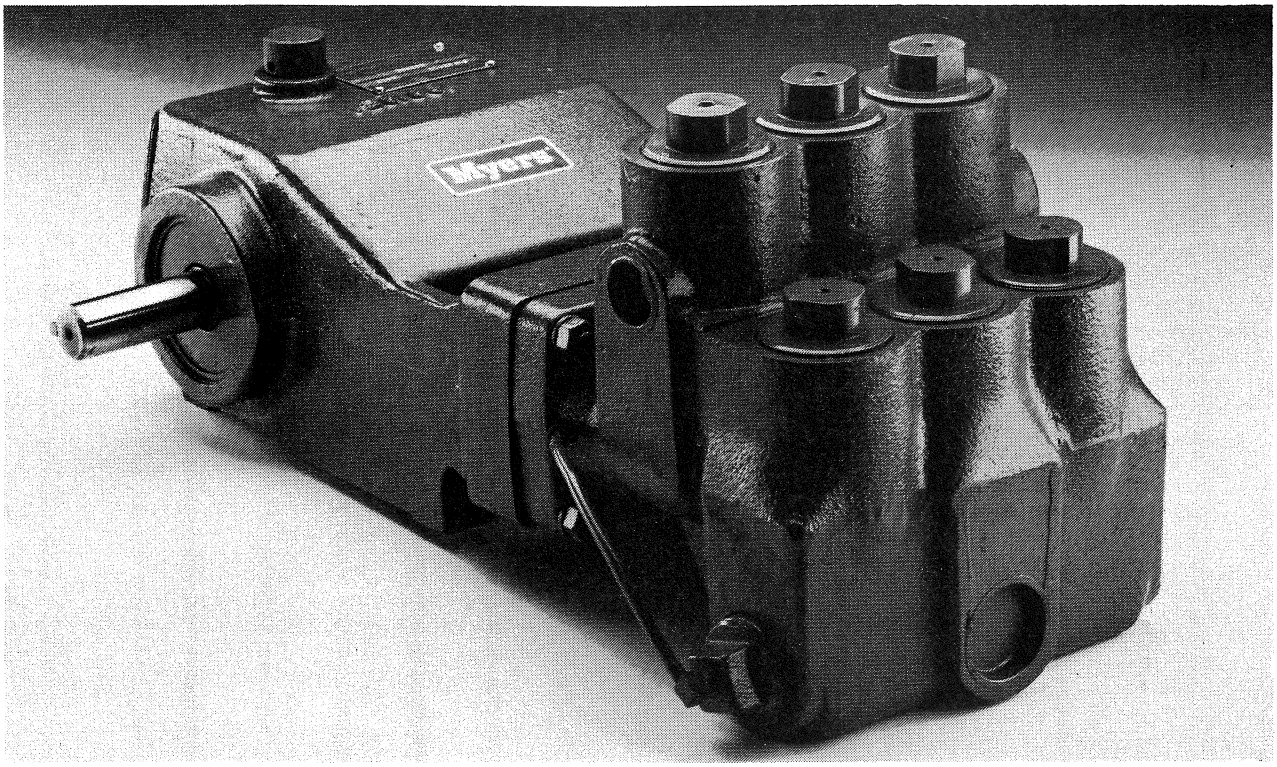
CXP Series Instructions and Service Manual

Myers®



SPECIFICATIONS

TYPE	Triplex - Single Acting						
	CXP30-12	CXP26-14	CXP22-16	CXP18-20	CXP14-24	CXP7-30	CXP5-35
Rated Capacity GPM @ 900 RPM/560 RPM*	30	26	22	18	14	7	5
Pressure Rating (PSI)	1,200	1,400	1,650	2,000	2,450	3,000	3,500
Required BHP @ 900 RPM and Rated Press	25	25	25	25	25	15	13
Temperature Rating (Max.)	160°F						
Plunger Size (Inch)	1 5/8	1 1/2	1 3/8	1 1/4	1 1/8	1	7/8
Stroke	1 1/4"						
Suction Size	1 1/2" NPT (Sides & Front)						
Discharge	1" NPT (Sides)						
Crankshaft Diameter	1 1/8"						
Keyway	1/4 x 1/8						
Hydraulic Motor Mounting Spec	2000 Series - Charlin						
Plunger Material	Alumina Ceramic						
Fluid End Material	A536 Ductile Iron/B148 Alum. Bronze				A536 Ductile Iron		
Plunger Seal Material	Nitroxile		Nitrile w/Cotton Fabric				
Valve Material	Stainless Steel & Delrin						
Seat Material	Stainless Steel						
Approx. Shipping Weight	152#						
Suggested Drive For 1750 RPM Motor	Drive Sheave 3V Section 3 Groove 6.9" O.D. Driven Sheave 3V Section 3 Groove 14" O.D. 1 1/8" Bore 1/4" x 1/8" K.W. Belts - matched sets of (3) 3V 630 (63" outside circumference)					Drive Sheave 4.5" O.D. Driven Sheave 14" O.D. Approx. Center Distance is 16.3"	

*560 RPM is maximum rated RPM for CXP7-30 and CXP5-35
900 RPM is maximum rated RPM for all other CXP Models.

INSTRUCTIONS FOR CXP SERIES MYERS INDUSTRIAL PUMPS

Reciprocating pumps of both the plunger and piston type are positive displacement in principle. Due to positive displacement characteristics, problems may arise through improper installation or application. When new or unusual installations are planned, or the material to be pumped is a liquid other than cold water, the customer should consult the "Myers Reciprocating Pump Manual" or factory for additional information.

CAUTION

Positive Displacement Pumps must have a proper size and operable type of pressure regulating valve or pressure relief valve piped into the discharge line. This is mandatory to prevent damage to pump and piping or possible injury to personnel. Do not install any valves or shutoff devices in the bypass line from pressure regulator to tank or supply.

I — INSTALLATION (Customer mounted pump)

A. If possible, install suction piping one pipe size larger than suction tapping in pump. Reduce piping size at pump with a reducer coupling as shown on installation drawings. A suction surge arrester, also shown, will assure smoother operation.

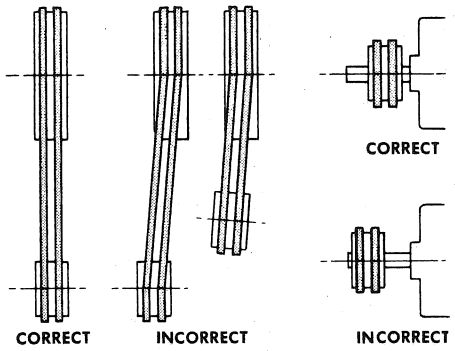
B. Pump performs best under +20 PSI suction pressure. When level of liquid supply is below that of the pump (suction lift condition) **both** side openings must be connected to the supply. Keep suction piping as short and simple as possible with a minimum of lift. Avoid any high points in suction line.

Suction piping must not have any air leaks. Check suction piping assembly for leaks by using 20-80 p.s.i. air pressure and soap bubbles or submerging assembly under water.

C. Use suction strainer and screen of adequate size to avoid restriction of pump suction. Strainer mesh should be sufficiently small to prevent passage of trash which may lodge under pump valves. Keep screen clean with a regular maintenance schedule to avoid starving of pump suction. A starved suction condition is usually indicated by excessive pump shock and noise. Many pump problems and most plunger seal failures are directly traceable to a starved suction condition.

D. When pumping liquids that are heated, reduce pump speed to avoid suction problems. Consult "Myers Reciprocating Pump Manual" or factory for temperature and speed limitations.

E. Make sure that drive is adequate for horsepower required and that drive is properly aligned and tensioned. With belt drives, pulley on both motor and pump should be located as closely as possible to bearing to reduce bearing and shaft bending loads.

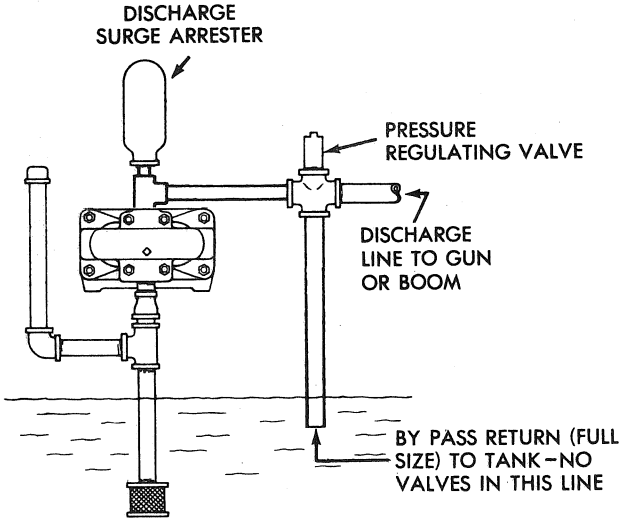


PULLEY LOCATION ON PUMP AND MOTOR SHAFT

CAUTION: Be sure that pump belts and pulleys are properly protected by guards according to industrial code within state of application.

F. Make sure that all bolts, nuts, set screws, and keys are properly tightened.

G. Be sure that discharge line is properly protected by means of a pressure regulating valve and a discharge surge arrester of proper size, capacity, and pressure rating. The discharge line should be of comparable size to discharge tapping in pump.



CORRECT LOCATION OF DISCHARGE SURGE ARRESTER WHEN USING PRESSURE REGULATING VALVE.

H. Nozzle capacity or demand should not exceed 90% of pump capacity for satisfactory regulating valve operation. Nozzling in excess of this capacity may cause unstable pressure regulator operation.

It is also preferred to nozzle in excess of 50% of pump capacity to reduce rate of erosion or wear on regulating valve and seat.

When lower system demands (than rated pump capacity) are required in an installation, the pump speed should be reduced by changing drive ratios. This will reflect savings in power consumption, reduce regulating valve wear, and extend pump life.

I. Where line shock or water hammer is encountered a second surge arrester should be installed in the discharge line adjacent to spray gun or nozzles. Under some conditions it may also be desirable to isolate pump from piping with a suitable high pressure hose. This will eliminate transmission of line vibration to the pump, with a resulting possible failure of piping, pipe threads, and/or pump casting.

J. Never pipe the bypass from a pressure regulating valve back into the pump suction. When discharge line is shut off, the complete bypass is circulated back into pump suction with a resulting rapid temperature rise which will destroy the plunger seal.

It is permissible to pipe the bypass from an unloader valve into the suction because the pump pressure is unloaded when discharge is shut off.

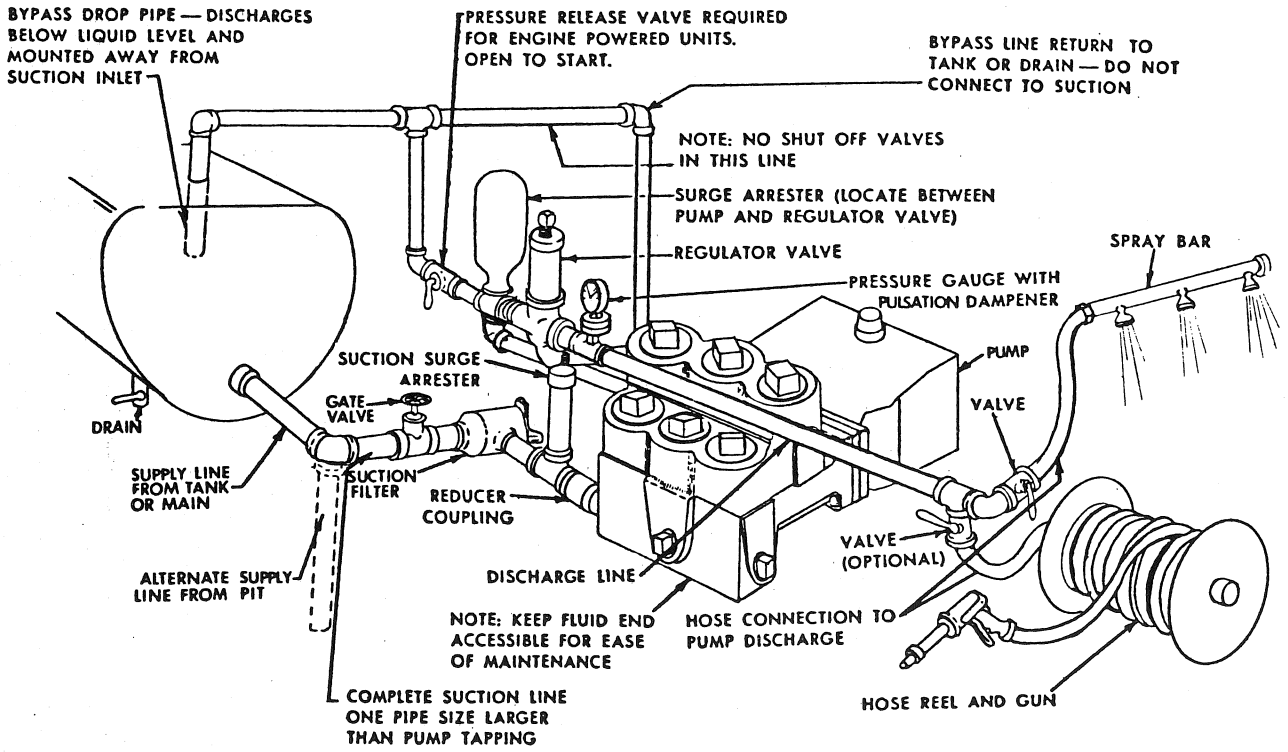
K. It is mandatory to shield the complete customer mounted pump to prevent possible injury to personnel due to high pressure leak.

II — STARTING PUMP

A. Before starting:

1. Read all instructions carefully.
2. Fill pump crankcase with recommended oil to level mark on oil saber. Oil recommendations are covered in lubrication section of pump instructions.
3. Replace all drain plugs in pump and piping.
4. Inspect tank to be sure that no foreign material is in tank or suction line.
5. Fill tank at least half full or connect suction to water supply. Open valve (if present) in suction line. If pumping from a pit, make sure that suction line is completely submerged.
6. Make sure all valves, including spray gun or nozzles, are open in discharge line. Spray gun may be anchored to discharge back into tank.
7. Completely back off pressure adjusting screw on pressure regulating valve.

TYPICAL INSTALLATION OF INDUSTRIAL PUMP EQUIPPED WITH PRESSURE REGULATOR VALVE

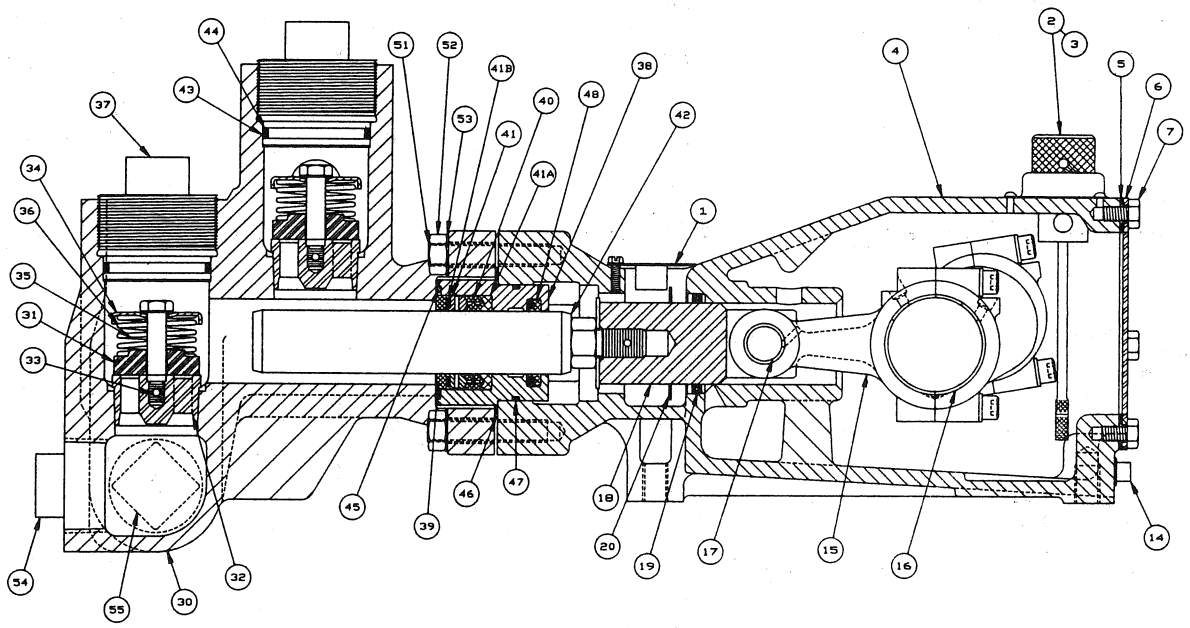


CAUTION: When pumping from a pit or under a suction lift condition, if pump does not prime in a short period, see paragraph 1B and fill the discharge side of fluid end with water to seal discharge valves. If pump still does not prime remove suction hose and fill pump with water. Dry operation will cause heating and wear on plunger seal. Be sure that an operating pressure gauge is located on discharge line.

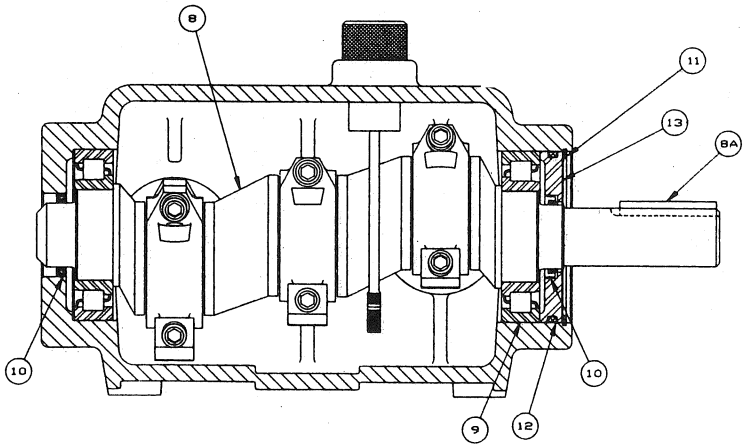
B. Starting the Unit:

1. After starting, close discharge valve or gun slowly while watching pressure gauge to make sure relief valve or unloader is operating properly.
2. Adjust relief valve to desired pressure. See regulator instructions.
3. Cycle nozzles or gun on and off to be sure that pressure adjustment and regulator operation is satisfactory.

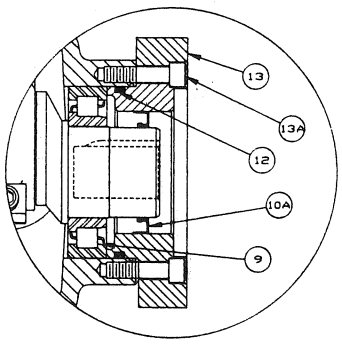
CXP Series Industrial Pumps Parts



NOTE: CXP7-30 & CXP5-35 only use single spring (35). Do not need spring (36)



Hydraulic Drive



CXP Series Industrial Pumps Parts List

Power End Parts (All 7 Models)

Ref. No.	Description	Qty. Req'd.	Part No.
1	Cover	1	19324A000
2	Oil Gauge	1	20360A000
3	O-Ring	1	05876A074
4	Crankcase (Shaft Drive)	1	19313E001
4	Crankcase (Hyd. Drive)	1	19313E014
5	Gasket	1	19314B000
6	Cover	1	19315B000
7	Screw	8	19100A001
8	Crankshaft (Shaft Drive)	1	18451C002
8	Crankshaft (Hyd. Drive)	1	18451C003
8A	Key (Shaft Drive)	1	05818A003
9	Roller Bearing	2	06114A003
10	Oil Seal (Shaft Drive)	2	14383A004
10	Oil Seal (Hyd. Drive)	1	14383A004

Ref. No.	Description	Qty. Req'd.	Part No.
10A	Oil Seal (Hyd. Drive)	1	05710A045
11	Retaining Ring (Shaft Drive)	1	10848A016
12	O-Ring	1	05876A035
13	Bearing Cap (Shaft Drive)	1	18452A000
13	Hydraulic Adapter	1	26368B000
13A	Screw (Hyd. Drive)	8	06106A047
14	Pipe Plug	1	05022A009
15	Link	3	18836B000
16	Half Bearing	3	18837A000
17	Wrist Pin	3	18448A000
18	Crosshead	3	18449B001
19	Oil Seal	3	14383A003
20	Washer, Splash	3	05030A198

Fluid End Parts

Ref. No.	Description	Qty. Req'd.	Part No.	Model
30	Body, Fluid End Ductile	1	24889E000	All Models
30	Body, Fluid End, Alum-Bronze	1	24889E001	CXP30-12AB, CXP26-14AB, CXP22-16AB, CXP18-20AB
31	Valve, Delrin	6	18834A000	All Models
32	Seat, Valve	6	18835A000	CXP30-12, CXP26-14, CXP22-16
32	Seat, Valve	6	18835A005	CXP18-20, CXP14-24
32	Seat, Valve	6	18835A006	CXP7-30, CXP5-35
32	Seat, Valve 316	6	18835A003	AB Models
33	Screw Cap	6	18832A000	All Models except AB
33	Screw Cap 316	6	18832A001	AB Models
34	Retainer, Spring	6	18833A001	All Models
35	Spring, Valve	6	11829A000	All Models
36	Spring, Valve	3	18462A000	All Models except CXP7-30, CXP5-35
37	Cap, Valve SS	6	24893A000	AB Models
37	Cap, Valve Iron	6	24893A001	All Other Models
38	Plate, Seal	3	24895B000	CXP30-12
38	Plate, Seal	3	24895B001	CXP26-14
38	Plate, Seal	3	24895B002	CXP22-16
38	Plate, Seal	3	24895B003	CXP18-20
38	Plate, Seal	3	24895B004	CXP14-24
38	Plate, Seal	3	24895B005	CXP7-30
38	Plate, Seal	3	24895B006	CXP5-35
38	Plate, Seal 316	3	24895B010	CXP30-12AB
38	Plate, Seal 316	3	24895B011	CXP26-14AB
38	Plate, Seal 316	3	24895B012	CXP22-16AB
39	Washer, Seal	3	24894A000	CXP30-12
39	Washer, Seal	3	24894A001	CXP26-14
39	Washer, Seal	3	24894A002	CXP22-16
39	Washer, Seal	3	24894A003	CXP18-20
39	Washer, Seal	3	24894A004	CXP14-24
39	Washer, Seal	3	24894A005	CXP7-30
39	Washer, Seal	3	24894A006	CXP5-35
40	Seal, High Pressure	6	24897A001	CXP30-12 (Use for both high and low pressure seal)
40	Seal, High Pressure	3	24897A002	CXP26-14
40	Seal, High Pressure	6	24795A001	CXP22-16
40	Seal, High Pressure	6	24795A002	CXP18-20
40	Seal, High Pressure	6	24795A003	CXP14-24
40	Seal, High Pressure	6	24795A004	CXP7-30
40	Seal, High Pressure	6	24795A005	CXP5-35

Ref. No.	Description	Qty. Req'd.	Part No.	Model
41	Male Adapter	3	24793A000	CXP22-16
41	Male Adapter	3	24793A001	CXP18-20
41	Male Adapter	3	24793A002	CXP14-24
41	Male Adapter	3	24793A003	CXP7-30
41	Male Adapter	3	24793A004	CXP5-35
41A	Female Adapter	3	24794A000	CXP22-16
41A	Female Adapter	3	24794A001	CXP18-20
41A	Female Adapter	3	24794A002	CXP14-24
41A	Female Adapter	3	24794A003	CXP7-30
41A	Female Adapter	3	24794A004	CXP5-35
41B	O Ring	3	05876A160	CXP22-16
41B	O Ring	3	05876A159	CXP18-20
41B	O Ring	3	05876A161	CXP14-24
41B	O Ring	3	05876A162	CXP7-30
41B	O Ring	3	05876A163	CXP5-35
41	Ring, Back-Up	3	24898A001	CXP30-12
41	Ring, Back-Up	3	24898A002	CXP26-14
42	Plunger, Ceramic	3	24896B000	CXP30-12 (1⅝)
42	Plunger, Ceramic	3	24896B001	CXP26-14 (1½)
42	Plunger, Ceramic	3	24896B002	CXP22-16 (1⅜)
42	Plunger, Ceramic	3	24896B003	CXP18-20 (1¼)
42	Plunger, Ceramic	3	24896B004	CXP14-24 (1⅛)
42	Plunger, Ceramic	3	24896B005	CXP7-30 (1)
42	Plunger, Ceramic	3	24896B006	CXP5-35 (⅞)
43	O Ring	6	05876A030	All Models
44	Back-Up Ring	6	18753A004	All Models
45	O Ring	3	05876A158	All Models
46	Gasket, Flange	1	24792B000	All Models
47	O Ring	3	05876A092	All Models
48	Seal, Low Pressure	3	24899A002	CXP26-14
48	Seal, Low Pressure	3	24899A003	CXP22-16
48	Seal, Low Pressure	3	24899A004	CXP18-20
48	Seal, Low Pressure	3	24899A005	CXP14-24
48	Seal, Low Pressure	3	24899A006	CXP7-30
48	Seal, Low Pressure	3	24899A007	CXP5-35
49	Fitting	2	09009A013	All Models
49	Fitting Straight	1	10519A002	All Models
49A	Fitting 90°	1	23188A001	All Models
50	Tube	1	10649A125	All Models
51	Studs	8	05659A116	All Models
52	Nut, Hex	8	19109A026	All Models
53	Washer, Lock	8	05454A005	All Models
54	Plug, Pipe 1½"	1	5022A016	All Models except AB
54	Plug, Pipe 1½"	1	5022A074	AB Models
55	Plug, Pipe 1½ for Fitting	1	5022A076	All Models except AB
55	Plug, Pipe 1½ for Fitting	1	5022A075	AB Models
57	Plug, Pipe 1	1	5022A043	All Models except AB
57	Plug, Pipe 1	1	5022A064	AB Models

LUBRICATION AND SERVICE
CXP SERIES INDUSTRIAL PUMPS

LUBRICATION

Pump — Crankcase must be filled with 2 to 2½ pints of S.A.E. 30 oil unless ambient temperature exceeds 90° F. when S.A.E. 40 should be used. Use only quality oils with S.A.E. designation MS, SC, or SD; maintain level at mark on dipstick. Foaming and yellow discoloration of oil is an indication of water; oil should be changed immediately to preclude possible damage to power and components.

NOTE — Drain oil from crankcase after first 30 hours of operation. It is best to always drain the oil when it is still hot. Refill with new oil as mentioned above. Run pump at full speed under no pressure for 2 or 3 minutes before returning to operation. Thereafter change oil every 300 hours or immediately if water droplets are found on dip stick. Check oil level regularly and add oil as needed.

Avoid Freezing by draining all water from pump and system in cold weather. This can be done by breaking suction connections, removing pipe plug from front face of pump and turning crankshaft over 4 or 5 times, or the fluid end can be removed to completely drain cylinders and fluid end.

SERVICE

(Caution — Disconnect electrical leads to motor or remove spark plug leads on engine before proceeding)

PLUNGER SEAL SERVICE

Removal: Remove 8 nuts holding fluid end to power end and pull straight forward. Use care with ceramic plunger pumps. Unscrew plunger from top opening and pull plunger out. Use screwdriver to pry the seal housing out. May take use of the crosshead to push seal housing out by inserting a block between crosshead and seal housing.

When replacing plunger seal, clean all plungers, replace and lubricate "O" rings. Ceramic plungers should be cleaned by soaking in muriatic acid to remove all build-up of packing material. **Caution! Avoid direct contact with muriatic acid. Wear protective gloves and eye protection. If exposed, flush exposed area with water. Consult a physician for treatment of muriatic acid burns.** Clean bore and lubricate "O" rings and plunger seal with a quality water proof grease before replacing seal housing and plunger. The plunger should be inserted into crosshead. Hand turn all the way until it stops. Use wrench to finish. Torque to 45 ft.-lb. With the seal housing seated properly, and the plunger fastened to crosshead, all internal parts in place in fluid end, the fluid end can be replaced. Be sure to install flange gasket between fluid end and power end when reassembling.

Insert all nuts & lock washers in place and pull fluid end down tight. Do not cock fluid end while tightening, pull down evenly by alternately tightening to final torque 25-30 ft.-lb.

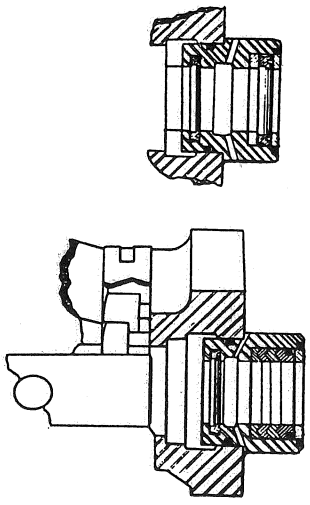
VALVE SERVICE

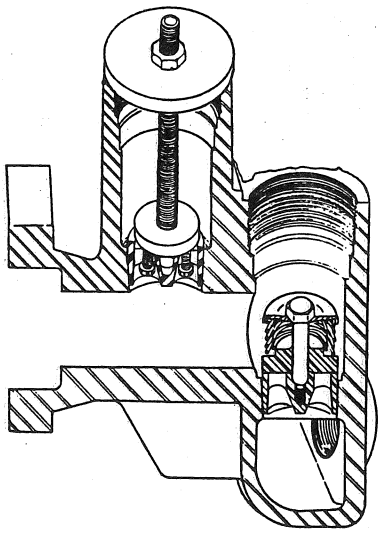
Remove the stainless steel shoulder screw which serves as a valve guide and spring retainer. The shoulder screw can be removed with a socket. Remove shoulder screw, spring retainer, spring and valve from the pump fluid end.

Use Kit 19555B. Assemble stud, retainer and three LARGE screws as shown. Insert screw heads thru holes in valve seat, rotate retainer to right until heads catch, and secure in place by screwing down stud firmly by hand. Place plate over stud, screw on nut, and torque slowly with wrench until seat breaks loose.

Both valve seats are identical and can be serviced same way.

NOTE: Valve seats are usually distorted and cannot be reused unless face is reground to flat condition.





SERVICING CRANKCASE PARTS

To remove crankshaft (8) the plungers and fluid end must first be removed, as explained earlier. Drai oil from crankcase and remove rear cover (6). Remove retainer ring (11) from bearing bore. The connecting link caps should be taken off and the free links pushed toward the water end as far as possible. BEFORE REMOVAL, BE SURE TO NOTE THE MARKINGS ON THE CONNECTING LINKS AND CAPS. THESE PARTS ARE NOT INTERCHANGEABLE AND MUST BE REASSEMBLED IN THEIR ORIGINAL POSITIONS. The crankshaft (8) bearings (9) and bearing cap (13) can now be removed by tapping with a hammer against a block of wood on one end of the crankshaft. The crankshaft should be supported so that as the bearings leave the bores the crank does not drop and damage a crank pin. See Fig. 3. Do not remove bearing (9) from crankshaft (8) unless replacement is necessary. After removing crankshaft, the links and crosshead can be pulled out the crankcase opening.

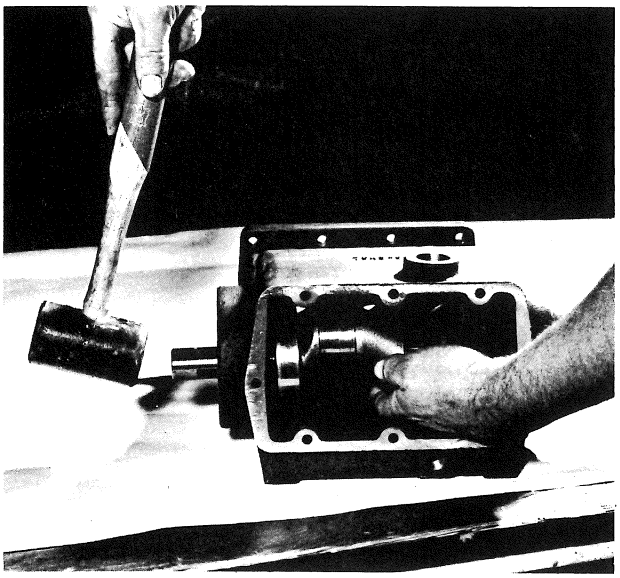


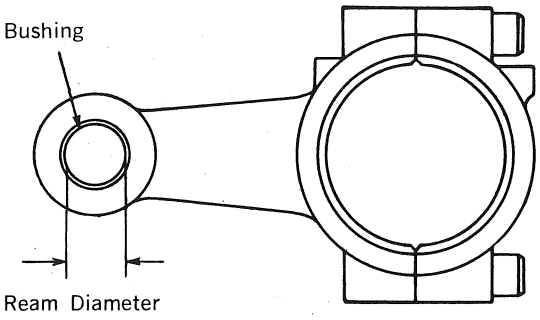
Fig. 3

SERVICING CONNECTING LINKS

The connecting rod link is furnished with replaceable split sleeve bearing inserts at the crank throw and a steel backed bushing at the crosshead end. When new replacement links are obtained, these bushings are reamed to the proper size for immediate installation. If the bushing only is removed from an old link, it may be necessary to ream the replaced bushing to the proper inside diameter after it is pressed into the link. When placing the bushing in the link be sure that the oil holes in the bushing and link will be in line after the bushing is pressed into position. Fig. 4 shows the proper diameter to which the bushing must be reamed for proper seating of the crosshead pin.

The connecting links should be checked for bearing wear only if the pump shows signs which might be due to a failing link or during a general overhaul. Unnecessary inspections may upset smooth operation and ultimately cause failure. If it becomes necessary to replace a link or crosshead, this can be done by driving out the link pin (25). When replacing the pin an arbor press should be used and care should be taken so that the link is not bent. As the pin is pressed in occasionally the two sides of the crosshead will give enough to grip the link so that it will not operate freely. If this occurs, rotate the link and crosshead 180° and rap the pin sharply in the opposite direction.

Always be sure that the proper side of the link is placed upward when attaching it to the crankshaft. The upper side contains three oil holes. These oil holes must be up to allow proper oil feeding.



Bushing Ream Dia. .6890 to .6894

Fig. 4

It is never practical to attempt to re-fit connecting links to the crankshaft by filing or grinding the face of the link cap where it contacts the link. Torque for link bolts not to exceed 65-75 inch/lbs. or 6 ft./lbs. Under normal conditions a crosshead will not wear nor will the bore of the crankcase wear to the extent that oversize crossheads will be required. If extreme wear does occur, it will be due to severe damage from the lack of oil or a fairly large metal object scoring the crosshead bore. A clearance of .002" to .004" is standard for the crosshead. The parts can wear until considerably more clearance than this exists before harmful operation will occur.

RECONDITIONING CRANKSHAFTS

When only a very small amount of damage has occurred on the crank pins, such as small surface grooves cut part way around the bearing surface, the crank pins can sometimes be reconditioned for further use. This can be done with emery cloth and polishing until all ridges are completely removed. The final polishing operation should be performed by using a very fine emery cloth. This procedure can only be followed where the amount of sanding does not reduce the normal diameter of the crank pin.

If the crankshaft cannot be refinished by hand in this manner, it will be necessary to regrind and polish the bearing surfaces for special undersize bearings.

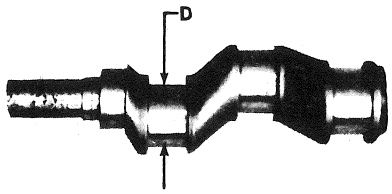


Fig. 5

Crank Pin Size "D" Standard—Use Standard Link Bearing 18837A100 (2 reqd. per link)	1.873 to 1.874
Size "D" for Reconditioned Shaft. Use Undersize Link Bearing 18837A20 (2 reqd. per link)	1.843 to 1.844

Fig. 5 shows the crankshaft with the crank pin sizes tabulated for both standard diameter and the undersize diameter that should be maintained. Worn or corroded crank pins can be ground and polished down to .030" under the size when the cranks were new. When this is done the surface should be polished to a good smooth finish. The undersize connecting links are made especially for turned down crankshafts. If the crankshaft has been reground to dimension "D" for reconditioned shafts, the undersize links can be used and will fit properly and operate as well as the original equipment.

If the surface is badly damaged, the crankshaft can often be salvaged by "metallizing" the crank pins and then regrinding and polishing to the original diameter.

REPLACING CROSSHEAD SEALS

With the crankshaft and crossheads removed, the worn seals (27) can be pried out. When installing new seals be sure to place them with the lip facing the power end and the metal face toward the water end. After cleaning the cavity and wiping with oil, the seal can be pressed into place with an arbor press or by tapping lightly with a hammer against a block of wood. The seals should be pressed in (27) as shown in cutaway pump view. When returning crossheads thru new seals care should be taken not to turn back or damage the lip of the seal. An assembly thimble can be very helpful in this operation. Fig. 6 illustrates an assembly thimble being placed on the end of the crosshead. Fig. 7 shows a recommended thimble for installation of oil seals.

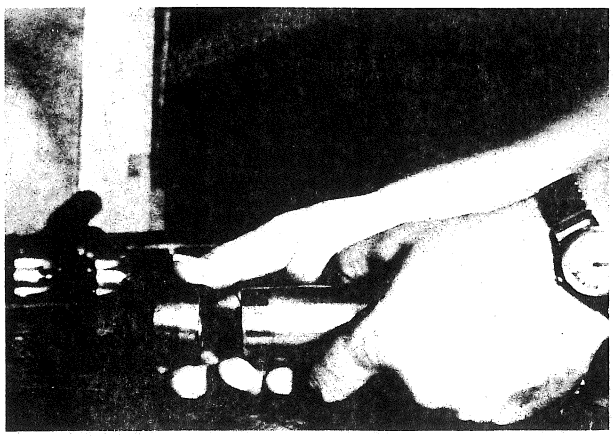


Fig. 6

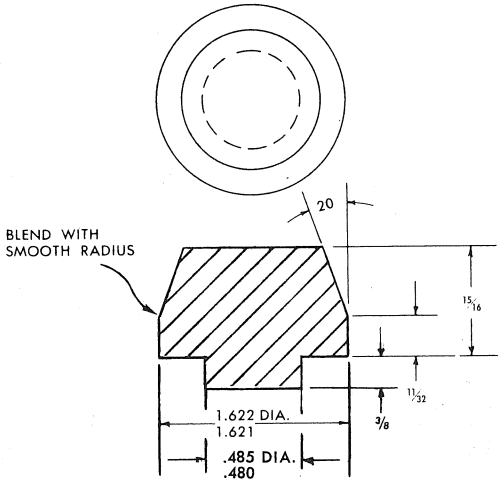


Fig. 7

After replacing the crossheads and links, they should be pushed all the way forward; then the crankshaft can be replaced just as it was removed. All link caps should be tightened in place and free operation of the crank assured before replacing bearing cap and retainer ring. When replacing bearing cap, an assembly thimble as shown in Fig. 8 is helpful. The thimble should be machined from high carbon steel and polished on the exterior to reduce possibility of seal lip damage. Clean and lubricate all seals and "O" rings before replacing.

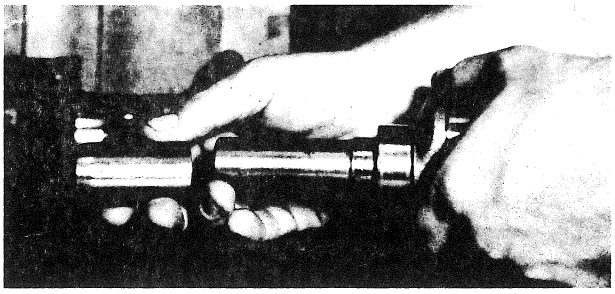
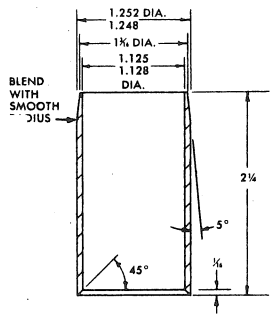


Fig. 8



SERVICE CHART/TROUBLE SHOOTING GUIDE

A	Failure of pump to build pressure with discharge closed						
B	Failure to hold pressure with discharge open						
C	Pump is noisy						
D	Pump gets hot						
E	Pressure gauge shows abnormal fluctuation						
F	Water in crankcase						
	POSSIBLE CAUSE OF PROBLEM	F	E	D	C	B	A
1.	Pump not primed						X
2.	Valve closed in suction line				X		X
3.	Suction line or sediment chamber clogged				X	X	X
4.	Air leaks in suction line				X	X	X
5.	Badly worn packing material	X				X	
6.	Pump cylinder cracked						X
7.	Nozzle hole too large					X	
8.	Air chamber waterlogged		X		X		
9.	Need vacuum chamber in suction line				X		
10.	Moisture or water in crankcase			X			
11.	Worn connecting links			X	X		
12.	Foaming spray mixture		X		X		X
13.	Regulator plunger stem sticks		X				
14.	Pressure regulator badly worn					X	X
15.	Foreign matter under pump valve					X	
16.	Badly worn or loose belts					X	X

WARNING — THIS PUMP MUST BE INSTALLED WITH A PRESSURE RELIEF VALVE IN DISCHARGE LINE.

Explanation of the Service Chart

1. Pump priming is usually not necessary when the pump is installed correctly. However, there are certain unusual conditions which may make it necessary to prime the pump to get the pumping action started. Priming will be required under conditions where it is impossible for the plunger to displace the air in the pump and replace it with water. This could be caused by a high suction lift (high from the water supply to the pump), the valves being stuck on the seat, such as after pumping a sticky fluid, or it might be caused by valves sticking due to extreme corrosion of the valves and seats. A pump will not prime readily if someone has tampered with the valve springs causing them to exert undue pressure of the valve plates against the valve seats. When the pump appears to need priming this condition can be checked by pouring water into the cylinder body through one of the valve cap openings or into the pump discharge opening at the same time operating the pump to work the water into the cylinder and valve passages.

2. Frequently a gate valve is installed in the suction line between a tank or pressure line and pump sediment chamber. This valve is usually installed in the line to shut off the supply source for cleaning sediment chamber or for pump repairs.

If this valve is closed or even partially closed it will interfere with the flow of water to the pump suction to such an extent that the pump will not perform to full capacity. If the valve is partially closed it may cause severe knocking and vibration of the pump because the water cannot flow into the cylinder cavities fast enough.

3. A sediment chamber should be installed in the suction line between the gate valve and the pump suction.

The strainers in these sediment chambers are of more than adequate capacity to allow a free flow of the liquid to the pump. However, because of its normal function of collecting sediment the strainer may become severely clogged and in some cases, it will completely stop the flow of liquid to the pump. The length of time the pump may operate before it is necessary to clean the strainer will depend upon the type of liquid pumped. After the pump has been used a short period the operator will soon become familiar with the amount of running time between strainer cleanings.

4. Any plunger pump, when operated at high pressure will not operate satisfactorily or quietly if a mixture of air and water is allowed to enter the pump suction. For this reason, a small air leak in the suction line will cause the pump to knock and vibrate excessively. This holds true only for a small air leak which allows the pump to draw a certain amount of water mixed with air on each stroke of the plunger. A large air leak will cause the pump to lose prime after which it cannot be reprimed until the air leak is stopped. Air leaks may occur at the joints of the suction line piping, at the gate valve in the suction line, at the gasket sealing the cap on the sediment chamber or by a crack in the suction wall of the cylinder body, such as might be caused by freezing if the pump is not properly drained in freezing weather. There is also a remote possibility of air drawing past the piston on the suction stroke if the packing is badly worn.

5. Badly worn packing or valves and valve seats will cause a serious drop in pump capacity. This will be indicated by a drop in pressure when guns are turned on. Worn packing is very easy to detect because of the water leakage. The packing should be replaced just as soon as this leakage is noticed. If it is allowed to continue some of the material may work past the oil seals into the pump crankcase. Water in the pump crankcase will cause severe corrosion of the bearings causing them to fail. Worn valves can only be detected by visual examination of each valve assembly. The most prevalent cause of valve wear is the use of highly abrasive liquids. This will cause the valve and valve seat to wire cut. The cut starts as a very small groove but increases very rapidly once the valve starts to leak through this groove. Cutting will usually be much more evident on the valve plate in flat valve pumps. If the valve plates are replaced as soon as they start to show this cutting action it will prevent the valve seat from becoming cut in a similar manner and keep the cost of replacement parts to a minimum.

6. Pump fluid end body must withstand an extreme amount of shock and pulsation while the pump is in operation. If the pump is allowed to freeze, due to not being drained, the freezing may crack the fluid end body in almost any location. If the crack should occur on the suction valve or fluid end body it may allow a small amount of air to enter on the suction stroke and cause noisy operation or a decrease in pumping capacity. If the crack develops in the walls between the compression chamber it may allow the water to flow from one cavity to the adjacent cavity and rob the pump of its effective displacement. This will not cause noisy operation but will reduce the pump capacity and may show up as a drop in pressure when the discharge is open.

7. The holes in gun or nozzle discs are continually subject to wear because of the high velocity of the liquid through the holes. Naturally they wear much faster if there is any abrasive or solid material in the liquid. If the holes become worn too much they may allow a higher rate of discharge than the pump is able to provide and a drop in pressure will be noticed. This can quickly be checked by reducing the number of nozzles or guns and at the same time watching the amount of overflow from the pressure regulator. If there is considerable overflow, even though a drop in pressure has been noticed, it is an indication that the regulator valve is worn rather than the gun or nozzle discs.

8.. When a pump is used for a long period of time without the source of supply being completely exhausted so that air can enter the pump we sometimes encounter a waterlogged air chamber. This decreases the effectiveness of the air chamber causing undue pulsation at the discharge. If this should happen the suction should be open to atmosphere at some point to allow air to be drawn through the pump to recharge the air chamber. This should be done with the pressure release valve open so the pump operates at no pressure, otherwise it will not pump air into the air chamber.

9. Suction surge arresters should be installed on the suction line of reciprocating pumps. A rubber bag type of suction surge arrester is preferred but a suitable vacuum chamber can be made by attaching a piece of vertical pipe as close to the pump suction as possible. One and one-half or two inch pipe can be used. A standing height of 12" to 15" will be sufficient with the top end closed by an ordinary pipe cap.

10. Water may accumulate in the pump crankcase from two sources; the most prevalent being leakage of the packing as explained in Paragraph 5. The other means of accumulation being a condensation of moisture inside the crankcase due to changes in weather or the repeated heating and cooling of the pump due to its normal usage. Pumps that are used rather consistently and run for a considerable period of time to heat the oil and other working parts will not normally accumulate water by condensation. If the packing is replaced as soon as it starts to leak it will be impossible for water to enter the crankcase from this cause. In localities or conditions where extremely abrasive liquids must be used, it is advisable to replace the plungers at the same time the worn packing is replaced. New packing will not give satisfactory service if it is placed in a badly worn and roughened plunger surface.

11. Worn connecting link bearings will only develop because of unusual or adverse operating conditions. They will, however, be seriously affected by corrosion if water is present in the crankcase and they will wear out from overheating if adequate oil is not provided in the crankcase. For this reason we recommend thorough draining, cleaning and refilling with new oil prior to any storage period. Replace bearings as soon as any damage is discovered to avoid possible damage to crankshaft. (See Lubrication instructons.)

12. A foaming mixture will sometimes have the same effect as a small air leak in the suction line. This is because various quantities of the foam is drawn through the suction line into the pump disrupting the normal flow of water.

13. Pressure regulators that are operated by plunger action may become sluggish in action due to the plunger sticking or fitting too tightly in its cylinder. This condition may be caused by an accumulation of chemicals collecting in and around the plunger, or may be due to excessive corrosion of the plunger parts. To check this condition, remove and clean the plunger. After cleaning the plunger, parts should be covered with a waterproof grease before assembling.

14. In some cases there is a tendency for the pressure regulator valves to chatter or vibrate excessively. This is an indication of unstable operation due to nozzling in the high or low capacity range of the regulator. On systems using pressure regulator valves, the nozzling requirements should be at least 50% and not exceed 90% of pump capacity. Due to nozzle disc wear, the system requirements may exceed the 90% limit, resulting in cycling or hammering of the regulator. This can readily be checked by replacing the worn discs with new discs.

15. If a large piece of foreign matter becomes lodged between a pump valve and valve seat or if something of this kind becomes wedged in so that it prevents the valve from operating normally we can expect drastic drop in capacity and considerable surge or pulsation will be noticed in the discharge line. To correct a condition of this kind it is usually necessary to examine each valve in the pump until the offending condition is located. The use of clean liquid and seeing that the suction strainer is in proper condition will prevent trouble of this kind.

16. If the V-belts have a tendency to wear rapidly, it may be due to having the belt tightener pulley adjusted too far into the belt, throwing a reverse bend in the belt where it passes over the pulley. If very much reverse angle seems necessary to keep the belt tight, other provisions should be made for tightening, such as placing shims under the pump base or otherwise spreading the drive centers enough to take up the belt length. On multiple V-belt drives, a complete set of belts should be installed when making a replacement. Further, all the belts in one set should be checked for length and accurately matched to avoid placing an undue load on any one belt.

Myers®
Pentair Pump Group

1101 Myers Parkway, Ashland, Ohio 44805-1969 • 419-289-1144 • Fax: 419-289-6658

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