast wetted parts unless otherwise specified.

This standard material was selected over cast iron for its greater tensile strength, ductility and resistance to impact and thermal shock. By comparing the physical properties of ductile iron and steel, it can be shown that the yield strength of 60-40-18 ductile iron exceeds that for low carbon steel at all temperatures up to 1200° F.

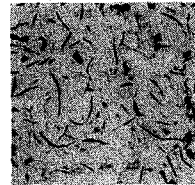
These unusual characteristics are accomplished by the spheroid shape of the graphite particles in the iron matrix. The graphite in conventional cast iron is in the form of flat, sharp-edged flakes resulting in a more brittle material.

The thermal expansion of ductile iron is similar to carbon steel while the corrosion resistance is similar to that of gray cast iron.

The following micro-photographs show the different graphite formations within the metals.



DUCTILE IRON



CAST IRON

A complete listing of pump parts and materials can be found on pgs. 78 & 79 under parts list and materials of construction. The following materials of construction available for APCO-CHEM and their stock status are listed.

MATERIAL	STOCK STATUS
DUCTILE IRON	All sizes stocked.
316 ST. STL.	
304 ST. STL.	Custom ordered to your exacting specifications.
HASTELLOY B	
HASTELLOY C	
MONEL	
NICKEL	

NOTE:

Alloy pumps are furnished in ceramic coated construction to eliminate the galling characteristic of these metals. For material selections not listed, please refer to the factory.

CHEMICAL & PHYSICAL PROPERTIES OF METALS															
NAME	FORM	SPECIFICATION	TYPICAL CHEMICAL COMPOSITION (%)											MECHANICAL PROPERTIES (MINIMUM)	
			Fe	Cr	Ni	C	Mn	Mo	Cu	Si	S	P	OTHER	TENSILE (PSI)	YIELD (PSI)
CAST IRON	CAST	ASTM A48 (Class 30)	BAL.	—	—	3.0-3.45	.5-1.0	—	—	1.7-2.4	.07-.15	.15-.60	—	30,000	—
DUCTILE IRON	CAST	ASTM A395 (60-40-18)	BAL.	—	1.0	3.4-4.0	.2-.6	—	—	2.0-2.75	—	.08 MAX.	Mg .02-.07	60,000	45,000
CARBON STEEL	CAST	ASTM A216 Grade WCB	BAL.	.40 MAX.	.50 MAX.	.30 MAX.	1.0 MAX.	.25 MAX.	.50 MAX.	.60 MAX.	.06 MAX.	.05 MAX.	—	70,000	36,000
ST. STL. (304)	CAST	ACI CF-8	BAL.	18-21	8-11	.08 MAX.	1.5 MAX.	—	—	2.0 MAX.	.04 MAX.	.04 MAX.	—	77,000	37,000
ST. STL. (304)	WRT.	AISI-304	BAL.	18-20	8-12	.08 MAX.	2.0 MAX.	—	—	1.0 MAX.	.03 MAX.	.045 MAX.	—	85,000	35,000
ST. STL. (316)	CAST	ACI CF-8M	BAL.	18-21	9-12	.08 MAX.	1.5 MAX.	2-3	—	1.5 MAX.	.04 MAX.	.04 MAX.	—	80,000	42,000
ST. STL. (316)	WRT.	AISI-316	BAL.	16-18	10-14	.08 MAX.	2.0 MAX.	2-3	—	1.0 MAX.	.03 MAX.	.045 MAX.	—	85,000	35,000
HASTELLOY B	CAST	ASTM A494	4-6	1.0 MAX.	BAL.	.12 MAX.	1.0 MAX.	26-30	—	1.0 MAX.	.03 MAX.	.04 MAX.	Co 2.5 MAX. V .2-.6	75,000	55,000
HASTELLOY B	WRT.	ASTM B335	4-6	1.0 MAX.	BAL.	.05 MAX.	1.0 MAX.	26-30	—	1.0 MAX.	.02 MAX.	.025 MAX.	Co 2.5 MAX. V .2-.4	130,000	56,000
HASTELLOY C	CAST	ASTM 494	4.5-7	15.5-17.5	BAL.	.12 MAX.	1.0 MAX.	16-18	—	1.0 MAX.	.03 MAX.	.04 MAX.	Co 2.5 MAX., V .2-.4 W 3.75-5.25	83,000	50,000
HASTELLOY C	WRT.	ASTM B336	4-7	14.5-16.5	BAL.	.08 MAX.	1.0 MAX.	15-17	—	1.0 MAX.	.03 MAX.	.04 MAX.	Co 2.5 MAX., V .35 W 3.0-4.5	120,000	55,000
#20 ALLOY	CAST	ACI CN7M	BAL.	18-21	27-30	.08 MAX.	1.5 MAX.	2-3	3-4	2.0 MAX.	.04 MAX.	.04 MAX.	—	70,000	30,000
CARPENTER 20	WRT.	—	BAL.	20	29	.07 MAX.	.75	2.0 MIN.	3.0 MIN.	1.0 MAX.	—	—	—	84,000	38,000
MONEL	CAST	QQ-N-288 Class E	3.5 MAX.	—	60	.3 MAX.	1.5 MAX.	—	26-33	1.0-2.0	—	—	Al .5 MAX. Co & Ta 1.0-3.0	65,000	32,500
MONEL	WRT.	QQ-N-281 Class A	2.5 MAX.	—	63-70	.3 MAX.	2.0 MAX.	—	BAL.	.5 MAX.	.024 MAX.	—	Al .5 MAX.	99,000	52,000
K-MONEL	WRT.	QQ-N-286 Class A	2.0 MAX.	—	63-70	.25 MAX.	1.5 MAX.	—	BAL.	1.0 MAX.	.01 MAX.	—	Al 2.0-4.0 Ti .25-1.0	140,000	80,000
NICKEL	CAST	—	.25 MAX.	—	97	.5 MAX.	.5 MAX.	—	.3 MAX.	1.5 MAX.	.015 MAX.	—	—	45,000	20,000
NICKEL	WRT.	ASTM B160	.4 MAX.	—	99 MIN.	.15 MAX.	.35 MAX.	—	.25 MAX.	.35 MAX.	.01 MAX.	—	—	75,000	50,000

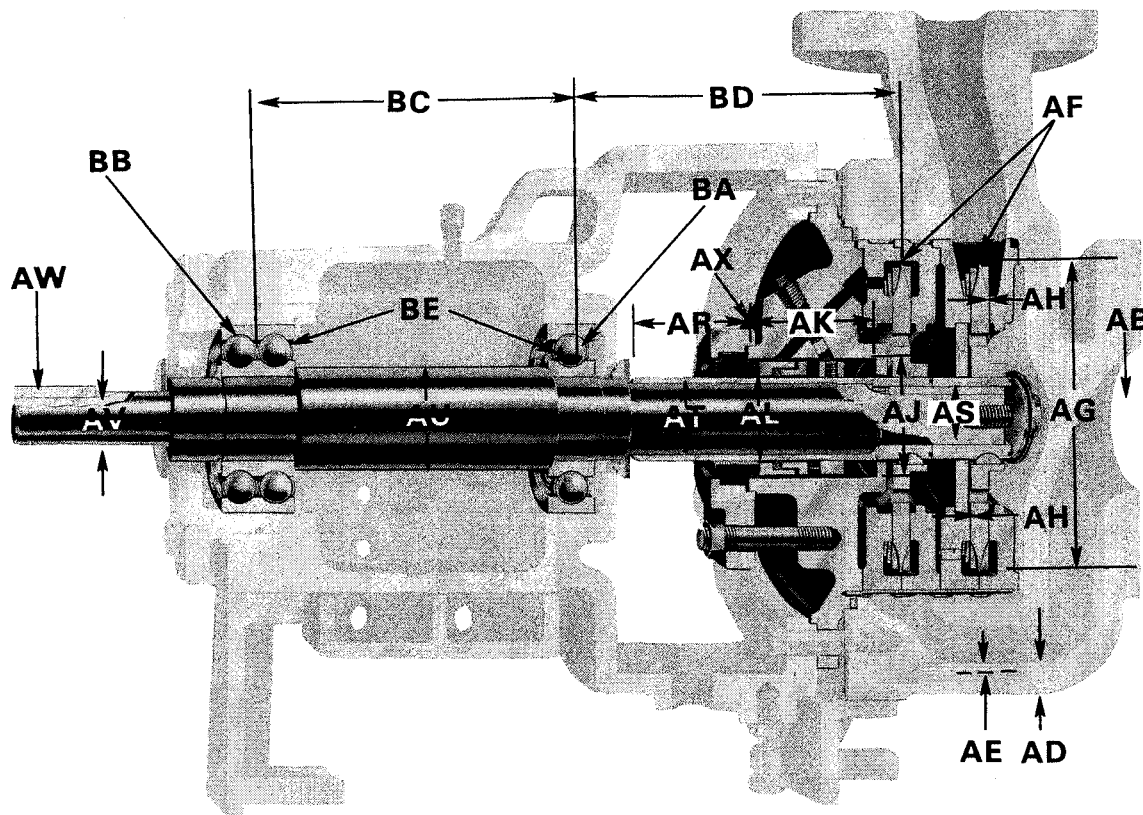
150 SERIES ENGINEERING DATA DESIGN DETAILS

		PUMP MODEL		
AREA	DIMENSION	151	152-153-154	
LIQUID END	AA Discharge—300 P.S.I.— A.S.A. Flat Face	1	1-1/2	2
	AB Suction—150 P.S.I.— A.S.A. Flat Face	1-1/2	3	
	AC Rotation—Facing Suction	CCW	CCW	
	AD Casing Wall Thickness	1/2	5/8	3/4 3/4
	AE Casing Corrosion Allowance (Safety)	1/8	1/8	
	AF Number of Stages (Impeller(s))	1	1	2 2
	AG Nominal Impeller Diameter	4-1/2	6	
	AH Clearance Between Imp. & Rings—Total both sides			
STUFFING BOX	1. Ductile Iron 2. Stainless Steel & Alloy 20	.005-.007 .005-.007	.005-.007 .005-.007	
	AJ Stuffing Box Bore Diameter	1-3/4	2-1/2	
	AK Stuffing Box Depth	2	2-5/8	
	AL Outside Diameter, Sleeve	1.125	1.750	
	AM Total Packing Rings With Lantern Rings	5	5	
	AN Number of Rings in Front of Lantern Ring	2	2	
	AP Packing Size	5/16	3/8	
	AQ Width of Lantern Ring	3/8	5/8	
	AR Distance from Box to Nearest Obstruction	1-15/16	2-9/16	

		PUMP MODEL		
AREA	DIMENSION	151	152-153-154	
SHAFT	AS Diameter at Impeller	.687	1.125	
	AT Diameter at Shaft Sleeve	.875	1.500	
	AU Diameter Between Bearings (Max. Shaft Dia.)	1.562	2.125	
	AV Diameter at Coupling End	.875	1.125	
	AW Coupling Keyway	3/16 x 3/32	1/4 x 1/8	
	AX Maximum Deflection at Stuffing Box Face	.002	.002	
BEARINGS	BA Bearing No. (Inboard Radial)	306	309	
	BB Bearing No. (Outboard Thrust)	5306	5309	
	BC Bearing Centers	5.37	6.56	
	BD Radial Brg. & 1st. Stg. Impeller Centers	5.75	6.87	
	BE Minimum B ₁₀ Bearing Life Under Maximum Recommended Load	2 Years	2 Years	

NOTES:

1. Pump model can be determined from range charts in 150 Bulletin.
2. Average bearing life is 5 times minimum life.
3. Inboard radial bearings are single row ball. Outboard thrust bearings are double row ball.
4. Packing box is not illustrated.
5. Add 1-5/8" to "BD" dimension on model 153 and 154 pumps to determine the 2nd stage impeller centerline.



150 SERIES ENGINEERING DATA BEARING LIFE

SECTION 150 PAGE 75
DATED FEBRUARY 1983

Is based on the radial and thrust loads imposed on the bearings at the specific operating head and suction pressure. The APCO-CHEM pump is designed for two year minimum B_{10} life at the maximum recommended loads. Bearing life at any other point of greater capacity on the curve will greatly exceed the minimum life shown. Average bearing life is equal to five (5) times the minimum bearing life.

Tables 12, 13 and 14 will enable you to determine the minimum radial and thrust bearing life for any APCO-CHEM pump size.

1. Determine the proper pump size and speed from the range charts illustrated on pages 4 and 9 of the 150 Bulletin.

2. From figure 12, determine radial load at impeller in pounds by reading across from differential pressure per pump stage to pump size and then down (divide differential pressure by 2 for two stage model 153 pumps). This value will be used for determining both inboard and radial bearing life in hours and shaft deflection at impeller.

3. Locate radial load at impeller in pounds on figure 13 and read across to the proper pump size and R.P.M. and then down for inboard radial bearing life.

4. Locate suction pressure (P.S.I.) on figure 14 and read across to the proper pump size and R.P.M. and then down for outboard thrust bearing life.

EXAMPLE:

1. Model 152 (single stage)—a CT914 pump operating at 3500 R.P.M. with a suction pressure of 40 P.S.I. and a differential pressure of 150 P.S.I. would have:

A. Radial load at the impeller of 202 lbs.

B. Continuous inboard radial bearing life of 51,500 hours min.

C. Continuous outboard thrust bearing life of 66,000 hours min.

D. Shaft deflection of .0038" at the impeller (see page 77).

2. Model 153 (two stage)—a CT924 pump operating at 1750 R.P.M. with a suction pressure of 40 P.S.I. and a

differential head of 150 P.S.I. (divide the differential head by 2) would have:

A. Radial load at the impeller of 101 lbs.

B. Continuous inboard radial bearing life of 300,000 hours min.

C. Continuous outboard thrust bearing life of 66,000 hours min.

D. Shaft deflection of .001" at the impeller (see page 77).

The above examples illustrate how lower pump operating speeds and two stage pump construction greatly extend the radial bearing life.

NOTE:

1. One (1) year life is based on 8740 HOURS (cont. operation).

2. Additional bearing information can be found on page 74.

3. Specific information on bearing life and shaft deflection can be obtained from the factory.

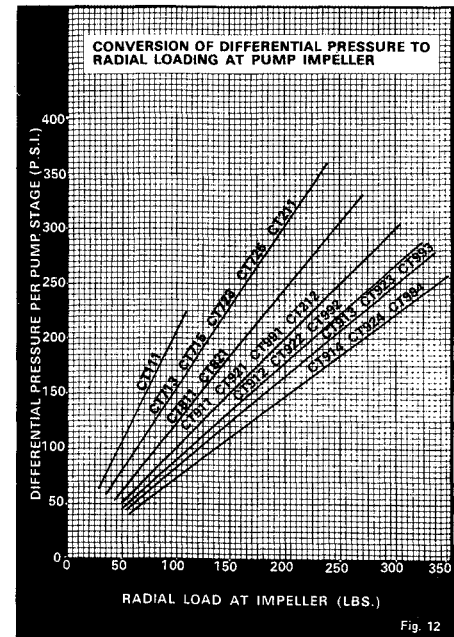


Fig. 12

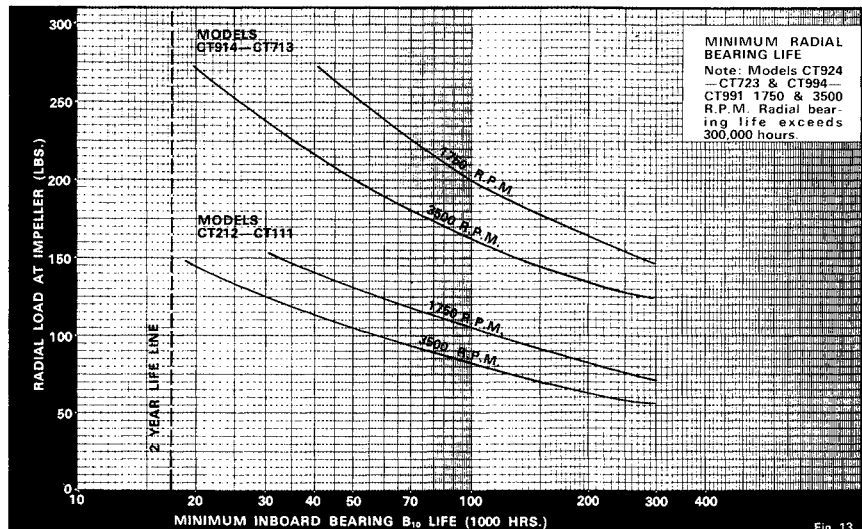


Fig. 13

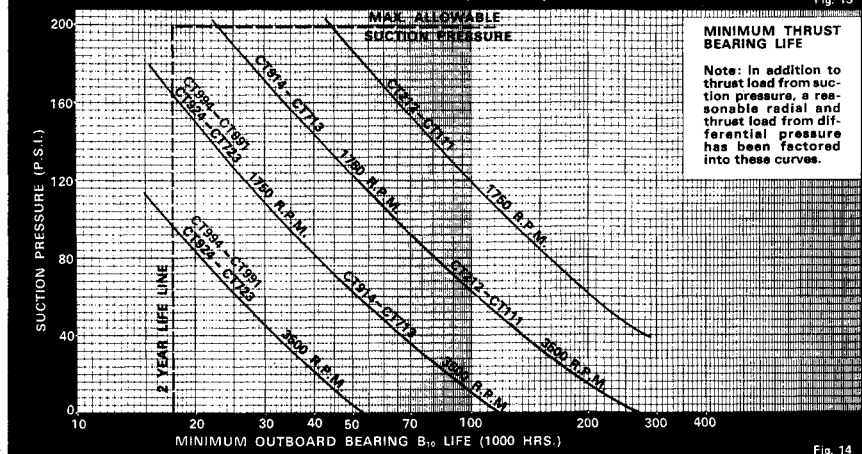


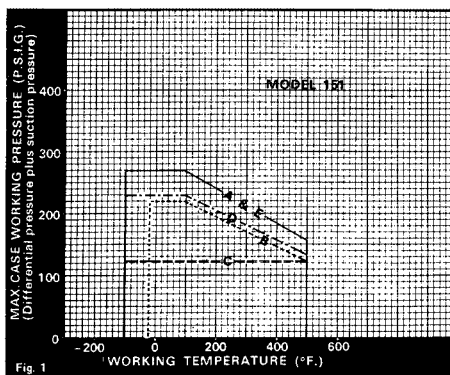
Fig. 14

Maximum Case Working Pressure

The case working pressure is the sum of the differential pressure and the suction pressure. Figures no. 1, 2 and 3 indicate the maximum case working pressure for the APCO-CHEM pump in various materials and at various operating temperatures. These maximum allowable pressures are based on wall thicknesses for the particular series of pumps and take into account the change in the tensile strength of the material at

Example: A model 152 pump with a 316 stainless steel casing has been selected for operation at a case working pressure of 370 P.S.I.G. at 200° F. Enter chart (figure 2) for model 152 pumps, at 200° F. and read upward to 370 P.S.I.G. It is determined that the selection is within the recommended maximum case working pressure area and is therefore acceptable.

Note that the example exceeds the maximum case working pressure limits if the material selected would have been ductile iron or nickel.



Maximum Pump Operating Temperatures: Three factors are required to properly determine maximum temperature limitations.

1. Strength of Material High Temperature Limitations:

The high temperature on the casing and other pressure containing parts will cause a reduction in the ultimate strength of the metal. This has already been illustrated under limitations for maximum case working pressure and as was shown, temperatures to 500° F. are allowable with a decrease in case working pressure.

2. Stuffing Box High Temperature Limitations:

A. Mechanical Seal Limitations:

The materials normally used in mechanical seals are suitable for operation at temperatures in the range of 300° F. as long as a lubricating film remains between the seal faces. Many liquids will retain this property at high temperatures. The

various allowable temps.

Maximum Pressure—Temperature Flange Rating This chart illustrates that under certain temperature conditions standard flange pressure can be exceeded.

Note: 1. Ratings are for American Standard specifications (ASA 16.5) Steel or Nodular Iron Flanges.

Note: 2. The curves indicate flange ratings ONLY. Refer to Fig. 1, 2, & 3 for maximum allowable case working pressure.

A. Type 316 Stainless Steel, Hastelloy "B", Hastelloy "C" and no. 20 Alloy.

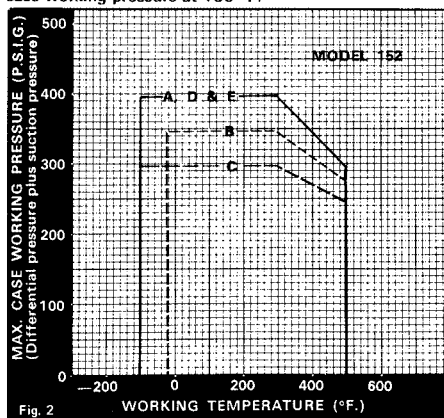
B. Ductile Iron

C. Nickel

D. Monel

E. 304 Stainless Steel

Maximum hydrostatic pressure 1-1/2 times maximum case working pressure at 100° F.



temperature limitation chart will indicate maximum allowable pump operating temperature at 300° F. without stuffing box cooling.

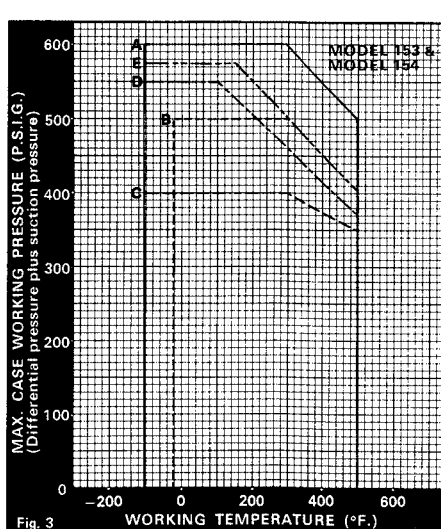
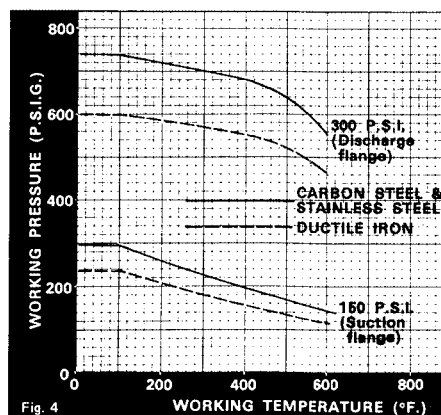
For Continuous Duty Water Applications, Stuffing Box Temperatures Cannot Exceed 180° F.

Other optional seal face materials will allow higher temperatures. For additional information, refer to the factory.

B. Packing Limitations: The limitations for packing are similar to those for mechanical seals except that temperatures to 250° F. can be tolerated for water applications before a water cooled stuffing box is required.

3. Ball Bearing Lubrication High Temperature Limitations: For longer bearing life, a frame cooling jacket should be provided at any pumping temperature exceeding 300° F.

Note: The following maximum temperature limitations and notes will apply to the majority of applications, however, for specific liquids and temperatures, refer to the factory.

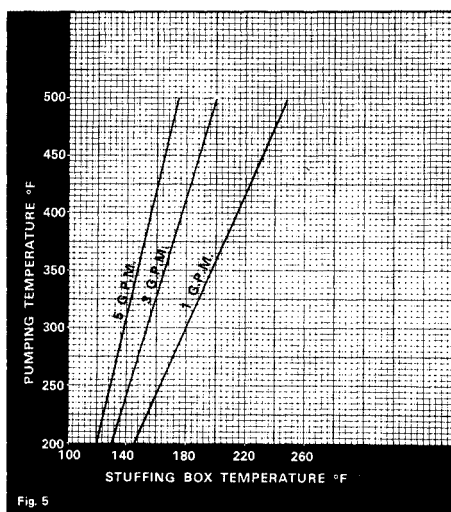


NOTES:

1. Pumps with standard mechanical seals on continuous duty water applications MUST NOT exceed 180° F. without providing cooling at the stuffing box. Special seal face materials will increase this limit—refer to factory.
2. Pumps with packing on water applications MUST NOT exceed 250° F. without providing cooling at the stuffing box.
3. For temperatures above 300° F. in models 152 and 153, the centerline casing support is recommended.

MAXIMUM TEMPERATURE LIMITATIONS FOR PUMPED LIQUID

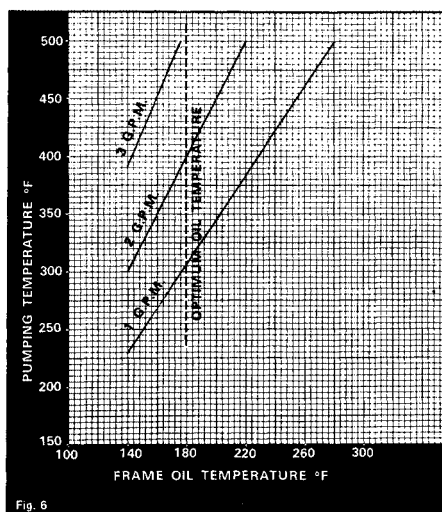
DESCRIPTION	PUMP SERIES	
	151	152-3 & 4
Mechanical Seal—without stuffing box cooling (See Note 1).	300° F.	300° F.
Mechanical Seal—without water cooled stuffing box and water jacketed frame.	N/A	500° F.
Packing—without stuffing box cooling (See Note 2).	300° F.	300° F.
Packing—with water cooled stuffing box and jacketed frame.	N/A	500° F.



Water Cooled Stuffing Box Stuffing Box temperature at various pumping temperatures and cooling rates.

Note:
Cooling water
80° F. at inlet.

Maximum Recommended Differential Head The differential head in a pump is the difference between the positive suction head and the discharge head. One effect of differential head is a radial load imposed on the impeller which deflects the shaft from its centerline. The following chart indicates the maximum recommended differential head in feet of liquid (specific gravity 1.0) which will produce a shaft deflection not exceeding .004" at the impeller and .002" at the seal faces. Where differential head does not indicate deflection problems, the maximum pump head is shown. Where specific gravity is less than 1, the allowable head in feet may be increased by the specific gravity correction.

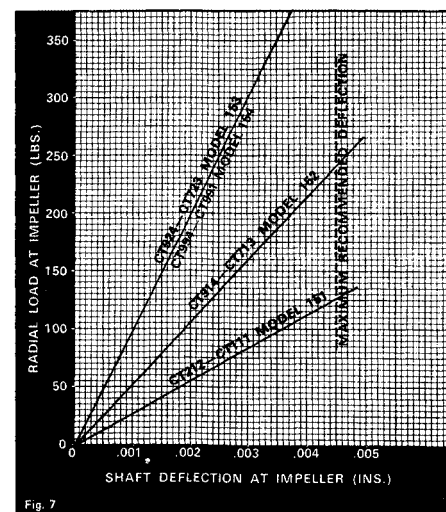


Water Cooled Bearings Frame oil temperature at various pumping temperatures and cooling rates.

Note: 1. Cooling water 80° F. at inlet. 2. Values shown are typical, final temperature based on Stuffing Box cooling and ambient temperature.

MODEL	SIZE	MAXIMUM DIFFERENTIAL HEAD			
		3500 R.P.M.		1750 R.P.M.	
		FEET*	P.S.I.	FEET*	P.S.I.
151 SINGLE STAGE	CT111	500	215	125	55
	CT211	375	160	150	65
	CT212	250	110	150	65
152 SINGLE STAGE	CT713	800	345	300	130
	CT715	800	345	400	175
	CT811	700	300	400	175
	CT911	600	260	400	175
	CT912	525	225	400	175
	CT913	475	205	400	175
	CT914	425	185	400	175
153 TWO STAGE	CT723	1200	520	550	240
	CT725	1200	520	750	325
	CT821	1200	520	800	345
	CT921	1200	520	800	345
	CT922	1200	520	800	345
	CT923	1200	520	800	345
	CT924	1200	520	800	345
154 DUPLEX	CT991	1200	520	620	260
	CT992	1200	520	660	285
	CT993	1200	520	720	310
	CT994	1200	520	720	310

*specific gravity 1.0

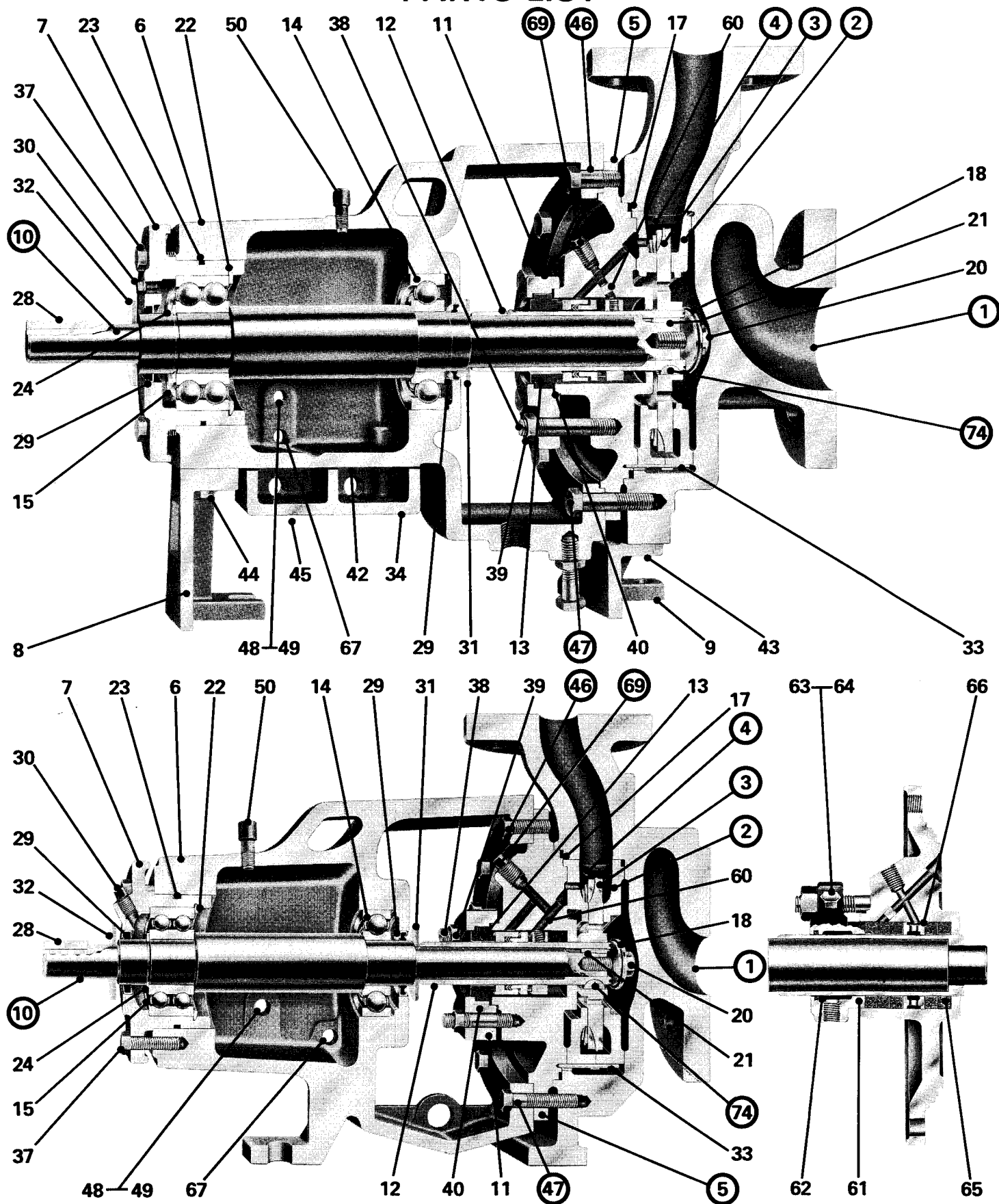


Shaft Deflection Is the consequence of the resultant hydraulic force acting inside the pump and on the impeller and shaft in a radial direction. The bending load tends to move the shaft from its centerline and is directly related to the differential pressure and the cross sectional area of the impeller. The radial load increases as the differential pressure increases and is maximum at shut off (zero capacity).

APCO-CHEM pumps are designed for a maximum deflection of .002" at the mechanical seal faces when operating at the maximum recommended differential pressure. The deflection at the impeller will not exceed .004".

Deflection in models 153 and 154 are minimized by opposing the two pump discharges by 180° and thereby nearly balancing the resultant forces acting on the shaft. Radial load at the impeller in pounds can be obtained from figure 12 on page 75.

150 SERIES PARTS LIST

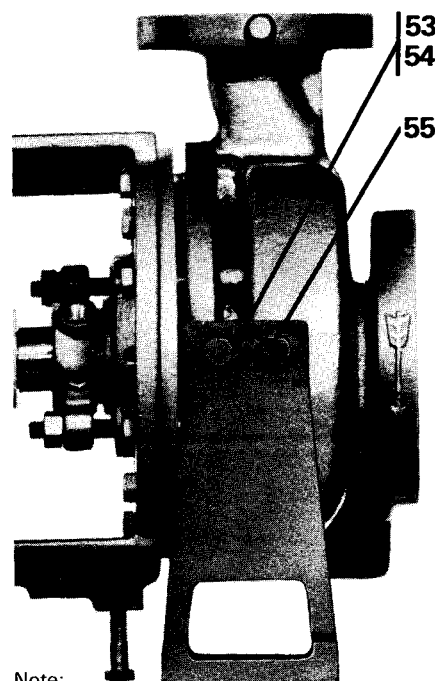
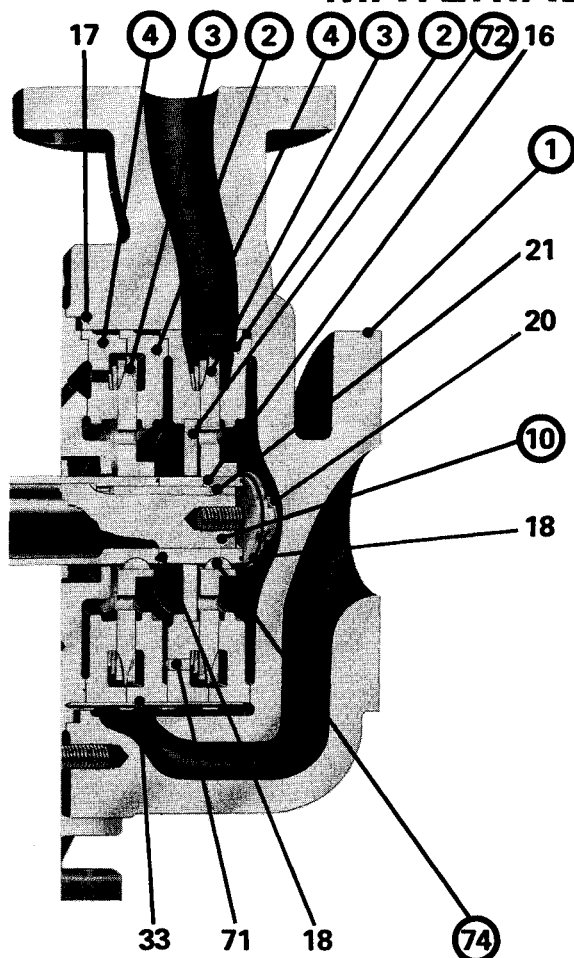


150 SERIES

ENGINEERING DATA

MATERIALS OF CONSTRUCTION

SECTION 150 PAGE 79
DATED FEBRUARY 1983

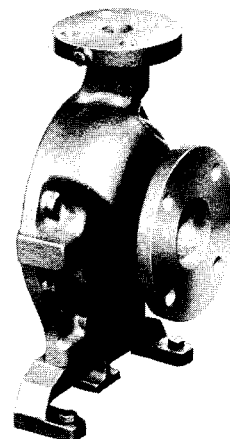


Note:
Complete material details can be found on pages 73 & 76. Piece numbers not shown 25, 26, 27, 41, 51, 52, 56, 57, 58, 59, 68 & 70.

STANDARAD		NON-WETTED PARTS	MATERIALS
PIECE NO.		PART NAME AND DESCRIPTION	MATERIAL OF CONSTRUCTION
6		Frame	C.I.
7		Bearing Cartridge	C.I.
8		Bearing Frame Foot	C.I.
9		Casing Foot	C.I.
11		Seal Gland	316
12		Shaft Sleeve	316
13		Mechanical Seal	316
14		Ball Bearing—Inboard	Steel
15		Ball Bearing—Outboard	Steel
16		Sleeve Extension (2 Std.)	316
17		"O" Ring—Casing to Stuffing Box	Viton
18		"O" Ring—Sleeve to Impeller Screw	Viton
18		"O" Ring—Sleeve Extension to Sleeve	Viton
20		Retainer Screw	316
21		Sleeve Key	316
22		Retaining Ring—O.B. Brg. to Brg. Cart.	Steel
23		"O" Ring—Brg. Cart. to Frame	Buna-N
24		Retaining Ring—O.B. Brg. to Shaft	Steel
25		Alemite Fitting—Brg. Cart. (Grs. Lube)	Steel
26		Alemite Fitting—Frame (Grs. Lube)	Steel
27		Alemite Fitting—Brg. Cart. (Grs. Lube)	Steel
28		Coupling Key	Steel
29		Oil Seal	Buna-N
30		Pipe Plug—Inboard Bearing	Steel
31		Slinger—Inboard	Glass Filled Teflon
32		Slinger—Outboard	Glass Filled Teflon
33		Pin—Channel Ring Locating	316
34		Frame Cooling Jacket	C.I.
37		Capscrew—Brg. Cart. to Frame	Steel
38		Stud—Gland to Box	316
39		Nut—Gland Stud	316
40		Gasket—Seal Gland	Teflon
41		Drip Pan	316
42		Gasket—Frame Cooling Jacket	Fiber
43		Capscrew—Casing Foot	Steel
44		Capscrew—Frame Foot	Steel
45		Capscrew—Frame Cooling Jacket	Steel
48		Constant Level Oiler	Alloy
49		Nipple—Oiler to Frame	Steel
50		Breather	Steel
51		Nameplate	Stainless Steel
52		Screw—Nameplate	Steel
53		Casing Foot—R.H. CL Mount	C.I.
54		Casing Foot—L.H. CL Mount	C.I.
55		Capscrew—CL Foot to Casing	Steel
56		Pipe Plug—Seal Gland (Vent & Drain)	316
57		Throttle Bushing—Seal Gland—(Vent & Drain)	Graphitar
58		Seal Collar (Special Seals)	316
59		Setscrew—Seal Collar (Special Seals)	316
60		Pin—Internal Box Flush	316
61		Packing Gland	316
62		Gland Packing—Quench Throttle	Graphited Fiber
63		Capscrew—Packing Gland Halves	316
64		Nut—Packing Gland Halves	316
65		Packing—Stuffing Box	Graphited Fiber
66		Lantern Ring	Teflon
67		Pipe Plug—Frame Oil Drain	Steel
68		Capscrew—Double Seal Gland	316
70		Gasket—Seal Gland	Teflon
71		Pin—L.H. Chan. Ring (2 Stg.)	316
OPTIONAL		WETTED PARTS (CIRCLED)	MATERIALS
1		Casing	Ductile Iron (Std.)
2		Channel Ring—Right Hand	316
3		Impeller	304
4		Channel Ring—Left Hand	Hastelloy B
5		Stuffing Box—Std. & Water Cooled	Hastelloy C
10		Shaft	Monel
46		Capscrew—Frame	Nickel
47		Capscrew—Casing to Frame	Carpenter #20
69		Pipe Plug—Stuffing Box Lube External	The above listed materials are available for all wetted parts (Piece No's: 1, 2, 3, 4, 5, 10, 46, 47, 69, 72, 74).
72		Interstage Bushing (2 Stg.)	
74		Impeller Key	

TOP CENTERLINE DISCHARGE

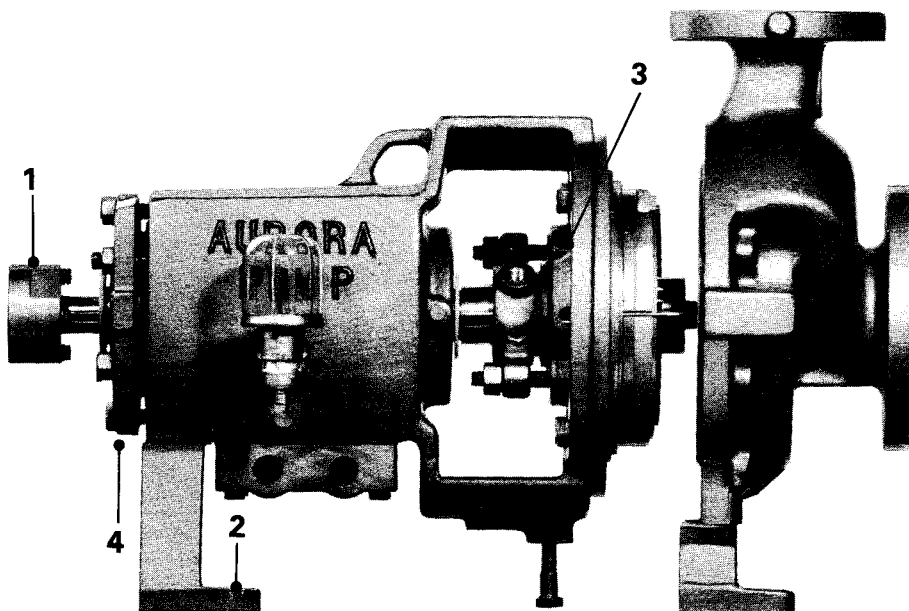
The top vertical discharge, back pull out, casing is self-venting and eliminates the need for opposed impeller rotation. Pipe stress associated with a tangential discharge position is also minimized. Center line mounting is available on model 152-53 & 4 casings. Center line mounting allows expansion on high temperature application. Discharge flanges are rated at 300 P.S.I. flat face and the suction flange at 150 P.S.I. flat face. Other types of flanges are optionally available up to 600 P.S.I. Heavy wall sections are designed for high pressure and long life and include 1/8" thickness for corrosion allowance.



BACK PULL OUT

Back pull out leaves the pump casing in line, allowing piping, insulation, gauges, etc. to remain undisturbed. Back pull out also allows alignment of the pump and driver to be maintained during disassembly. The spacer coupling insert can be dropped out, leaving sufficient space to allow the power frame, stuffing box and impeller assembly to be removed. Jack screw taps are provided to facilitate removal from the casing. The driver and conduit remain in place.

1. Remove capscrews from both coupling hubs and remove spacer insert.
2. Remove capscrews from frame support foot.
3. Remove eight casing capscrews.



STANDARD MECHANICAL SEAL **SINGLE INSIDE-UNBALANCED** **TYPE APCO-CHEM PUMPS**

DATED **AUGUST 1967**

Factory option seals are of high quality and supplied by leading mechanical seal manufacturers.

Seal faces are carbon vs. ceramic, with corrosion resistant alloy metal parts and TEFLON* secondary sealing elements. Various other materials are also available.

Gland plates are stainless steel and can be supplied as indicated in alternate designs.

Recommendations and limitations are general. Specific selections can be offered only after rotating speeds, pressures, temperatures, type of equipment and liquid nature are known.

PRESSURES: Below atmospheric pressure up to approximately 200 P.S.I.

The pressures referred to are those found at the pump discharge. Most seal manufacturers recommend a flushing arrangement from the discharge to the stuffing box where "below atmospheric pressure" is encountered. The APCO-CHEM stuffing box incorporates a bypass arrangement which permits either internal or external flushing to the mechanical seal faces.

TEMPERATURES: From minus 100°F. up to 300°F. non-cooled and 500°F. cooled.

The temperature limitation of a mechanical seal is frequently determined by the shaft packing material. The various elastomer "O" ring materials have varying temperature limits, depending upon the chemical and/or physical properties of the process fluid. Filled TEFLON* shaft packings are available for temperatures up to 425°F.

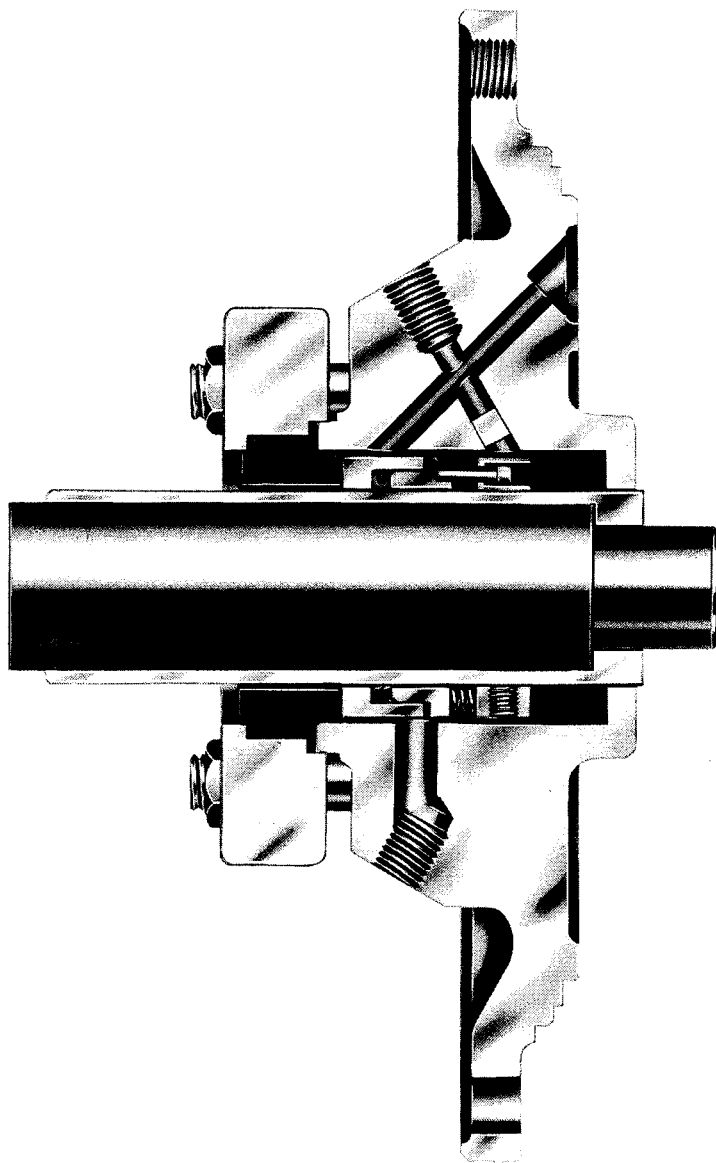
LIQUIDS: With a specific gravity heavier than .6.

Due to varying degrees of resistance of various sealing compounds in different pumped liquids, the following mechanical seal shaft packings are available: BUNA-N, NEOPRENE, VITON, TEFLON* and other synthetic elastomers. All liquids except molten alkali metals and some fluorine compounds in the higher temperatures can be pumped.

SEAL GLANDS:

1. Standard (illustrated)
2. Vent and drain with tapped openings
3. Vent, drain and cooled with tapped openings
4. Cooled with coolant tapped openings.

*DUPONT registered trademark



OPTION NO. 2

MECHANICAL SEAL

SINGLE INSIDE-BALANCED TYPE APCO-CHEM PUMPS

Factory option seals are of high quality and supplied by leading mechanical seal manufacturers.

Seal faces are carbon vs. ceramic, with corrosion resistant alloy metal parts and TEFLON* secondary sealing elements. Various other materials are also available.

Gland plates are stainless steel and can be supplied as indicated in alternate designs.

Recommendations and limitations are general. Specific selections can be offered only after rotating speeds, pressures, temperatures, type of equipment and liquid nature are known.

PRESSURES: Up to 600 P.S.I. (for pressures in excess of 600 P.S.I. please refer to the factory for recommendations).

The pressures referred to are those found at the pump discharge. Most seal manufacturers recommend a flushing arrangement from the discharge to the stuffing box where "below atmospheric pressure" is encountered. The APCO-CHEM stuffing box incorporates a bypass arrangement which permits either internal or external flushing to the mechanical seal faces.

TEMPERATURES: Minus 100°F. up to 300°F. non-cooled and 500°F. cooled.

The temperature limitation of a mechanical seal is frequently determined by the shaft packing material. The various elastomer "O" ring materials have varying temperature limits, depending upon the chemical and/or physical properties of the process fluid. Filled TEFLON* shaft packings are available for temperatures up to 425°F.

LIQUIDS: With a specific gravity of .6 or lighter.

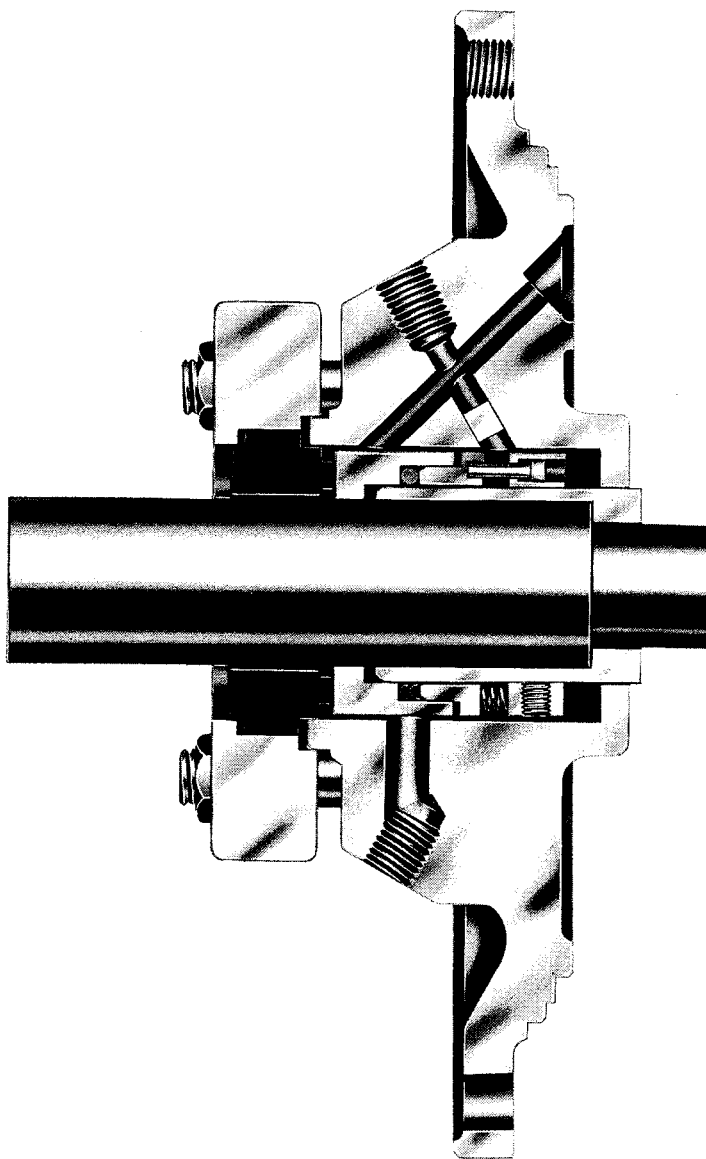
Due to varying degrees of resistance of various sealing compounds in different pumped liquids, the following mechanical seal shaft packings are available: BUNA-N, NEOPRENE, VITON, TEFLON* and other synthetic elastomers. All liquids except molten alkali metals and some fluorine compounds in the higher temperatures can be pumped.

SEAL GLANDS:

1. Standard (illustrated).
2. Vent and drain with tapped openings.
3. Vent, drain and cooled with tapped openings.
4. Cooled with coolant tapped openings.

NOTE: An alloy shaft will be furnished with this option.

*DUPONT REG. TRADEMARK



MECHANICAL SEAL**DATED AUGUST 1967****DOUBLE INSIDE-UNBALANCED
TYPE APCO-CHEM PUMPS**

Factory option seals are of high quality and supplied by leading mechanical seal manufacturers.

Seal faces are carbon vs. ceramic, with corrosion resistant alloy metal parts and TEFLON* secondary sealing elements. Various other materials are also available.

Gland plates are stainless steel and can be supplied as indicated.

Recommendations and limitations are general. Specific selections can be offered only after rotating speeds, pressures, temperatures, type of equipment and liquid nature are known.

NOTE:

1. Double seals are only recommended when operating conditions are such that a single seal is not practical. Double seals provide a greater degree of safety in sealing hazardous and toxic fluids.
2. Double seal operation requires that a sealing fluid be circulated between both sealing faces at a pressure 10-20 P.S.I. greater than that of the pumped liquid at the stuffing box. The secondary liquid furnishes lubrication to the sealing faces and provides cooling.

PRESSURES: Below atmospheric pressure up to approximately 450 P.S.I. depending upon velocity and pressurizing liquid.

The pressures referred to are those found at the pump discharge. Most seal manufacturers recommend a flushing arrangement from the discharge to the stuffing box where "below atmospheric pressure" is encountered. The APCO-CHEM stuffing box incorporates a bypass arrangement which permits either internal or external flushing to the mechanical seal faces.

TEMPERATURES: From minus 100° F. up to 300° F. non-cooled and 500° F. cooled.

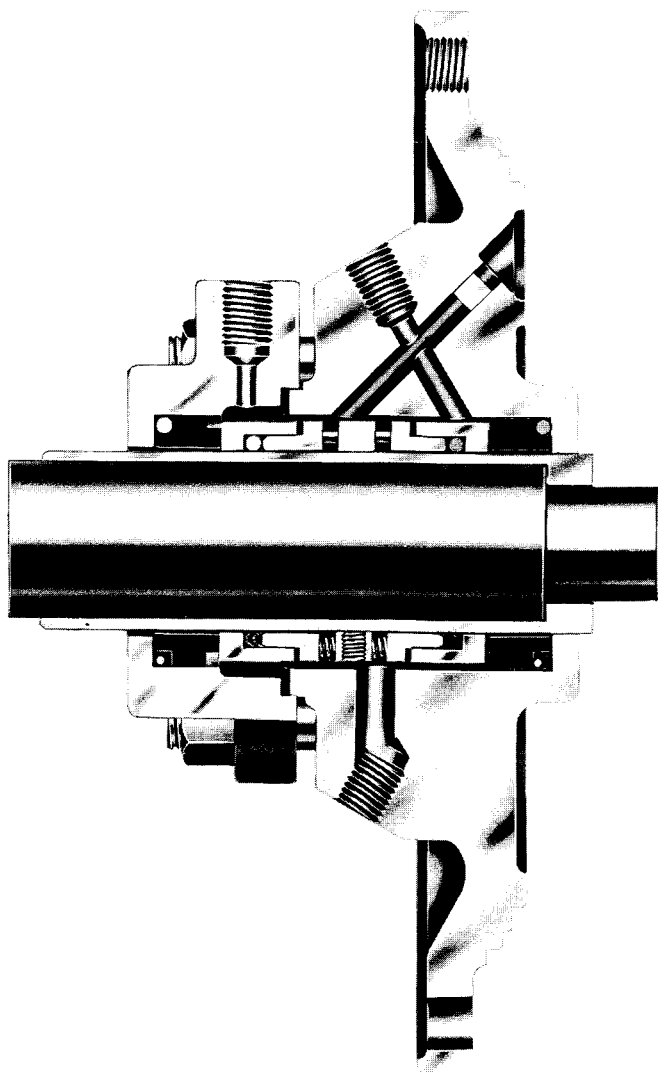
The temperature limitation of a mechanical seal is frequently determined by the shaft packing material. The various elastomer "O" ring materials have varying temperature limits, depending upon the chemical and/or physical properties of the process fluid. Filled TEFLON* shaft packings are available for temperatures up to 425° F.

LIQUIDS: With a specific gravity heavier than .6.

Due to varying degrees of resistance of various sealing compounds in different pumped liquids, the following mechanical seal shaft packings are available: BUNA-N, NEOPRENE, VITON, TEFLON* and other synthetic elastomers. All liquids except molten alkali metals and some fluorine compounds in the higher temperatures can be pumped.

SEAL GLANDS: Standard with sealant tapped opening (illustrated).

*DUPONT REG. TRADEMARK



OPTION NO. 4

MECHANICAL SEAL

DOUBLE INSIDE-BALANCED TYPE APCO-CHEM PUMPS

Factory option seals are of high quality and supplied by leading mechanical seal manufacturers.

Seal faces are carbon vs. ceramic, with corrosion resistant alloy metal parts and TEFLON* secondary sealing elements. Various other materials are also available.

Gland plates are stainless steel and can be supplied as indicated.

Recommendations and limitations are general. Specific selections can be offered only after rotating speeds, pressures, temperatures, type of equipment and liquid nature are known.

NOTE:

1. Double seals are only recommended when operating conditions are such that a single seal is not practical. Double seals provide a greater degree of safety in sealing hazardous and toxic fluids.
2. Double seal operation requires that a sealing fluid be circulated between both sealing faces at a pressure 10-20 P.S.I. greater than that of the pumped liquid at the stuffing box. The secondary liquid furnishes lubrication to the sealing faces and provides cooling.

PRESSURES: Up to 600 P.S.I. (for pressures in excess of 600 P.S.I., please refer to the factory for recommendations).

The pressures referred to are those found at the pump discharge. Most seal manufacturers recommend a flushing arrangement from the discharge to the stuffing box where "below atmospheric pressure" is encountered. The APCO-CHEM stuffing box incorporates a bypass arrangement which permits either internal or external flushing to the mechanical seal faces.

TEMPERATURES: Minus 100°F. up to 300°F. non-cooled and 500°F. cooled.

The temperature limitation of a mechanical seal is frequently determined by the shaft packing material. The various elastomer "O" ring materials have varying temperature limits, depending upon the chemical and/or physical properties of the process fluid. Filled TEFLON* shaft packings are available for temperatures up to 425°F.

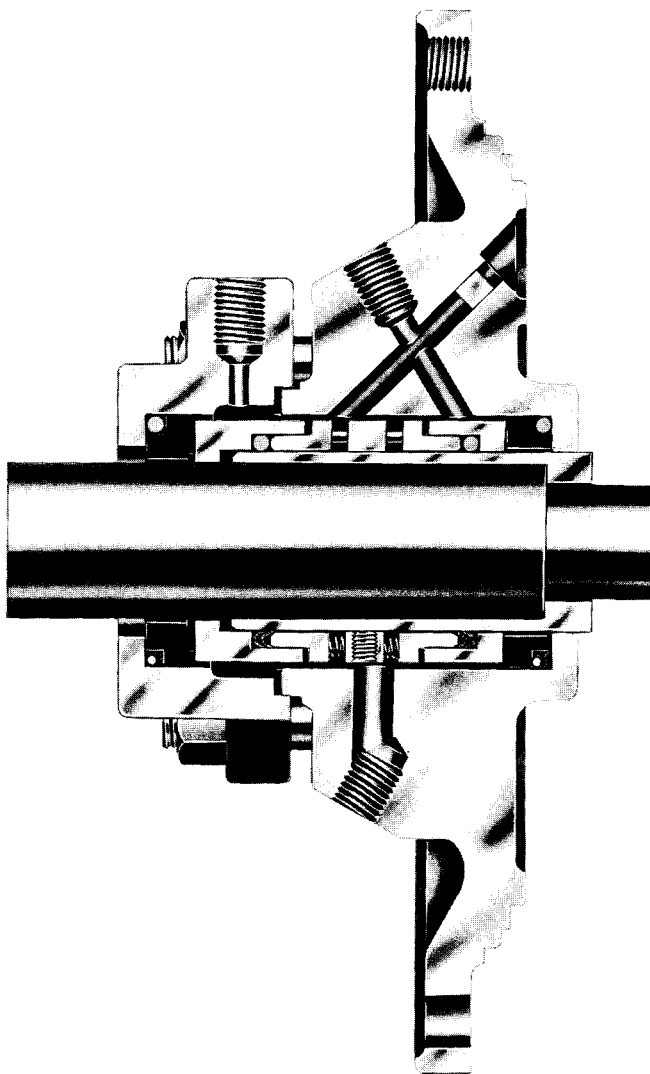
LIQUIDS: With a specific gravity of .6 or lighter. Due to varying degrees of resistance of various sealing compounds in different pumped liquids, the following mechanical seal shaft packings are available: BUNA-N, NEOPRENE, VITON, TEFLON* and other synthetic elastomers. All liquids except molten alkali metals and some fluorine compounds in the higher temperatures can be pumped.

SEAL GLANDS: Standard with sealant tapped opening (illustrated).

NOTE:

1. An alloy shaft will be furnished with this option.
2. This seal option is not available for model 151 pumps.

*DUPONT REG. TRADEMARK



MECHANICAL SEAL

DATED **AUGUST 1967**

**SINGLE OUTSIDE-BALANCED
TYPE APCO-CHEM PUMPS**

Factory option seals are of high quality and supplied by leading mechanical seal manufacturers.

Seal faces are carbon vs. ceramic, with corrosion resistant alloy metal parts and TEFLON* secondary sealing elements. Various other materials are also available.

Gland plates are stainless steel and can be supplied as indicated in alternate designs.

Recommendations and limitations are general. Specific selections can be offered only after rotating speeds, pressures, temperatures, type of equipment and liquid nature are known.

PRESSURES: Below atmospheric pressure up to 400 P.S.I.

The pressures referred to are those found at the pump discharge. Most seal manufacturers recommend a flushing arrangement from the discharge to the stuffing box where "below atmospheric pressure" is encountered. The APCO-CHEM stuffing box incorporates a bypass arrangement which permits either internal or external flushing to the mechanical seal faces.

TEMPERATURES: From minus 100°F. up to 300°F. non-cooled and 500°F. cooled.

The temperature limitation of a mechanical seal is frequently determined by the shaft packing material. The various elastomer "O" ring materials have varying temperature limits, depending upon the chemical and/or physical properties of the process fluid. Filled TEFLON* shaft packings are available for temperatures up to 425°F.

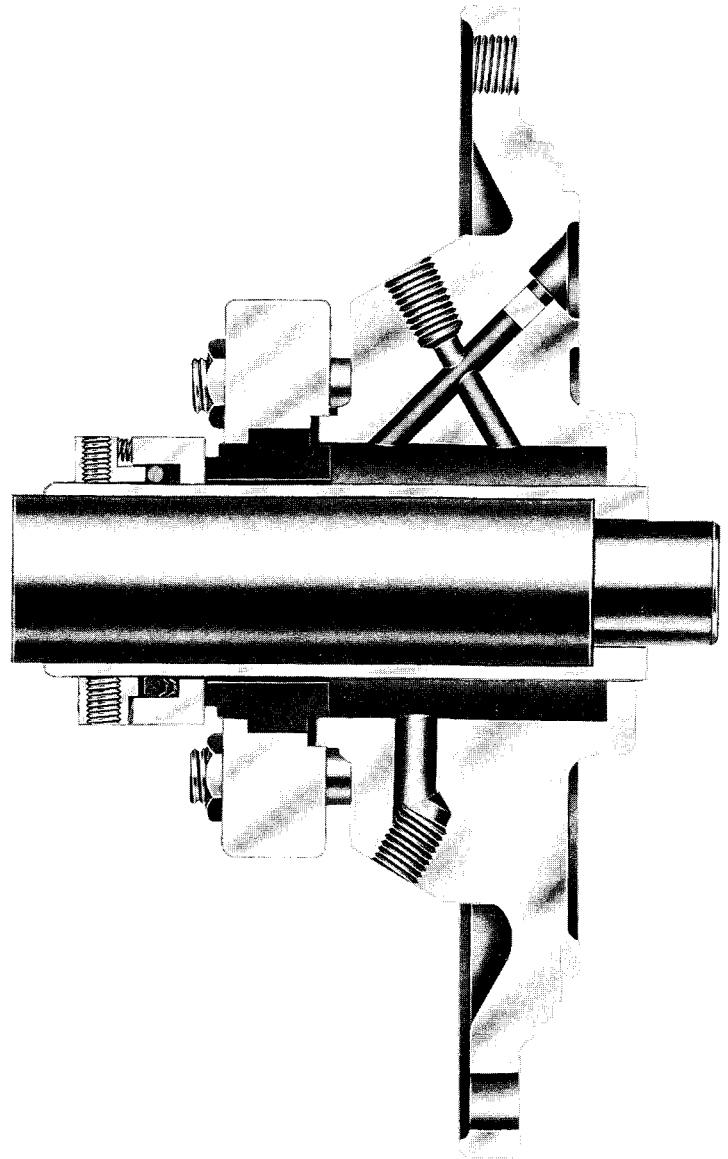
LIQUIDS: With a specific gravity of .6 or lighter.

Due to varying degrees of resistance of various sealing compounds in different pumped liquids, the following mechanical seal shaft packings are available: BUNA-N, NEOPRENE, VITON, TEFLON* and other synthetic elastomers. All liquids except molten alkali metals and some fluorine compounds in the higher temperatures can be pumped.

SEAL GLANDS:

1. Standard (illustrated).
2. Cooled with coolant tapped openings.

*DUPONT REG. TRADEMARK



DATED MAY 1996

PACKING

SUPERSEDES PAGE 170
DATED AUGUST, 1967

TYPE APCO-CHEM PUMPS

Factory option die molded, diagonal cut packing rings are of high quality and supplied by leading manufacturers.

Packing rings are impregnated braided acrylic yarn. Various other materials are also available. Lantern rings are TEFLON* and diagonally cut for easy assembly.

Gland plates are stainless steel and can be supplied as indicated.

Recommendations and limitations are general. Specific selections can be offered only after rotating speeds, pressures, temperatures, type of equipment and liquid nature are known.

PRESSURES: Below atmospheric pressure up to approximately 150 P.S.I.

The pressures referred to are those found at the pump discharge. Most packing manufacturers recommend a flushing arrangement from the discharge to the stuffing box where "below atmospheric pressure" is encountered. The APCO-CHEM stuffing box incorporates a bypass arrangement which permits either internal or external flushing to the lantern ring.

TEMPERATURES: From minus 100°F. up to 300°F. non-cooled and 500°F. cooled.

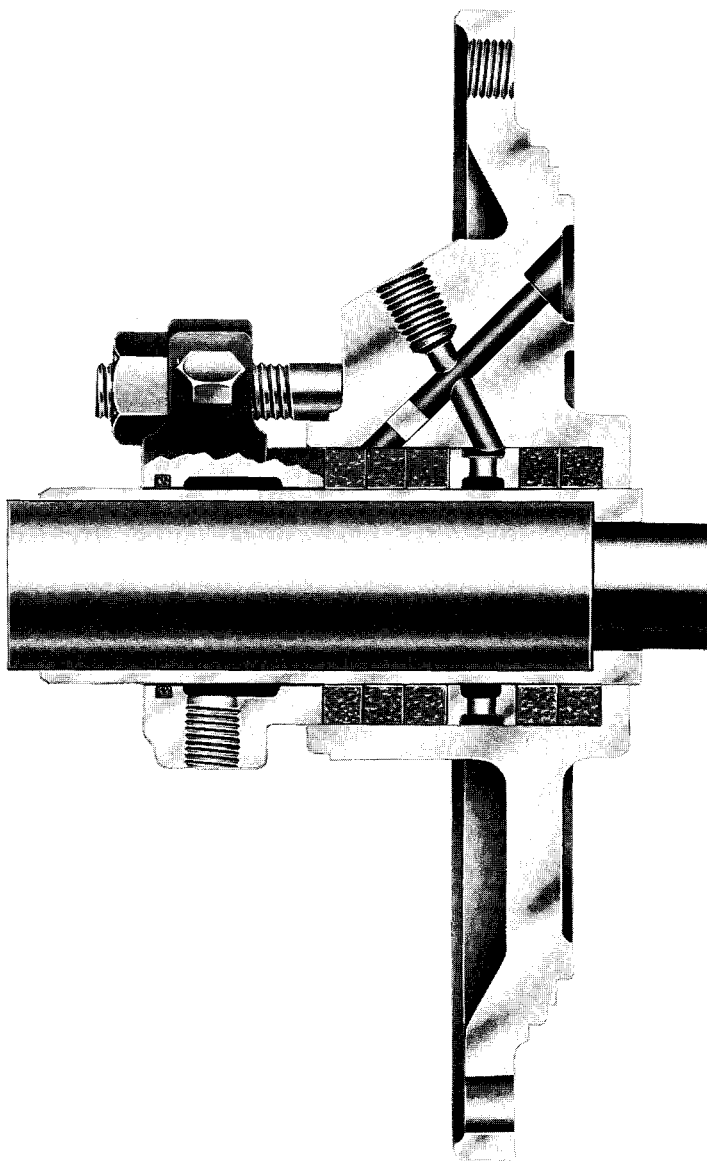
The temperature limitation of packing is frequently determined by the shaft packing material. The various materials have varying temperature limits, depending upon the chemical and/or physical properties of the process fluid. Filled TEFLON* shaft packings are available for temperatures up to 500°F.

LIQUIDS: All liquids that are compatible with white asbestos yarn. Other packings are available for special applications.

PACKING GLAND: Quench with coolant tapped openings (standard illustrated).

NOTE: Hardened stainless steel (450 minimum brinell) shaft sleeves are furnished with this option.

*DUPONT REG. TRADEMARK



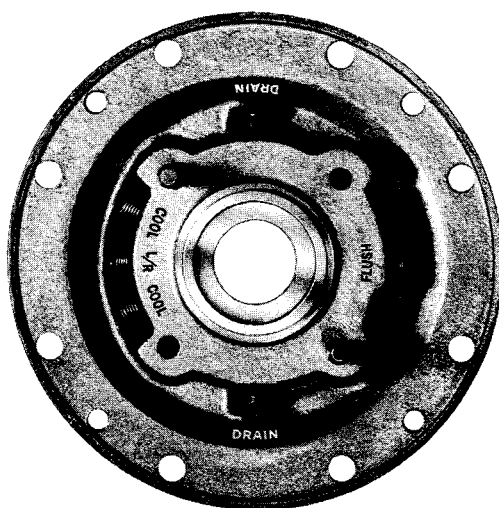
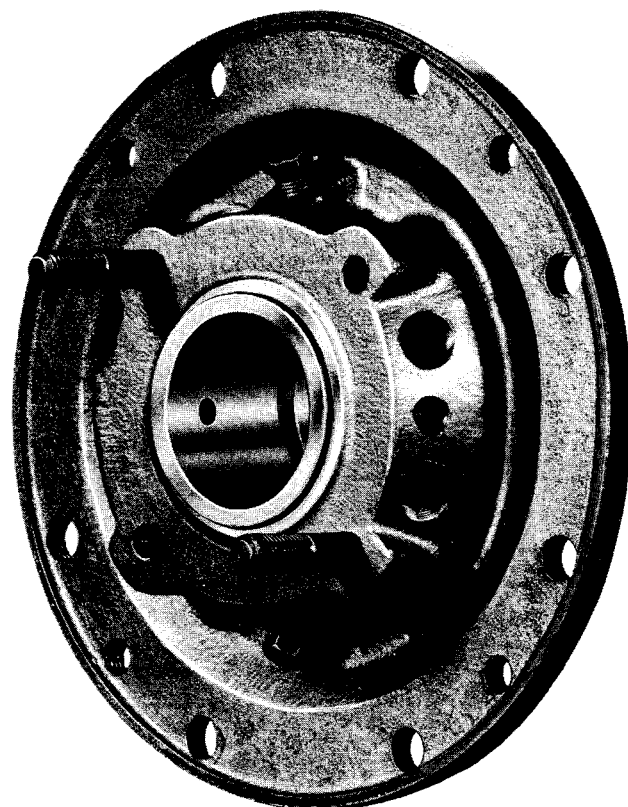
OPTION NO. 7
WATER COOLED STUFFING BOX
TYPE APCO-CHEM PUMPS

SECTION **150** PAGE **171**
DATED **AUGUST 1967**

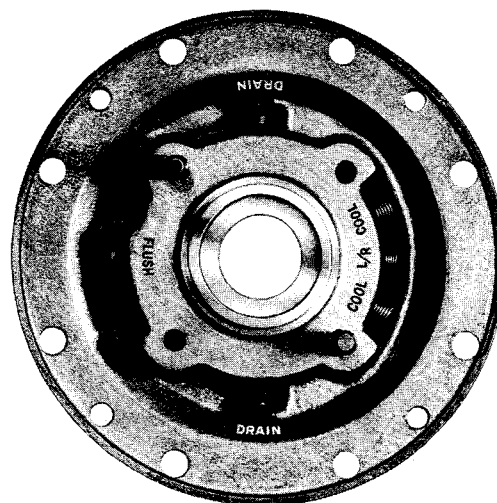
The water cooled stuffing box is interchangeable with the standard box and is required for high temperature applications.

Stuffing box covers offer maximum interchangeability. One cover can be used for either mechanical seals or packing. The cover is a back pull out design and includes an integrally cast stuffing box. The cover is register aligned and securely clamped between the casing and the power frame with eight capscrews. Four additional capscrews lock the stuffing box cover to the power frame which allows the frame and cover assembly to be removed as a unit for maintenance purposes. Two of these capscrews (opposing) may be substituted with extra length capscrews to serve as jack screws to facilitate removal of the cover and frame assembly from the casing.

The covers are fully machined and the stuffing boxes are machine faced for seal or packing and include facilities for internal or external flushing or lubrication of mechanical seals or packing. One quarter (1/4") N.P.S.F. taps are provided for external flushing. Mechanical seal gland gaskets are TEFLON* and are completely confined. Water jacketing includes 1/2" N.P.S.F. inlet and outlet taps in the model 152, 153 and 154; and 3/8" N.P.S.F. taps in the model 151 pumps. The covers are completely interchangeable in the field for seals or packing and require only the necessary glands.



MODEL 151 & 152
SINGLE STAGE



MODEL 153 & 154
TWO STAGE

PIPING ORIENTATION ON APCO-CHEM PUMPS

*DUPONT REG. TRADEMARK

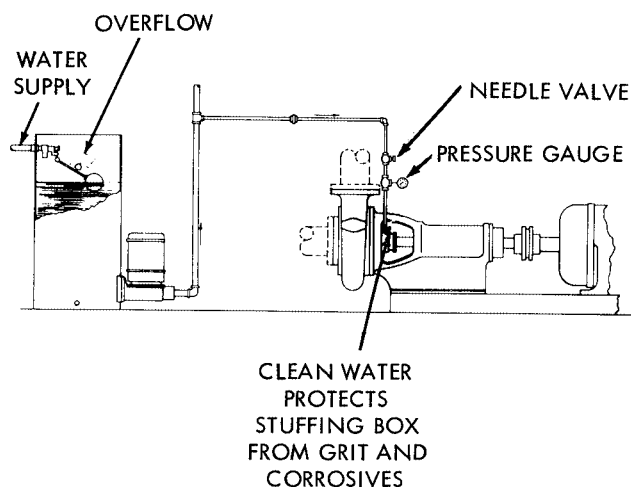
OPTION NO. 8

WATER SEAL UNITS

TYPE APCO-CHEM PUMPS

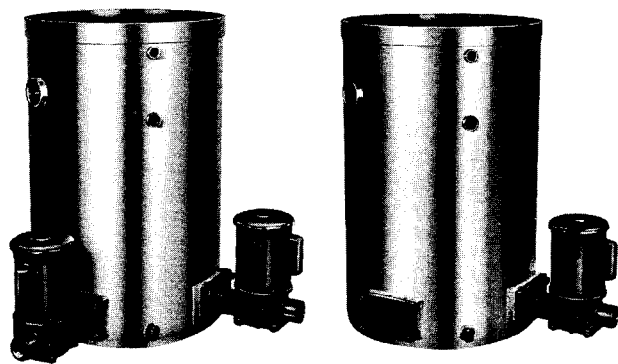
Water seal units are complete pumping systems used with, but independent of, larger industrial pumps. Their purpose is to pump clean water into the stuffing box or for wear ring flushing of pumps handling abrasive or corrosive materials. This provides clear water lubricating and flushing of mechanical seals, packing or wear ring faces. For complete details, see Bulletin 680.

TYPICAL INSTALLATION OF AN AURORA WATER SEAL UNIT



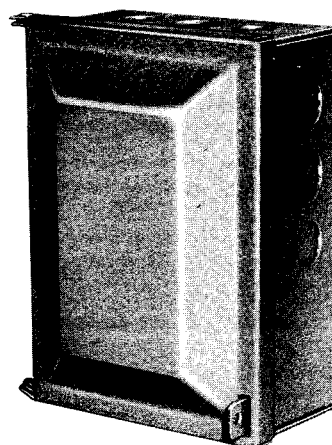
Water Seal Units are available in either a **SIMPLEX** (one pump) or **DUPLEX** (two pumps) configuration.

Duplex units extend pump life by alternating pump operation. An electric sequence changer is available to alternate the operation of the two pumps provided in the duplex system.



DUPLEX

SIMPLEX

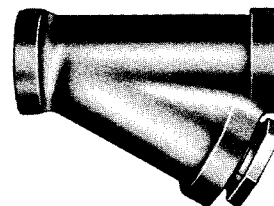


OPTION 8A

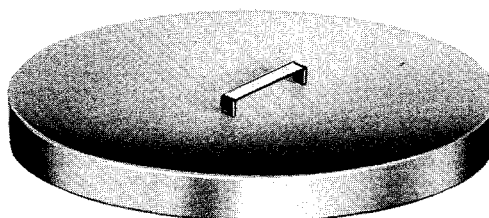
Sequence changer is available in Standard, Weatherproof, or Explosion Proof Enclosures 60/50 Cycle only, 230 volt Maximum.

OPTION 8B

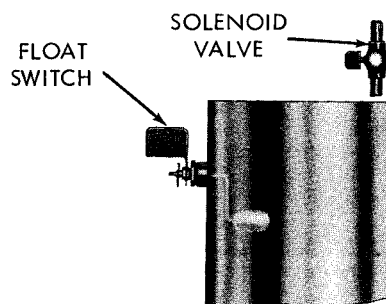
"Y" strainers are available for installation in the inlet pipe line.



OPTION 8C



A 24 gauge galvanized steel cover is available for covering the open top water seal receiver. A handle allows easy removal.



OPTION 8D

Specify this option when local codes require more than a 7" air gap between the incoming water supply and the tank overflow. As the water level drops in the receiver to a predetermined level the float switch activates the solenoid valve which in turn refills the receiver with fresh water. When the high water level is reached the float switch deactivates the solenoid valve, stopping the incoming water flow.

OPTION NO.'S 13 THRU 15 CENTERLINE MOUNT, DRIP CUP, AND W/J BEARING FRAME

SECTION 150 PAGE 177

DATED JUNE 1994

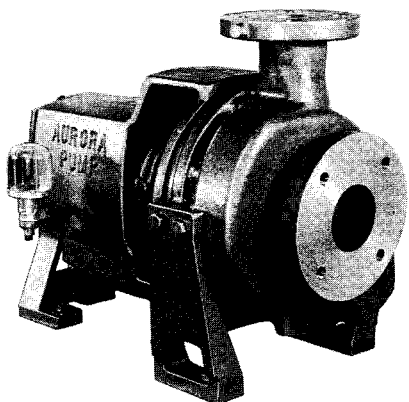
SUPERSEDES PAGE 177

DATED AUGUST 1967

TYPE APCO-CHEM PUMPS

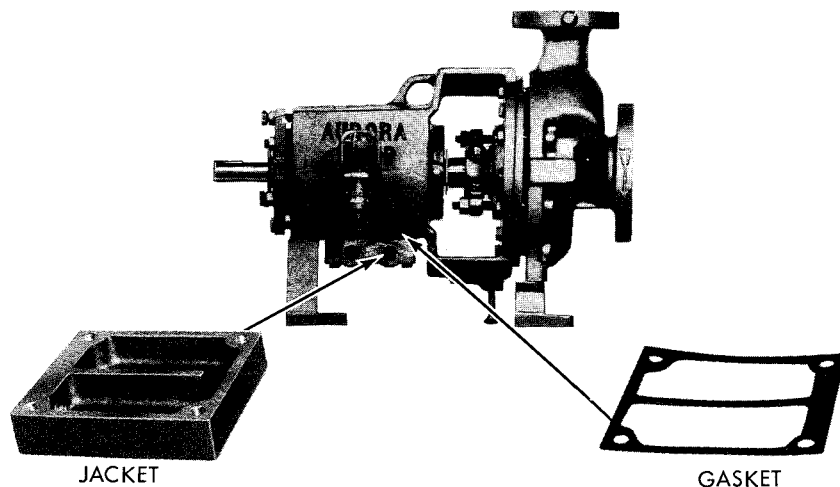
OPTION 13

CENTERLINE MOUNTED CASING: Pump models 152, 153 and 154 are recommended for high operating temperatures (generally above 300°F.). This option allows for expansion in all directions from the horizontal ϕ of the shaft. The support does not affect the A.N.S.I. pump mounting dimensions.



OPTION 15

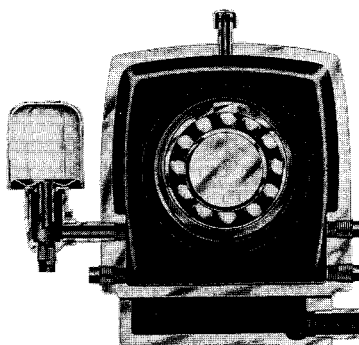
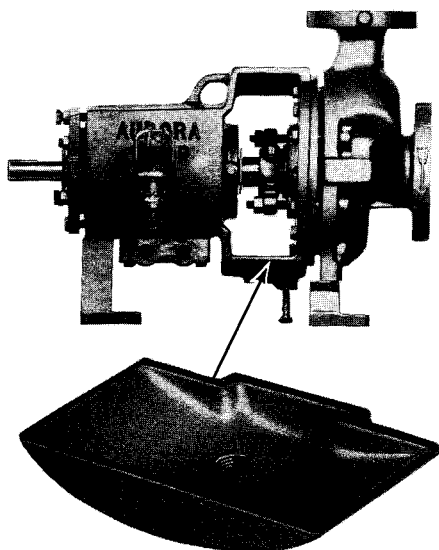
WATER JACKETED BEARING FRAME: For operation over 300°F., a bolt on water jacket for easy inspection and cleaning, provides oil lubrication cooling for the power frame of models 152, 153 and 154, and should be specified. Actual limitations vary due to other considerations.



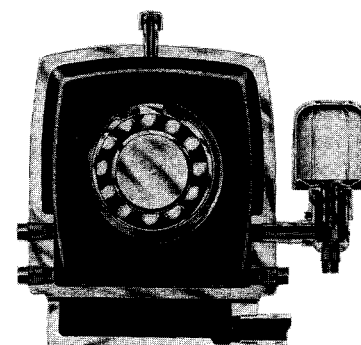
OPTION 14

DRIP CUP: Prevents stuffing box leakage from corroding the bearing frame. Models 152, 153 and 154 have a 3/8" N.P.S.F. and model 151 a 1/4" N.P.S.F. pipe tap in the bottom of the cup for drain piping.

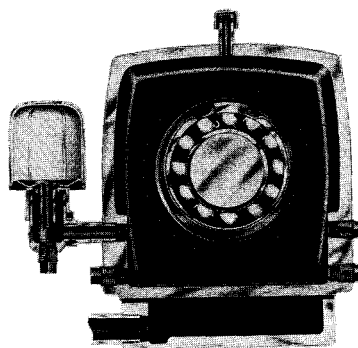
This option is furnished as standard on all model 152, 153 and 154 alloy pumps.



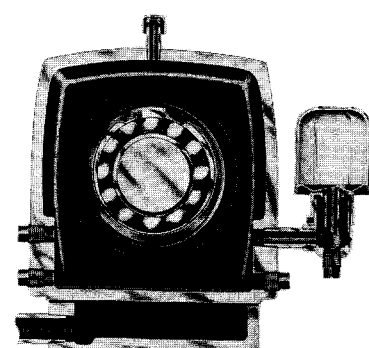
POSITION 1
OPTION 15A



POSITION 2
OPTION 15B



POSITION 3
STANDARD



POSITION 4
OPTION 15C

VARIOUS POWER FRAME PIPING AND LUBRICATION ARRANGEMENTS
(AS VIEWED FROM SUCTION FLANGE)

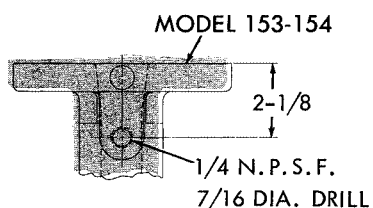
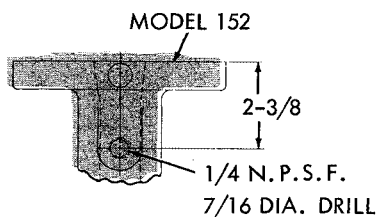
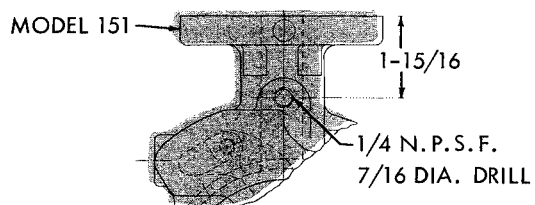
DATED JUNE 1994
SUPERSEDES PAGE 178
DATED AUGUST 1967

GAUGE AND DRAIN CONNECTIONS - FLANGES

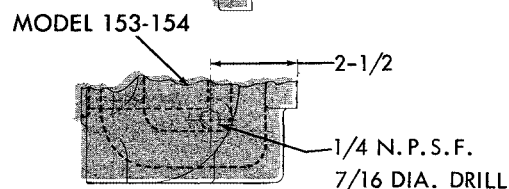
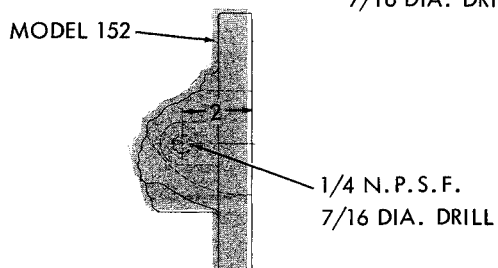
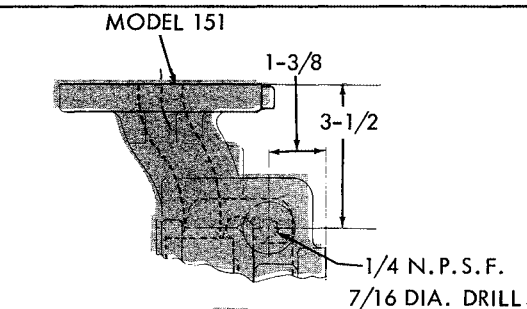
TYPE APCO-CHEM PUMPS

OPTION NO. 16
NOZZLE GAUGE CONNECTIONS

DISCHARGE TAP
AS VIEWED FROM SUCTION



SUCTION TAP
AS VIEWED FROM SIDE



Conveniently located bosses are provided for optional gauge and drain taps.

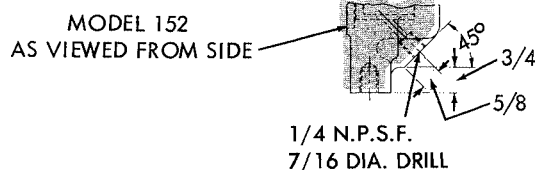
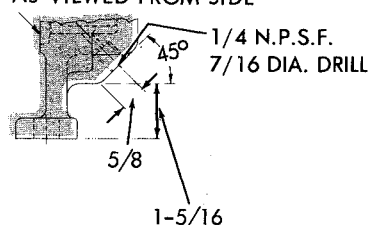
The casing is not tapped as standard to provide maximum corrosion protection. Casing drain taps are furnished with 1/4 N.P.S.F. threads. Two stage model 153 pumps have provision for two (2) taps, one for each stage.

Gauge taps are standard 1/4" N.P.S.F.

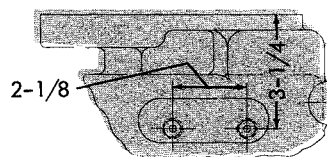
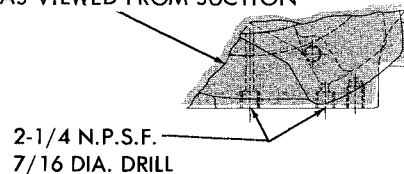
OPTION NO. 17

CASING DRAIN
1/4 N.P.S.F.

MODEL 151 - AS VIEWED FROM SIDE



MODEL 153 - AS VIEWED FROM SUCTION



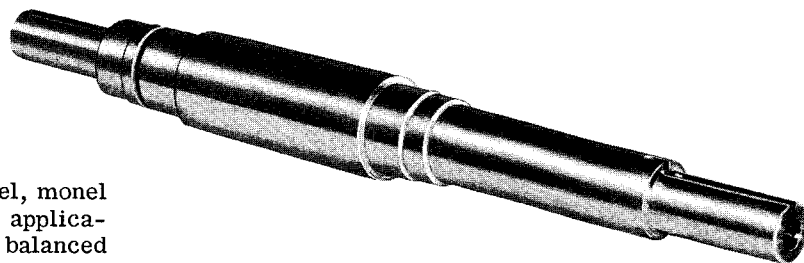
*DUPONT REG. TRADEMARK

OPTION NO.'S 19 THRU 22
SHAFTS, SLEEVES, GREASE LUBE
AND MOTORS
TYPE APCO-CHEM PUMPS

SECTION **150** PAGE **179**
DATED **JANUARY 1988**
SUPERSEDES PAGE 179
DATED AUGUST 1967

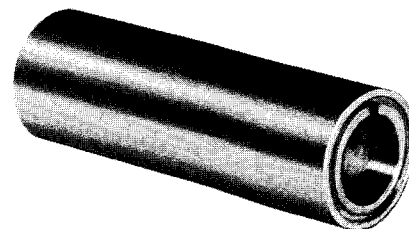
OPTION 19

Precision machined shafts of stainless steel, monel and other alloys are available for difficult application. Alloy shafts are required when inside balanced seals are specified.



OPTION 20

Shaft sleeves, machined to close tolerances are available for mechanical seals in various alloys. Stainless steel sleeves of 450 minimum brinell hardness are standard for packed pumps.



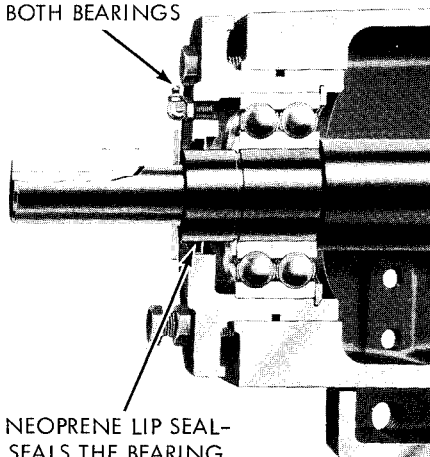
OPTION 22

The Aurora Apco-Chem pump can be provided with any driver. When specified an electric motor, of suitable horsepower, RPM, voltage, phase and enclosure characteristics will be furnished.

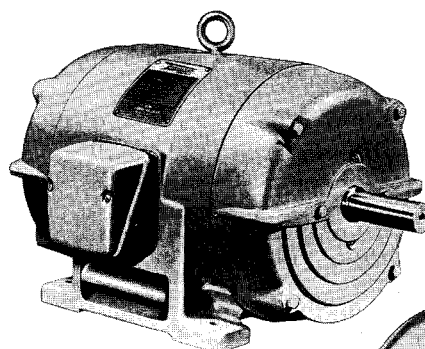
OPTION 21

GREASE LUBRICATION: Can be specified for specific applications.

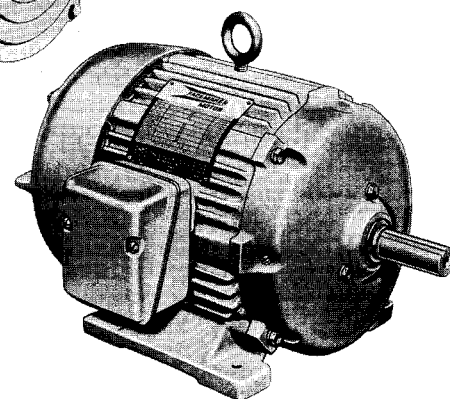
PIPE PLUG IS
REPLACED BY
A GREASE
FITTING AT
BOTH BEARINGS



NEOPRENE LIP SEAL-
SEALS THE BEARING



OPEN DRIPPROOF
ELECTRIC MOTOR



TOTALLY ENCLOSED OR
EXPLOSION PROOF
ELECTRIC MOTOR

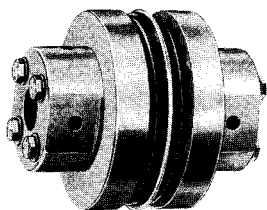
OPTION NO.'S 23 THRU 27

COUPLINGS, COUPLING GUARDS AND BASES

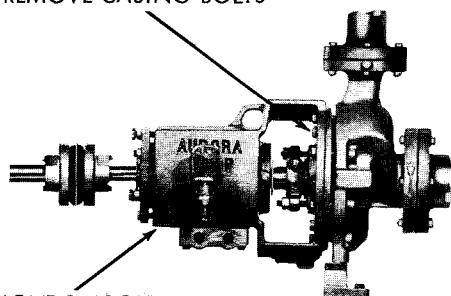
TYPE APCO-CHEM PUMPS

OPTION 23

SPACER COUPLINGS - are recommended for horizontal pump applications where it is desirable to remove the bearing assembly without disturbing the pump or motor. The ANSI Standard for chemical pumps specify spacer couplings. Aurora Pump will provide spacer couplings for complete pump units unless otherwise specified.



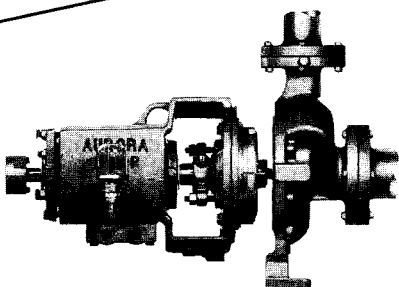
REMOVE CASING BOLTS



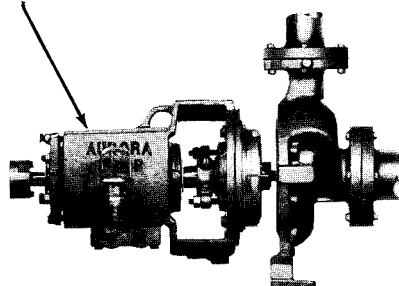
REMOVE SUPPORT



REMOVE SPACER COUPLING SLEEVE



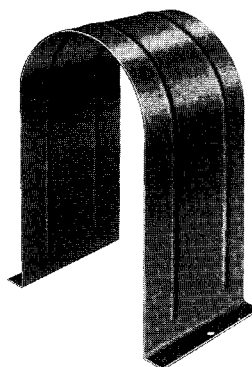
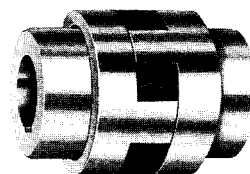
REMOVE POWER FRAME ASSEMBLY



SUPPORT IS INTEGRALLY CAST ON MODEL 151 PUMPS

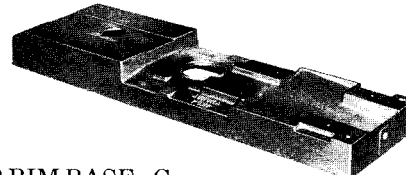
OPTION 24

FLEXIBLE COUPLINGS - Factory selected couplings from leading manufacturers are available. Special couplings are also available. The motor must be moved to allow back pull out of the pump bearing assembly.



OPTION 25

COUPLING GUARD - A formed steel coupling guard for rigid bolting to the base plate is standard. Non-sparking and special enclosed guards are optionally available.



OPTION 26

CAST IRON DRIP RIM BASE - Conform to all ANSI dimensions. Cast iron drip rim type base plates are designed to form a rigid mount for pump and motor. It has machined mounting pads for both the pump and motor and an integral tapered drip rim for condensation and stuffing box leakage.

A 1" pipe tap is provided for drain piping. Grouting holes are also provided.

OPTION 27

FORMED STEEL BASE - Heavy duty steel base plates are available and conform to all ANSI dimensions.

