SC-170DD TRIPLEX

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ILLUSTRATED PARTS BREAK DOWN

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MYERS/APLEX INDUSTRIES, INC.
Ashland, Ohio U.S.A.
SC-170DD TRIPLEX PLUNGER PUMP

POWER END ENGINEERING DATA

Model Triplex Pump	SC-170DD
Max. Input HP @ Speed	230 @ 450 rpm
Rated Continuous Plunger Load	14,280 lbs
Stroke	4 1/4”
Max. Rated Continuous Speed	450 rpm
Normal Continuous Speed Range	150 to 420 rpm
Minimum Speed	100 rpm
Oil Capacity	18 U.S. qrts
Viscosity, S.S.U. @ 210°F	70 to 84
Power End Oiling System	Pressure Lubrication
Power Frame, One-Piece	Cast Iron
Crosshead, Full Cylindrical	Cast Iron
Crosshead, Dia. x Length	5 3/4” x 6 3/16”
Crankshaft	Forged Steel and Nitrided
Crankshaft Diameters:	
At Drive Extension	3.750/3.749”
At Tapered Roller Bearings	4”
At Crankpin Bearings, Dia. x Length	4” x 3”
Crosshead (Wrist) Pin, Case-Hardened and Ground	AISI 8620
Wrist Pin Bushing, SAE 660, Dia. x Width	2” x 3”
Main Bearings, Tapered Roller	Timken
Crankpin Bearings, Precision Automotive	Steel Backed, Babbitt-Lined
Extension (Pony) Rod:	
Diameter	2”
Material	17-4PH S.ST.
Connecting Rod, Automotive Type	Ductile Iron
Average Crosshead Speed:	
At 450 rpm	318 fpm
Minimum Life Expectancy, Main Bearings, L_{10}	45,000+hr

LIQUID END ENGINEERING DATA

Piston Size Range, diameter	4” Thru 4 1/2”
Max. Continuous Working Pressure	2,020 psi
Hydrostatic Test:	
Discharge	3,250 psi
Suction	425 psi
Discharge Connection Size	3” ANSI 600FF
Suction Connection Size	6” ANSI 150FF

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SC-170DD LIQUID END ENGINEERING DATA (*CONTINUED*)

Liquid End Materials, A.S.T.M.
- Ductile Iron A536 80-55-06

Piston Liner:
- Chromed Steel 4140
- High Chrome Iron 4140

Piston Cups Available:
- Urethane
- Nitrile
- HSN and Kevlar

Seals, Stuffing Boxes, Valve Covers, Cyl. Heads ..... Teflon

Studs, Material, A.S.T.M. ..... A193 Gr. B7, Cadmium Plated

Valve Type:
- Regularly furnished ..... Abrasion Resistant

Valve Spring Material ..... Inconel

Valve Seat, Liquid Passage Areas ..... 5.15 sq. in.

Avg. Liquid Velocity,4" plungers @ 450 rpm:
- At 450 crankshaft rpm : ..... 12.9 fps
- Suction Manifold ..... 3.4 fps
- Discharge Manifold ..... 16.3 fps

SC-170DD GENERAL ENGINEERING DATA

Overall Dimensions:
- Length ..... 50 3”
- Width ..... 42 5/8”
- Height ..... 291/4”

Approximate Weight:
- With Ductile Iron Liquid End ..... 2415 lbs

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MYERS/APLEX

ASHLAND, OHIO USA

TRIPLEX PISTON PUMP

Model SC-170DD Serial XXXX

Rated Max HP 230 @ RPM 450

Rated Max Plunger Load, Lb. 14,280

Year Built XXXX Fluid End D.IRON

U.S. Patents 4477236 and 4520842

Plunger Diameter Inches,	Max. Rated Discharge Pressure, PSI	Displacement	
		U.S. Gallons Per Revolution	U.S. GPM @ Rated RPM
4.500	900	.8778	395
4.250	1000	.7830	352
4.000	1136	.6936	312

Relief Valve: Pump must be protected by an adequate relief valve, with set pressure not over 25% above the pressure rating of the plunger installed.

Speed Rating: Rated speed is based on cold water and a well-designed suction system. Reduced speed and horsepower ratings result for hot, or abrasive, or viscuous liquids. Consult Aplex, Inc. for specific recommendation.

Displacement: Actual capacities delivered will depend on condition of valves and the compressibility characteristics of liquid and the pressures pumped.

Lubrication: Use non-detergent industrial turbine oil of S.A.E. viscosity classification of 10W-40; or 70 to 84 S.S.V. at 210 F.

Crankcase capacity 15 U.S. Quarts

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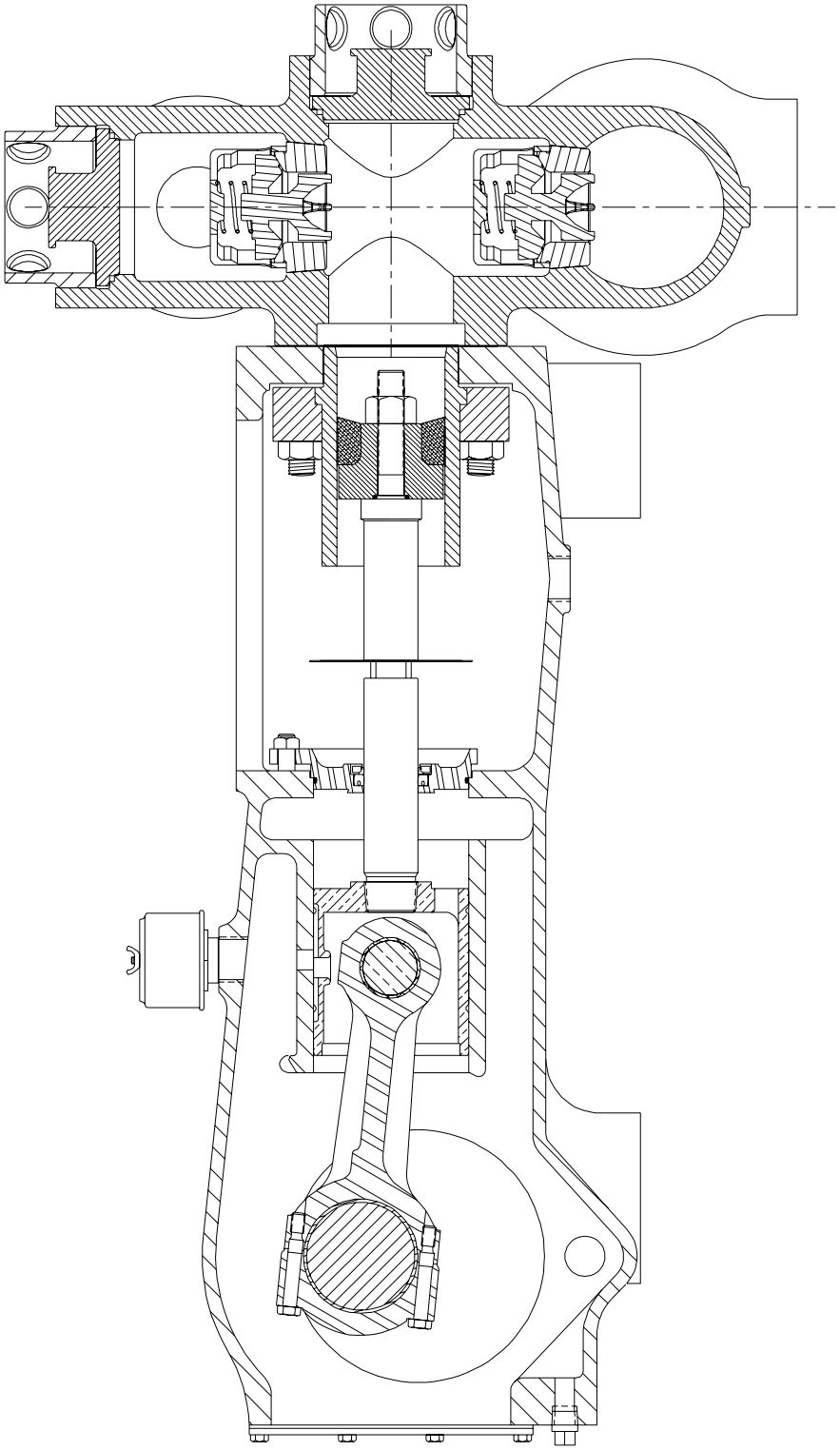

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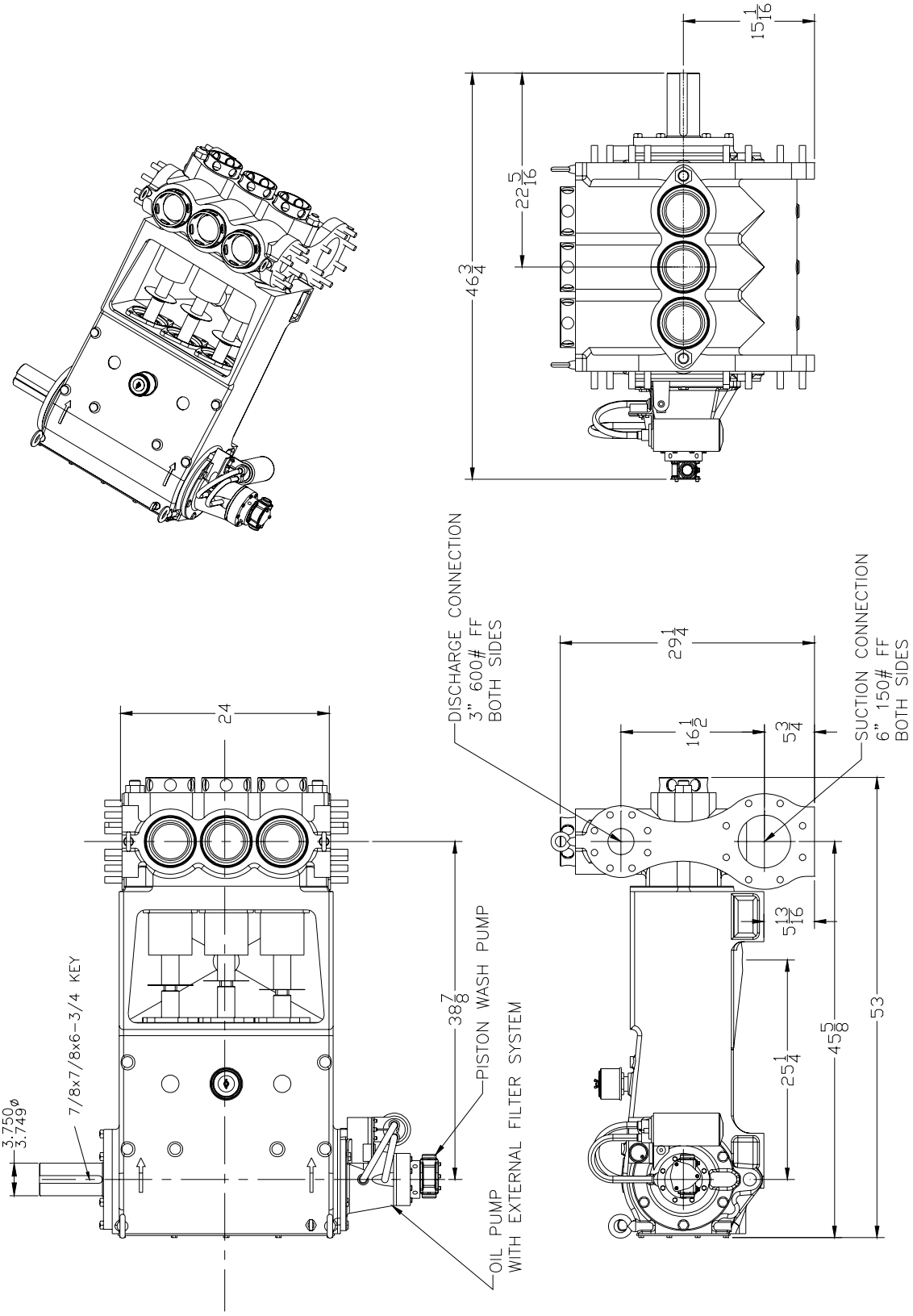

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INSTALLATION, OPERATION, LUBRICATION, MAINTENANCE AND STORAGE INSTRUCTIONS

SAFETY

Electrical power or engine must be shut off completely before attempting service on the pump or its drive. Air surrounding the unit to be free of toxic, flammable, or explosive gases.

Tools needed should be planned for in advance, (see valve seat pulling instructions), and should be clean and of adequate size. A torque-wrench will be required to tighten connecting rod cap screws.

A properly sized and set relief valve installed in the pump discharge system (ahead of any block valves) is necessary to protect personnel and to avoid dangerous overpressure. The relief valve set pressure should be not more than 25% above the design operating pressure and should discharge to tank or to the atmosphere (toward the ground), and must *not* be directed back to the pump suction system.

WARNING: *Improper use of this equipment could result in loss of life....*

STORAGE

Pumps are shipped dry from the factory. If a pump has been in storage in a humid environment for more than 6 months the crankcase cover should be removed and carefully examined for rust or water collected in the power end. Flush out any evidence of rust or damage which exists, using a light clean oil.

Pumps to be placed in extended storage should be cleaned, repaired as needed, and completely filled to the top with clean oil to prevent rusting. Rotate pump monthly 4 1/2 resolutions. Plug all openings to prevent air entry and oil leakage.

Fluid ends must be completely drained of water and suction and discharge ports blanked off. Store pump in a clean, dry location.

PUMP LOCATION & PIPING DESIGN

Locate pump and driver in a clean, well drained, ventilated, and brightly illuminated area, with adequate working spaces around the pump to provide ample access to fluid end, power end, and associated drive elements. Do *not* expect good maintenance to result if the pump is positioned on muddy terrain, or in a dirty, cramped, dimly-lighted area!

The supply tank(s) should be large to allow dissolved air and other gases to escape from the liquid and allow suspended solids to settle out before entering pump. A system employing dams and settling chambers is desirable.

Pumps are *not* designed to withstand piping weight, vibration, and the effects of thermal piping expansion/contraction. Piping loads may be considerable and the weight of all valving, dampeners, filters, and associated forces, moments, and couples must be completely isolated. Use flexible hoses and rigid piping supports to isolate the pump and its driver from these effects.

SUCTION PIPING

No part of the piping system deserves more careful planning than the suction piping system. Suction piping must be **SHORT, DIRECT,** and **OVERSIZE**. Use one pipe size larger than the pump suction connection. For example, since the suction connection for the SC-170DD pump is 6", use a 8" short, direct suction line from tank to this pump. The shorter it is, the better! 1 to 3 feet per second suction velocity is acceptable.

Use no elbows, tees, or restricted port valves in this line. Do *not* install orifice plates or positive displacement type fluid meters in the suction line which act as flow restrictors. Avoid the use of suction filters, if possible. Consider filtering the liquid as it *enters* the supply tank rather than as it *leaves* it. The use of an eccentric reducer with the flat side up located at the pump suction connection is recommended. The suction line should slightly rise from tank to pump and loops in which air may collect must be avoided.

The absolute pressure in a suction line may be less than atmospheric pressure and air may be "sucked" into the line unless all flanges and connections are airtight and watertight. If you can

see water leaking out of a suction line when the pump is still, that may mean air is being sucked in when the pump is running.

Suction piping should be buried beneath the frost line, or insulated to avoid freezing in the winter. If the suction line has a block valve at the supply tank, a suitable relief valve is suggested to relieve the suction piping from any possible dangerous overpressure from the discharge piping system.

Suction piping is often large, heavy (especially when filled with liquid), and tends to vibrate. Proper solid supports are recommended. A suction hose located near the pump will isolate these effects, protecting the pump from the forces and moments that piping weight creates.

New suction piping systems should be flushed free of pipe scale, welding slag, and dirt before starting the pump. Hydrostatic testing to detect air leaks is advisable. Proper choice of suction hose construction is essential to avoid collapse of the hose liner.

Install a dry type compound gage in the suction line near the pumps which should fluctuate evenly. If violently pulsating, this gage indicates that the pump is not fully primed, or that one or more valves are inoperative.

ACCELERATION HEAD

A characteristic of all reciprocating pumps is the imperative need to consider the effects of acceleration head which is a **SYSTEM** related phenomenon. Acceleration head may be considered to be the loss of available hydraulic head (energy) in the piping system occurring because the demand by the pump cylinders for liquid is not smooth and even. Because the pump's demand for liquid is cyclical, the velocity of the liquid in the entire suction system is not truly constant but varies in response to the combined demand of the reciprocating plungers. Thus, liquid in the suction system is compelled to be accelerated and decelerated several times during each crankshaft revolution, depending on the number of plungers. Called "acceleration" head, this loss of available hydraulic head is proportional to:

(a) The speed (RPM) of the crankshaft
(b) The average liquid velocity in the piping
(c) The length of the suction piping
(d) The number of pumping chambers (triplex, etc.)
(e) The compressibility of the liquid

Thus, for a given pump, acceleration head effects may be reduced by the use of the shortest possible suction line, sized to reduce liquid velocity to a very low speed. This is often more economical than the use of charge pumps, or expensive suction stabilizers.

NOTE: *Charge pumps should be sized to 150% of rated pump volume. Charge pumps need to be centrifugals not a positive displacement pump.*

A charging pump is usually *not* a good substitute for a short, direct, oversize suction line, nor is it a substitute for the computation of available **NPSH**, acceleration head, friction head, vapor pressure and submergence effects duly considered. Required **NPSHR** of Myers/Aplex pumps depends on speed, choice of plunger size, and valve spring type. Consult Myers/Aplex Engineering for help with your particular application. A full discussion of suction system losses is given in the Standards of the Hydraulic Institute, 14th Edition.

A common design mistake is the connecting of two (or more) reciprocating pumps to a **COMMON** suction header. This is a profoundly complicated suction system, largely not amenable to mathematical analysis, and is frequently the cause of severe pump pounding, vibration and early valve failures. Each pump should be fed by its own separate, individual piping system, free from the effects of other pump cyclical demands for liquid.

DISCHARGE PIPING

A properly designed discharge piping system usually obviates the need of a pulsation dampener. The most common mistakes made in the design of the discharge piping system are:

Pumping *directly* into a tee or header. A "standing" wave (either audible or sub-audible) then often occurs. If flow must enter a header, use a 45° branch lateral (or equivalent) to avoid a reflecting surface from which sound can reflect.

Pumping into short radius 90° elbows. Instead, use two 45° elbows spaced 10 or more pipe diameters apart.

Pumping into a right angle choke valve.
Pumping into too small piping line size. Piping

should be sized to keep fluid velocity below 15 feet per second, max.

Pumping through an orifice plate, small venturi, or reduced port "regular opening" valve.

Pumping through a quick closing valve, which can cause hydraulic shock (water-hammer).

A good discharge piping system includes:

A properly sized, correctly set relief valve. Discharge from relief valve returned to tank (not to pump suction).

A full opening discharge gate or ball valve. Avoid restricting plug valves, globe valves, and angle valves.

A pressure gauge with gage dampener or snubber. Consider a liquid filled gauge. (Scale range to be double the normal pump operating pressure.)

Locate the relief valve and pressure gauge ahead of any block valve and so that the pressure in the pump is always reflected at the relief valve. The relieving capacity of the relief valve must exceed the capacity of the pump to avoid excessive pressure while relieving. Use a full size relief line.

To minimize vibration, (whether hydraulic or mechanical), discharge lines should be kept short, direct, well supported and solidly anchored. Avoid "dead" ends and abrupt direction changes.

BYPASS PIPING

Some designers ignore this important aspect of proper design of pump piping systems.

A reciprocating pump, especially after maintenance of the valves or plungers, **STARTS WITH ONE OR MORE FLUID CHAMBERS FULL OF AIR.** Pumps operating on propane, butane, or other volatile liquids **START WITH VAPOR IN THE FLUID CHAMBER(S).**

Positive displacement pumps do *not* automatically purge themselves of air and gas after shutdown. For example, a quintuplex plunger pump will, after servicing, expel the air in four of the five pump chambers. Thus, the pressure from four of the "active" cylinders will keep shut the discharge valve of the "inactive", or "air bound" cylinder. Then, the air or gas in this cylinder will be compressed and expanded by its reciprocating plunger, and never leave the chamber. Similar effects occur in duplex and triplex pumps.

To overcome these difficulties, adequate provision for expelling the gas in the "air bound" cylinders must be present. Common practice is to totally relieve the pump of all discharge pressure during the start-up, after servicing.

Consider the operational advantage of a full-sized bypass line (return to tank) which substantially removes discharge pressure from all cylinders during the start. This requires a block valve on the discharge side and a full opening bypass valve on the other side.

For economy, the bypass (to tank) can be combined with the relief valve discharge line. This line must be full-sized, well supported, and sloped downward to avoid freezing in cold weather. (A frozen relief valve line provides **NO** protection to either the pump or operating personnel!)

The ability of a reciprocating pump to be "self-priming" depends on the ratio of the swept (displaced) volume in the cylinder to the unswept (clearance) volume at the end of the stroke. This depends on the design of the fluid end and on the plunger size selected.

Choice of the largest size plunger for a particular fluid end improves this compression ratio and so leads to "self priming", or easy priming. Choice of the minimum size plunger sometimes leads to difficulties, especially with pumps that require frequent servicing, or which handle volatile liquids, or which contain substantial amounts of dissolved air or gas. An automatic bypass and purging system for these for these applications may be merited.

SUGGESTED PIPING SYSTEM FOR PLUNGER PUMPS

NOTES

1) CENTERLINE OF PUMP SUCTION (INLET) TO BE SLIGHTLY HIGHER THAN CENTERLINE OF SUCTION (INLET) VALVE-SO ANY AIR IN SUCTION SYSTEM PROMPTLY REACHES THE PUMP AND IS EXPELLED.

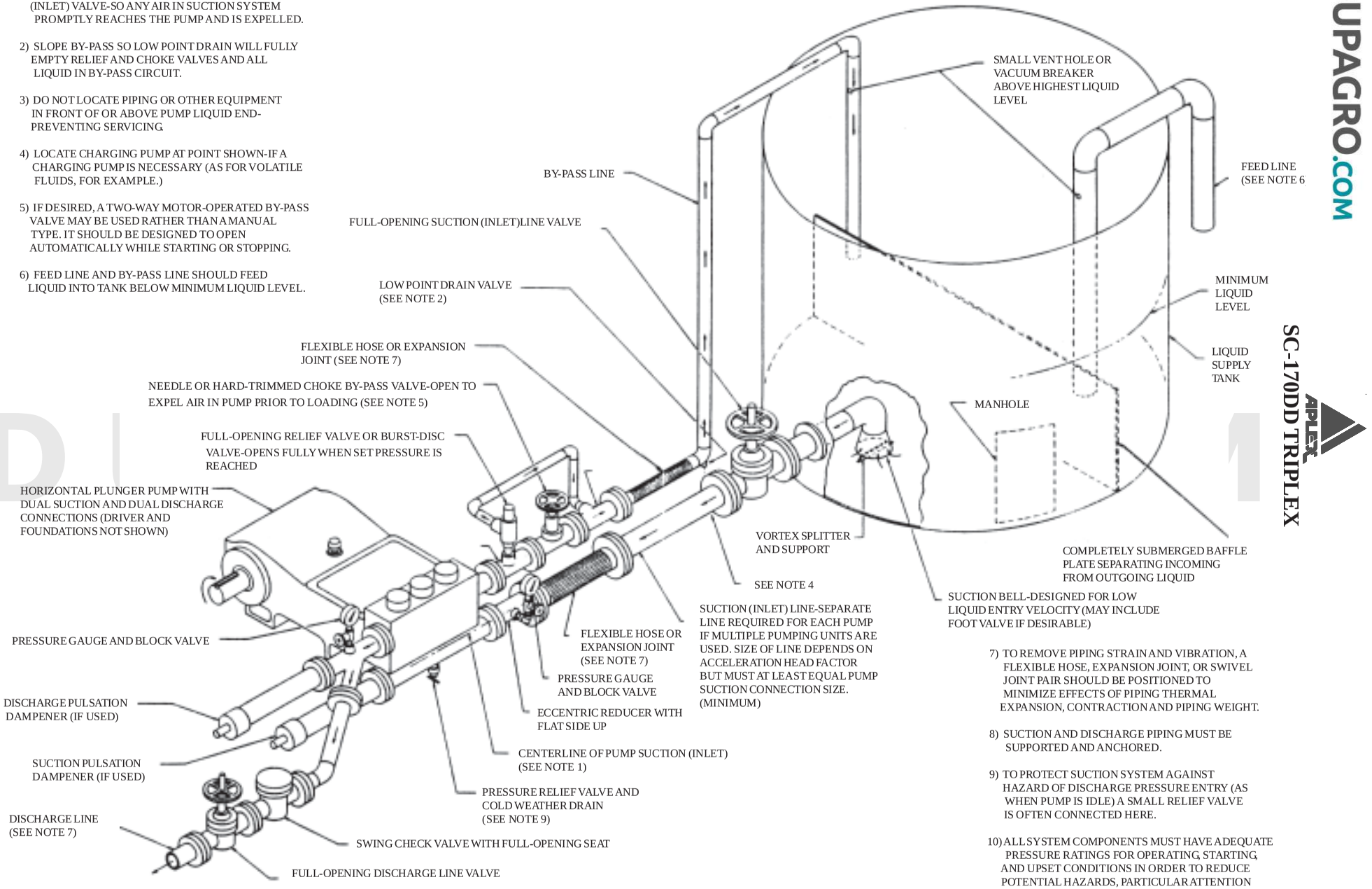
2) SLOPE BY-PASS SO LOW POINT DRAIN WILL FULLY EMPTY RELIEF AND CHOKE VALVES AND ALL LIQUID IN BY-PASS CIRCUIT.

3) DO NOT LOCATE PIPING OR OTHER EQUIPMENT IN FRONT OF OR ABOVE PUMP LIQUID END-PREVENTING SERVICING.

4) LOCATE CHARGING PUMP AT POINT SHOWN-IF A CHARGING PUMP IS NECESSARY (AS FOR VOLATILE FLUIDS, FOR EXAMPLE.)

5) IF DESIRED, A TWO-WAY MOTOR-OPERATED BY-PASS VALVE MAY BE USED RATHER THAN A MANUAL TYPE. IT SHOULD BE DESIGNED TO OPEN AUTOMATICALLY WHILE STARTING OR STOPPING.

6) FEED LINE AND BY-PASS LINE SHOULD FEED LIQUID INTO TANK BELOW MINIMUM LIQUID LEVEL.



7) TO REMOVE PIPING STRAIN AND VIBRATION, A FLEXIBLE HOSE, EXPANSION JOINT, OR SWIVEL JOINT PAIR SHOULD BE POSITIONED TO MINIMIZE EFFECTS OF PIPING THERMAL EXPANSION, CONTRACTION AND PIPING WEIGHT.

8) SUCTION AND DISCHARGE PIPING MUST BE SUPPORTED AND ANCHORED.

9) TO PROTECT SUCTION SYSTEM AGAINST HAZARD OF DISCHARGE PRESSURE ENTRY (AS WHEN PUMP IS IDLE) A SMALL RELIEF VALVE IS OFTEN CONNECTED HERE.

10) ALL SYSTEM COMPONENTS MUST HAVE ADEQUATE PRESSURE RATINGS FOR OPERATING, STARTING, AND UPSET CONDITIONS IN ORDER TO REDUCE POTENTIAL HAZARDS, PARTICULAR ATTENTION IS RECOMMENDED FOR THE SURGE CONDITION THAT WILL RESULT DOWNSTREAM OF THE RELIEF VALVE WHEN NORMAL DISCHARGE IS BLOCKED.

LUBRICATION

SC-170DD Myers/Aplex pumps utilize 18 U.S. quarts of S.A.E 40 wt. non-detergent oil in the crankcase. This oil requires only a non-foaming additive and should possess good water separation (anti-emulsion) characteristics. Such oils are often labeled "industrial" or "turbine" quality lubricants. If these oils are not available, a good quality gear oil or EP oil may be substituted. See lubrication guide lines.

In temperate climates oil viscosity selected should fall between 70 and 84 seconds Saybolt viscosimeter at 210° F. In arctic service, low pour point oils are needed.

After the first 500 hours of operation in a new pump, drain the oil. Refill with clean, fresh oil. Thereafter, change the oil every 1,500 hours or sooner if it becomes contaminated with water or dirt. Fill to the center of the sight gage. Recheck after starting, adding oil to center of gage while running.

V-BELT DRIVE

A properly designed, well-aligned v-belt will provide years of reliable, economical service if properly tensioned and kept dry, free of oil, and ventilated.

Alignment is critical for long life. If the shaft axes are not truly parallel, or if the sheave grooves are not positioned in good alignment, some belts will carry most of the load resulting in their disproportionate load share and may actually twist or turn over in the groove. Use a straight edge across the rim of the sheaves to detect and correct for misalignment.

After about one week of operation, new v-belts will have stretched somewhat. The motor must be moved on its slide base to re-establish proper belt tensioning.

Insufficient tension results in slippage, burning, squealing (especially during starting), and shortened belt life. Overtightening imposes excessive loads on pump and motor bearings and can cause early shaft fatigue failure.

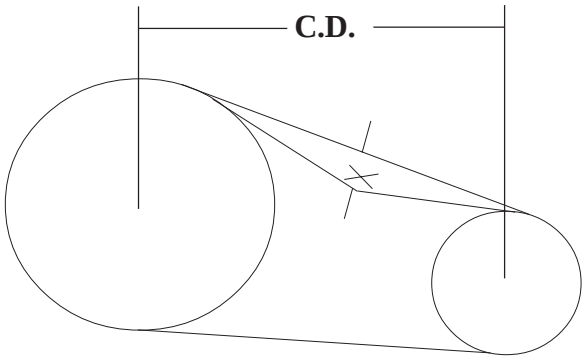
Use the following table in adjusting V-belt tension:

Belt Cross-Section	Tension at Mid - Span New Belts	Used Belts
"B"	5-6 lb.	3 1/4-5 lb.
"C"	9 3/4-13 lb.	6 1/2- 9 3/4 lb.
"3V"	4-10 lb.	3-7 1/2 lb.
"5V"	17-30 lb.	13 - 23 lb.

Applying the above forces with a small spring scale, adjust motor position to provide the following deflection at mid-span:

Approx. Center Distance (Span)	Deflection, inches
16"	1/4"
22"	3/8"
28"	7/16"
32"	1/2"
40"	5/8"
48"	3/4"
60"	15/16"

Belts must be *matched* in pitch length. If one or two belts are slack, when the others are correctly tensioned, investigate for possible reasons. Correct any misalignment or lack of matching, so each belt will transmit its load share.



Sheaves must be balanced to prevent abnormal vibration. Balancing weights must **NOT** be removed. Type "QD" sheaves must be evenly tightened on their tapered hubs to avoid rim wobble and severe lateral vibration. V-belts which snap and jerk will produce abnormal vibration and loads on both pump and motor or engine.

Run the pump several minutes at full load with belt guard removed observing for uneven motion on the belt slack side, especially.

When an old V-belt drive becomes unserviceable, replace **ALL** belts, not just the broken or cracked belts. Do not operate belts on sheaves having worn, rusted, greasy, or broken grooves. Shut off power to driver before servicing drive or pump.

WARNING: *Do not operate without appropriate guards in place.*

DIRECTION OF ROTATION

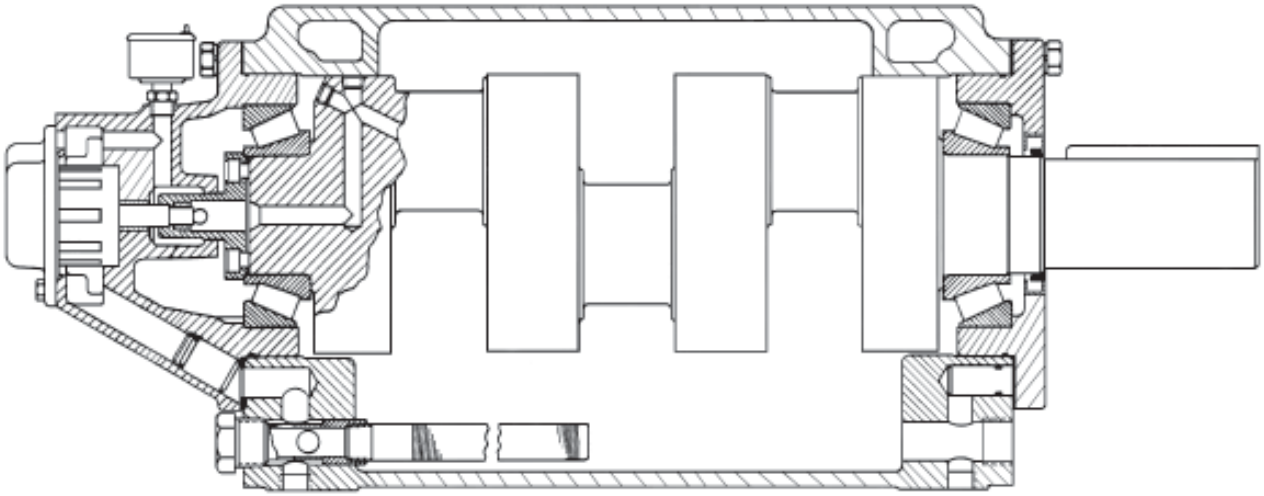
Before placing pump in operation, check that crankshaft rotation agrees with the arrows cast on top of the power frame by briefly jogging the electric motor. Crankshaft rotation must be clockwise as viewed from the right side of pump.

If pump is gear driven, remember that the pinion shaft turns opposite the crankshaft, if using a single-reduction geared drive or in the same direction as the crankshaft when using a planetary gear.

AUTOMATIC (SAFETY) SHUTDOWNS

Carefully check all electric shutdown devices present such as crankcase oil level, discharge pressure, vibration, lubricator oil level, motor thermostat, etc.

SC-170DD TRIPLEX
CRANKSHAFT ASSEMBLY



GENERAL

Myers/Aplex crankshaft suspension utilizes two single-row tapered bearings, which are shim adjusted to provide the correct running clearance.

Thorough cleaning of all components prior to assembly is essential.

Power frame, shaft, bearings and retainer **MUST** be scrupulously scrubbed with clean solvent (such as kerosene) before starting. Remove any oil, dirt, rust and foreign matter which might prevent the correct fit up.

Crankshaft journals are critical. Remove all burrs, rust spots, and nicks, paying special attention to the ground areas on which bearings and oil seals operate.

Connecting rods and crossheads may be installed either before or after installing the crankshaft in the SC-170DD.

TAPERED ROLLER BEARINGS

Shaft and frame tolerances provide a tight (shrink) fit on the shaft, and in the carrier. The best way to install the cone assembly (consists of the inner race, cage and rollers) on the shaft is to heat the cone assembly in an electric oven for 30 minutes at 300 to 400°F. *No More!* (**Do NOT heat** bearings with an acetylene torch. This ruins the bearings!) Using clean, insulated gloves, remove the hot cone assembly from the oven, promptly dropping it on to the shaft.

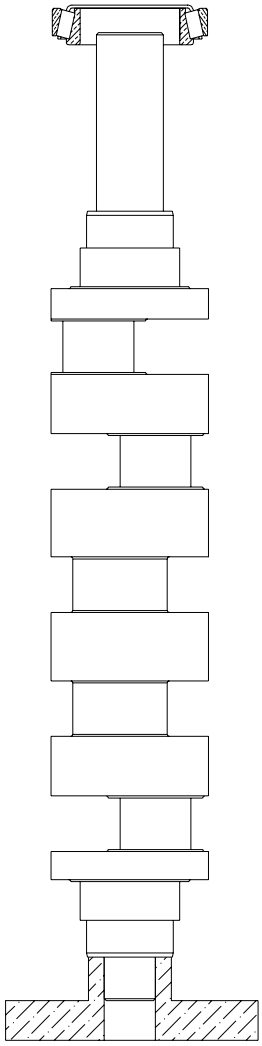
The cone assembly **MUST** contact the seat thrust face (not be cocked), and the large end of the rollers **MUST** be down. Do not hammer on the bearing. The soft steel cage is easily distorted, ruining its function as a roller separator and guide against skewing. If the cone does not contact its thrust face properly, it must be pressed into place using a specially machined sleeve (which does not touch the soft steel cage). A hydraulic press is recommended if this difficulty arises.

CUP INSTALLATION

Tapered roller bearing cup (outer races) is a press-fit in the bearing carrier, using a hydraulic press. Cup must be pressed into a clean carrier-until the race solidly abuts its shoulder (must not be cocked).

The tool or plate used for this must only contact the outer end face-not on the taper.

INSTALLING CRANKSHAFT



SHIM ADJUSTMENT OF TAPERED ROLLER BEARINGS

To provide for crankshaft thermal expansion, sufficient shims must be installed to provide .005" to .015" lateral end play, when shaft is cold. Shims must only be placed under the drive side bearing carrier. The lube oil housing has a gasket under it.

A feeler gage and a 1" micrometer caliper is required. Install a trail shim set on one side of the pump. Tighten the flange bolts on this side only.

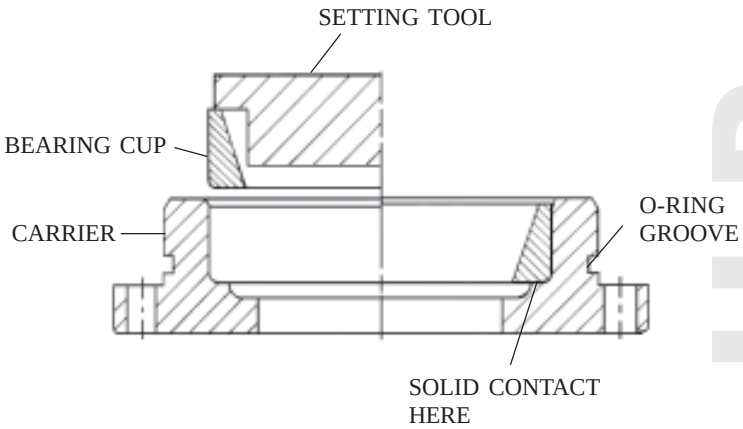
CAUTION: *Lubricate the frame bores and the o-ring seals located in each carrier to prevent damage during entry. Oil the bearings.*

Draw up the carrier, evenly tightening its cap screws. Rotate the crankshaft slowly by hand, seating all rollers into running position.

Measure the gap existing between the frame face and carrier flange. The correct thickness of the shim set to be installed equals: the measure gap **Plus** about .010". (No pre-load)

After installing above shim set, a dial indicator may be used against the end of the shaft to confirm the shim selection. Bump the shaft in one direction and zero the dial indicator. Bump the shaft the opposite way. If shimming is correct, the shaft will move laterally from .005" to .010".

The recommended tightening torque for bearing retainer 5/8"-11UNC cap screws is 118 to 145 Ft.Lb.



INSTALLATION OF CRANKSHAFT OIL SEAL

Insert oil seal over the end of crankshaft and position it into the oil seal bore in the bearing carrier. Using a rubber mallet, tap it into the bore until the face of the seal is flush with the bearing carrier.

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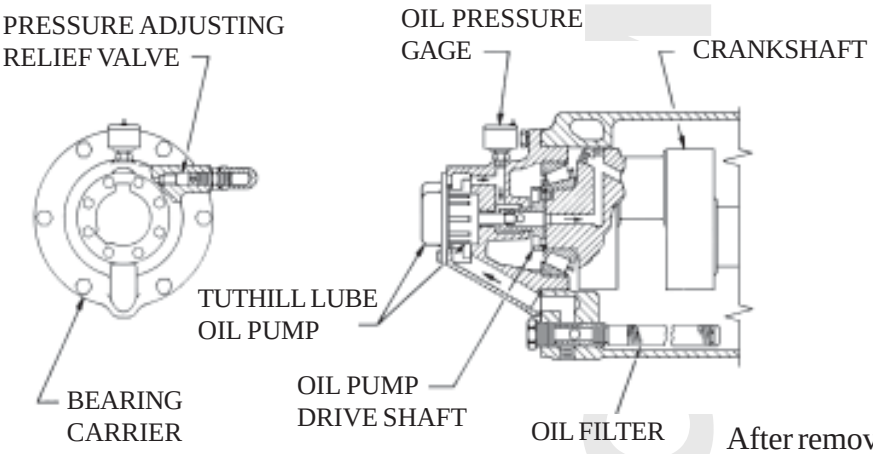


LUBE OIL PUMP ASSEMBLY

Lube oil pump and filter assemblies are employed in certain Aplex pumps. This assembly is installed after the shaft and its tapered bearings have been correctly set. Providing filtered oil under pressure (35 to 75 psi) to all crosshead pin bushings and crankpin bearings, this special gear pump is driven by a bolted-on drive shaft. Driver is made with a female drive square which drives the male square end of the lube oil pump shaft.

The lube oil pump should be re-primed before putting the pump into service. This is done by unscrewing the oil pressure gage and repeatedly filling the cavaity with pump oil.+

The driver shaft is piloted by the main bearing inner race cone and is secured to the crankshaft by four socket head cap screws. Stake their heads using a center punch to upset the adjoining metal.

The lube oil pump (Tuthill) is a gear type pump possessing a self-reversing sector which automatically switches suction and discharge connections in the event (not recommended) that the pump is caused to rotate opposite the correct direction. The lube oil pump is readily removed for inspection, repair, or replacement without disturbing any other pump component.

The lube oil pump shaft is journaled in a bronze bushing fitted into the bearing carrier. If this bushing becomes worn (check for contaminated crankcase oil), it must be promptly replaced. A worn bronze bushing will cause this pump to frequently lose its prime, and also may cause excessive wear in the pump rotor teeth.

DISASSEMBLY

After removing the connecting rod cap and cap bolts (note identifying marks on each cap so each may be later correctly reassembled onto its own rod) remove a bearing carrier from the frame. Two jack out tapped holes are provided in the flange of the carrier for this purpose. Support the shaft during removal to avoid damage.

The crankshaft may now be extracted, once all connecting rods are moved clear. Examine the crankpin surfaces for wear or corrosive pitting. The correct diameters of these journals are:

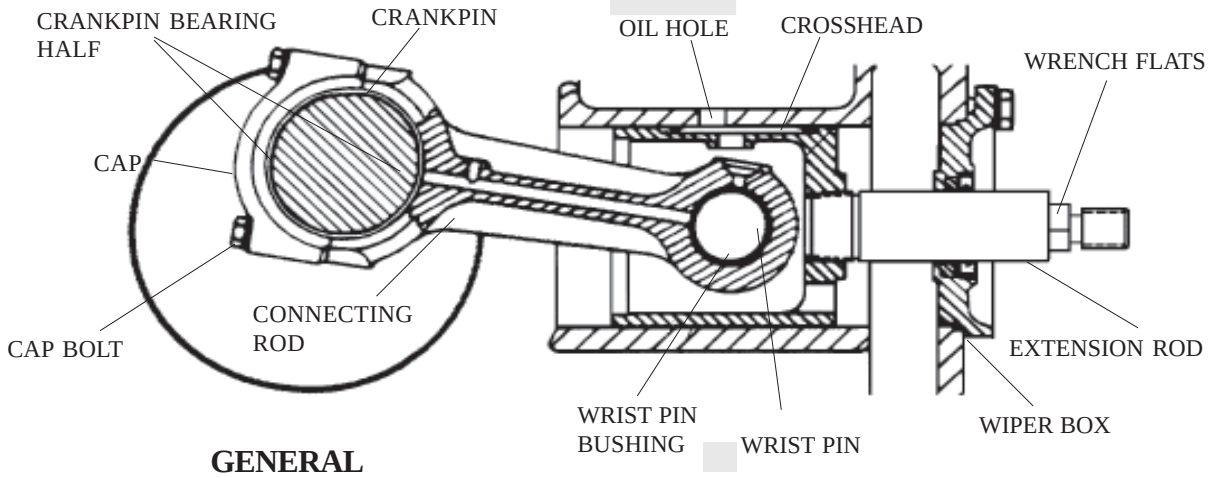
Crankpin Diameter.....4.0000/3.9990”

If worn more than .010” undersize, crankshaft should be replaced, or an attempt to salvage it may be made at a shop well equipped to grind the crankpins which must be fully round, chrome-plated, and finish ground to the above sizes. ***(Myers/Aplex does not perform this function.)***

Crankshaft tapered roller bearings should be carefully examined for pitting, scoring or corrosion, and replaced as required. The cone and roller assembly is most easily removed by first cutting away the cage using an acetylene cutting torch. Then heat the cone (inner race) with the shaft held vertically so cone will drop off due to its own weight. Avoid excessive heat on the crankshaft which tends to distort its geometry.

Cups (outer races) of tapered roller bearings may be extracted from bearing carrier using a conventional bearing puller tool of the automotive type (widely available). Do not attempt to use heat on a bearing carrier as this will result in severe distortion (out-of-round). Replace the bearing carrier, if broken or out-of-round.

CONNECTING ROD, CROSSHEAD, EXTENSION ROD, CROSSHEAD PIN and WIPER BOX ASSEMBLY & DISASSEMBLY:



GENERAL

Myers/Aplex connecting rod assemblies employ precision automotive type steel backed, babbitt-lined crankpin bearing halves which require no shims for clearance adjustment. This pump employs full circle (piston type) crossheads, and hardened stainless steel extension rods, which are field replaceable.

Extension rods are provided with a wrenching flats to permit tightening of the tapered thread into the crosshead, establishing accurate alignment while affording easy field installation.

Before beginning the assembly all parts must be scrupulously cleaned, removing all oil, dirt, rust, and foreign matter which prevent proper fitting, or which might tend to score the rubbing surfaces. Clean and examine the power frame bores for scoring and abnormal wear, especially wear of the lower crosshead guide way. Hone smooth, if rough.

Measure the bores of the frame using inside micrometers to determine abnormal frame wear if any.

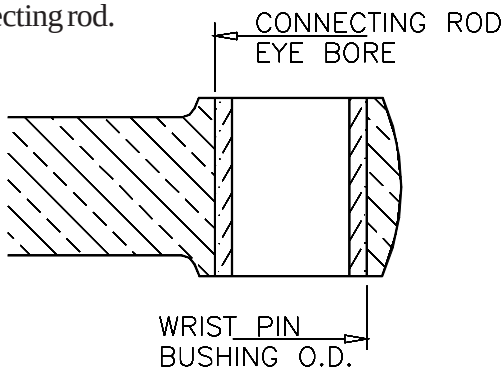
New crosshead O.D. ..... 5.742/5.740”
New frame bores ..... 5.749/5.752”

Frame bores which have become worn more than .015" must be sleeved with a cast iron liner to re-establish correct geometry and alignment. Contact Myers/Aplex concerning the repair of badly worn frame bores.

Smooth any rough corners and edges on the crosshead skirts, using fine emery cloth. Examine and clean the female tapered threads and wrist pin holes.

INSTALLING WRIST PIN BUSHINGS

The wrist pin bushing is precision machined bearing bronze which is press fitted into the eye of the connecting rod.



Bushing O.D. ..... 2.256/2.255”
Connecting rod eye bore .... 2.251/2.254”

Carefully align the bushing with its hole and after applying oil to bushing O.D. use a hydraulic press to force it home. When a bronze bushing is pressed into place, the I.D. (bore) of the bushing is

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reduced somewhat, owing to the extent of press fit. Therefore, a clean, new wrist pin should be inserted into the bushing bore to establish that running clearance has been obtained. The running clearance between the wrist pin and installed bushing is:

New pin O.D. ..... 2.0238/2.0233”
Installed bushing bore ..... 2.0251/2.0261”
Oil Clearance ..... .0013/.0028”

Replacement bushings are furnished pre-bored by Myers/Aplex which usually eliminates the need to ream the installed bushing bore. However, due to slight variations in finishes and tolerances it sometimes happens that more than predicted contraction of the I.D. occurs. This occurrence results in a slight interference which may be eliminated by lightly honing the bore of the bronze. (**NOT** by reducing the pin size!). An automotive engine repair shop usually is equipped with power honing machines capable of smoothly finishing the bushing bore. Bore of bushing must be round and free of taper.

PINNING THE CROSSHEAD

A pressfit is employed between the crosshead pin and crosshead to secure the pin against any motion. A hydraulic press is employed to force the pin thru the bosses of the crosshead.

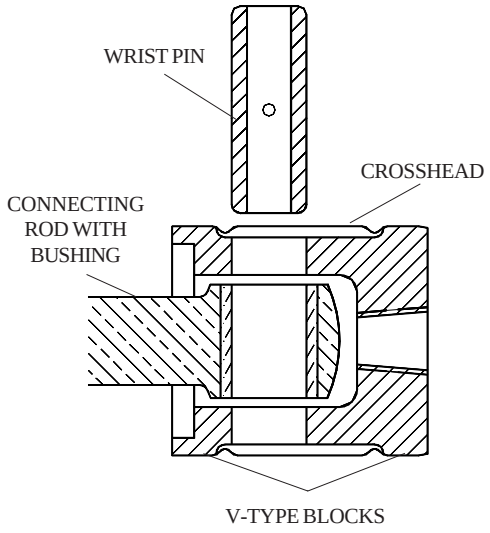
A mishap during insertion can occur causing the ruin of the pin or the crosshead, *if* during application of pressure:

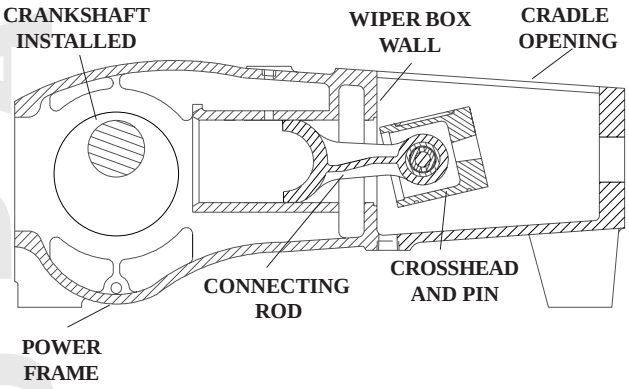
a.) Pin is not aligned absolutely square with the crosshead.
b.) Crosshead is not supported on v-blocks so it can roll while under load.
c.) Connecting rod is not fully supported so pin cannot enter the bushing without damage to it. This will damage the bushing.
d.) Failure to oil pin O.D. and crosshead bores, to prevent galling. Use clean motor oil.

After installing the pin, carefully check the crosshead O.D. to see if it is out-of-round. If so, a smart blow with a rubber mallet will restore the crosshead O.D. into its original roundness.

ORDER OF ASSEMBLY

The connecting rod/crosshead assembly is installed **AFTER** the assembly of the crankshaft. In these models, the rod and crosshead will pass through the wiper box wall bore. With the frame in the horizontal position, load the rods through the cradle.





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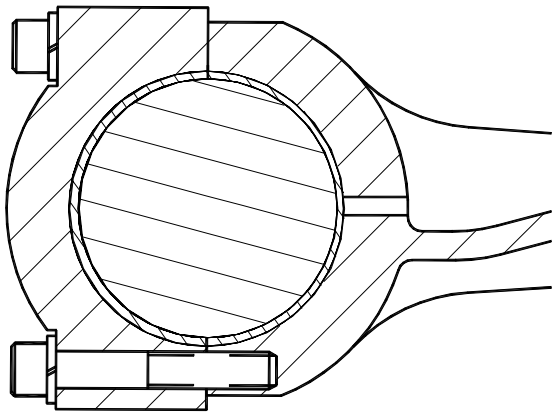
PRECISION CRANKPIN (CRANKTHROW) BEARINGS

Myers/Aplex pump crankpin bearings require no shimming to establish correct running clearance. Precise machining of the connecting rod, caps and crankpin journals is necessary to achieve this convenience.

New crankpin O.D. ..... 4.000/3.999”
New connecting rod bore ..... 4.232/4.233”

Crankpins which are worn out-of-round, tapered, or badly scored should either be discarded or perhaps salvaged by grinding undersize, hard chrome-plated, and finish ground to above diameter. (*Myers/Aplex does not offer this service.*)

Connecting rod/cap bore must be perfectly round and within above sizes and free of taper. Discard, if elliptical or tapered as the result of abnormal heating. Each cap and rod is match-marked for correct identification. Take care that each cap is reinstalled properly with its companion rod. Bearing halves are identical and are prevented from rotating by tongues which fit into slots in the cap.



Check that all oil holes are clean and fully open. **GRIT** is the greatest enemy of bearings, however precisely manufactured. Hence, all surfaces must be perfectly clean and lightly oiled prior to assembly. Remove any burrs or sharp corners which prevent the perfect fitting of these precision bearings. Using a torque wrench, tighten cap bolts as follows:

Thread Size	Tightening Torque
1/2”-13UNC	60-75 Ft.Lb.

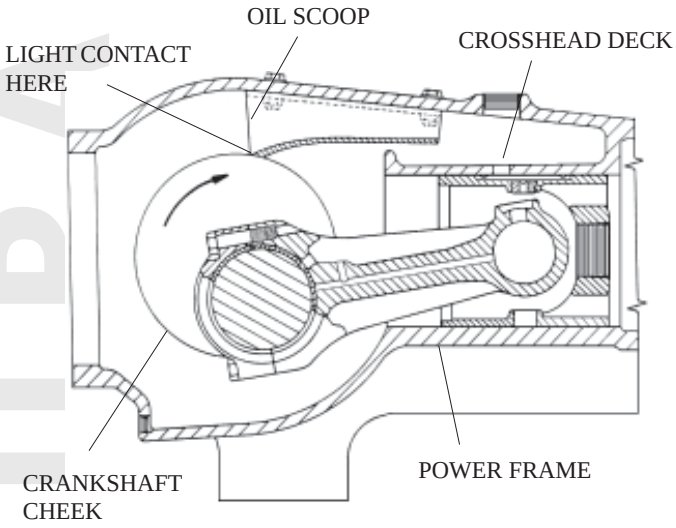
Specified torque, applied to clean, well oiled threads and bearing faces, will create tensile stresses in the cap bolts from 90,000 to 110,000 psi, approx. and will provide correct initial tension. Myers/Aplex pumps utilize high strength cap bolts suitable for these initial loadings, maintained by hardened spring lockwashers. Models MA-95, MA-120, and MA-240 use hardened lock washers and other models use safety wire to maintain the required tightness.

After all rods and caps are secured, slowly turn the crankshaft to be sure no bearing is in a bind.

Using a flash light examine the location of each connecting rod (eye end) within its crosshead. Rods must not touch any crosshead boss or skirt.

OIL SCOOP

Model SC-170DD also employs oil scoops which are cast integrally with the power frame and are machined to lightly contact the crankshaft cheek. No adjustment is required.



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WIPER BOX ASSEMBLY

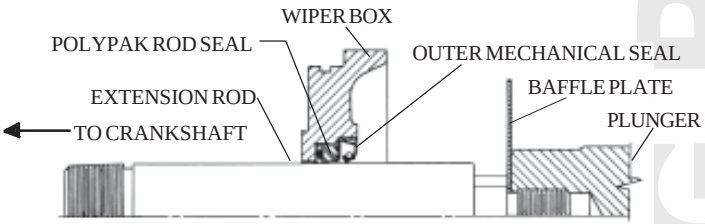
GENERAL

Extension rod wiper boxes (sometimes referred to as the diaphragm stuffing box, or stripper housing assembly) serve two important functions: retention of crankcase oil in the power end, and exclusion of dirt and water.

Myers/Aplex has developed a unique sealing set which operates on a hardened and ground stainless steel extension rod (often called "pony" rod), and a rubber baffle disc affording protection against leaking plunger packing. The seals require no adjustment, only correct and careful assembly.

"POLY PAK" SEAL

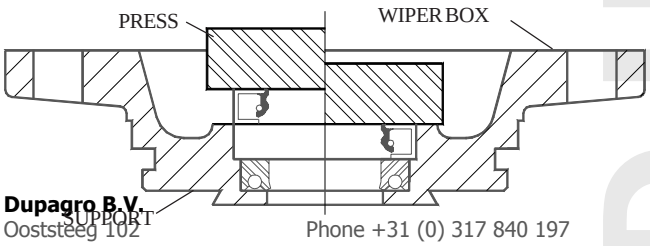
This seal keeps oil from leaking out of the power frame. Developed by the Parker Seal Group, this patented rod seal, employs a soft nitrile rubber o-ring to energize a special hard polyurethane "Molythane" shell by forcing the inner lip against the rod and the outer lip against the housing bore, as shown.



The "Poly Pak" seal is inserted into its counter bore with its lips directed *toward* the oil in the crankcase. (Will **NOT** work if installed backwards!)

MECHANICAL OIL SEAL

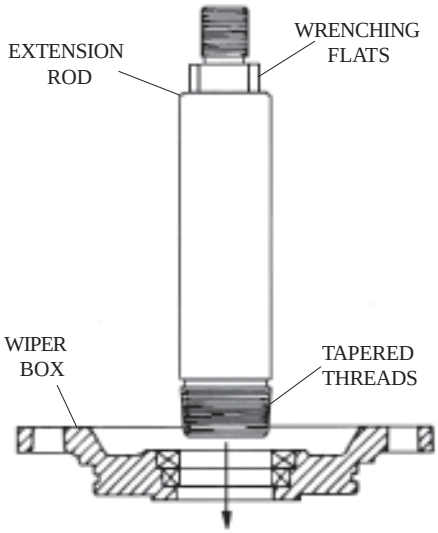
The oil seal is to keep contamination out of the power frame. With the box positioned in a hydraulic press, install the backup seal against the "Poly Pak" seal, with the lips of both seals facing downwards.



The mechanical seal contains a garter spring. Check to see that this spring is still properly located and in its position. The mechanical seal has a metal case which serves to force the "Poly Pak" seal into its cavity, energizing its lips. Apply oil lightly to the bore of the box before pressing each seal into its counterbore.

INSERTING THE EXTENSION ROD

Insert the extension rod through the wiper seals with the tapered thread and entering **FIRST**. Care should be used in moving the extension rod through the seals with wrenching flats entering first. **Do not force!** The sharp corners on the wrenching flats may damage the seal lips! (Resulting in oil leakage.)



With extension rod inserted through the wiper box seals, thread the tapered threads (must be clean!) into the tapered crosshead female threads. Firmly tighten, apply torque to the wrenching flats only. Never damage the extension rod ground surfaces!

Then fasten the wiper box to the power frame by tightening the cap screws. Oil leakage between frame face and wiper box is prevented by use of an o-ring.

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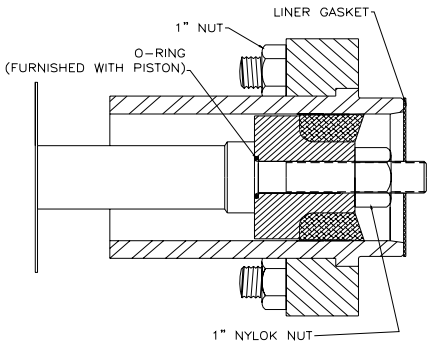


INSTALLING THE PISTON IN LINER

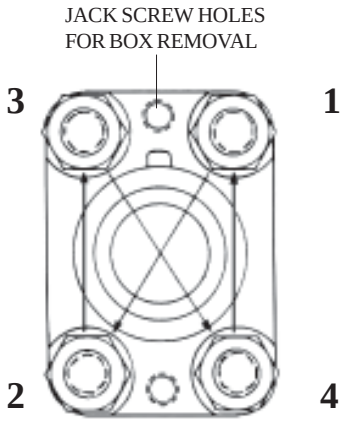
The piston must be installed in the liner before the liner is put in the pump. First set the piston rod in a bench vise and install the piston on the rod. Make sure the o-ring is in its counterbore. Use a new Nylok nut every time a piston is installed. Torque the nut to approximately 200 ft.lb. Next thoroughly grease the piston and the inside of the liner with any standard automotive type grease and hammer into the liner with a soft mallet. The piston must be inserted metal end first through the chamfered end of the liner.

INSTALLING THE LINER

Myers/Aplex liners derive their alignment from the bores of the power frame and the faces of the fluid end. So these surfaces **MUST** be cleaned of rust, scale, and dirt before assembly is begun. Wash all contacting surfaces with clean solvent and dry with a **CLEAN** shop towel.

Thouroughly lubricate the powerframe bore and nose of the liner to aid in assembly and disassembly. Insert the liner in the powerframe bore, being careful not to cock the liner. A hard red fiber gasket is used to seal between the face of the fluid end (must be flat, clean and smooth) and the face of the liner. Replace with every new liner.

All liners are retained by a rectangular liner flange. Slip this flange over the liner after the liner with piston and piston rod is installed in the powerframe bore. Four large studs and nuts extend through the power end, and serve to clamp the liner and the powerframe tightly against the fluid end face. These four stud nuts must be **EVENLY** tightened.



Using a socket, socket extension, and torque wrench, tighten clean, well-oiled threads and nut faces.

Stud Threads	Tightening Torque
1”-8UN	300 Ft.Lb.

CONNECTING PISTON ROD

Install the metal baffle plate on the extension rod, roll the pump slowly until the extension rod male threads just touch the mating piston rod female threads.

Applying a pipe wrench to rod knurled area, thoroughly tighten the connection. Do **NOT** use a “**cheater**” when connecting piston rod to extension rod. (*Serves no useful purpose, and may damage the connection!*)

PISTON WASH

The black “oilfield” style piston assembly requires a piston wash system. The purpose of the wash is to wash away abrasives and more importantly to cool the rubber of the piston.

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DISC VALVE SYSTEMS and ABRASION RESISTANT

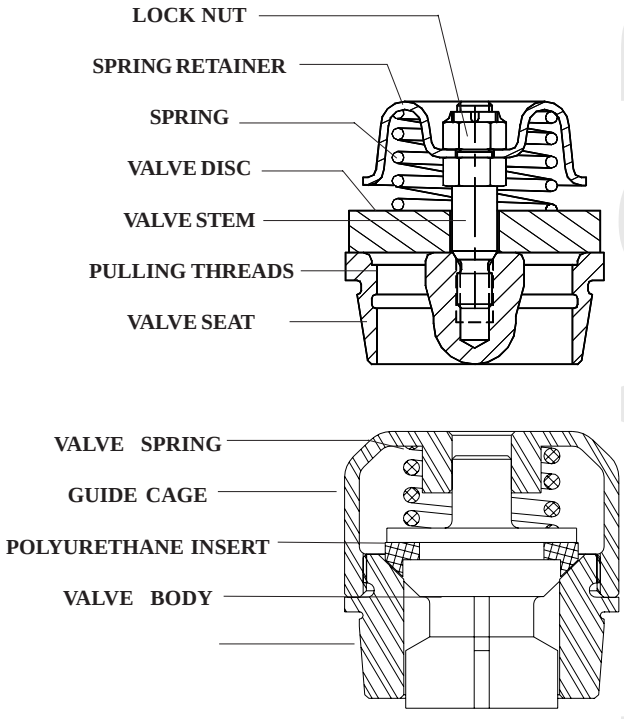
GENERAL

Aplex has developed a unique setting/puller system permitting quick, easy and safe methods of installing and removing tapered seat valves.

The system allows servicing without distortion of the seat, with minimum effort and **NO** damage to fluid end tapers or seat.

Tapered seats notoriously drive solidly down into mating deck tapers, so firmly that extraction heretofore has always posed severe problems. Old style valves may be pulled only with the greatest effort, using "J" puller heads (prone to failure), CO_2 - Dry Ice, and other improvisations.

DISC VALVE and ABRASION RESISTANT VALVE CONSTRUCTION



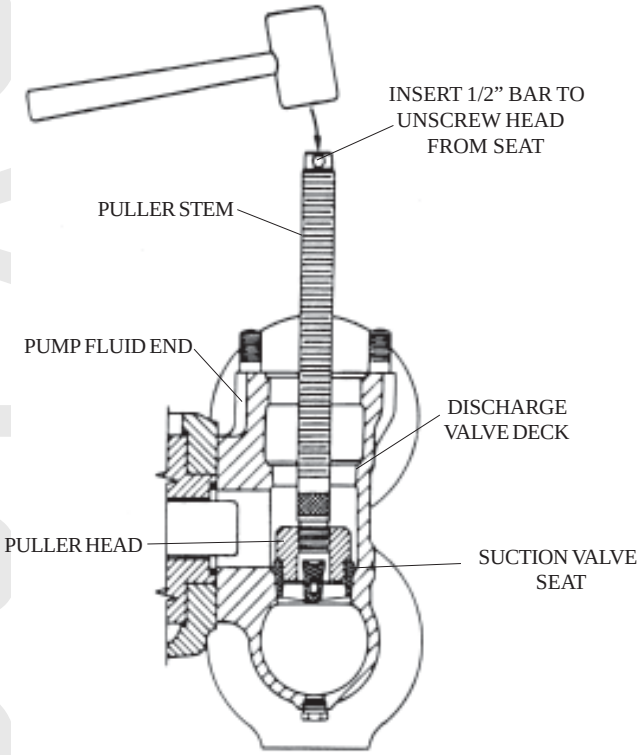
The Aplex valve is a precision made sub-assembly utilizing threads cut into the rim of seat for use with Aplex setting/pulling tool. These threads do **NOT** deteriorate as proven by field experience. By locating these on the rim setting/pulling forces are now applied only to the rim of the seat, never to the webs (or "spokes"), or to the center section. Distortion of the seat is eliminated.

Access to these seat threads is provided by the removal of the valve cage on Abrasion Resistant valve or the spring retainer on Disc valves which is screwed onto the seat. An anti-seizing lubricant applied to all threads is good insurance against future difficulty.

SETTING THE VALVE SEAT

Effective pressure-sealing between tapered (male) seat, and tapered (female) fluid end deck is possible **ONLY** if the tapers are absolutely clean and dry just prior to installation. Thoroughly clean surfaces using a clean solvent. Dry with a **CLEAN** shop towel.

Examine the cleaned fluid end deck tapers, using a flashlight, and remove all deposits of gyp, salt, or other incrustation. Lightly emery cloth any minor imperfections found in the deck taper.



The puller stem and puller head are provided with tapered (locking) threads. Screw them together using two pipe wrenches applied to the knurled areas provided. Then screw the valve seat onto the puller head by hand-until it shoulders against the puller shoulder. Do not tighten.

Lower the seat and puller assembly into the fluid end, squarely setting the seat into the deck. Then pound the top of the stem with a rubber mallet.

Unscrew the head and stem from the seat using a 1/2" bar (or screwdriver) into the hole provided at the top end of the stem.

INSTALLING DISC, SPRING, DISC VALVES AND STEM:

Myers/Aplex offers discs of "Delrin" acetal resin, of 17-4PH S.S. hardened and ground, and of titanium alloy.

Position the disc and Inconel spring on the seat, aligning the hole in the disc with the stem threads in the seat center.

The stem, spring retainer, and locknut are shipped from Myers/Aplex already assembled and tightened with a torque wrench with "Loc-Tite" sealant added to the top stem threads only.

Stem Threads	Tightening Torque
1/2"-13UNC	65-75 Ft.Lb.

Use an anti-seizing lubricant in these threads. This is very necessary when seats and stems of Type 316 stainless steel are selected (optional) to prevent galling. CLEANLINESS of threads and other contacting surfaces is of paramount importance in the assembly of all valve elements.

VALVE SPRING OPTIONS

All Myers/Aplex valve springs are made of "Inconel" material, precisely designed and fabricated. Unless otherwise specified, the standard spring is furnished. It provides excellent results in the great majority of applications.

Pumps employed in marginally available NPSH conditions may require a "softer" spring, to reduce the required NPSH. For these special conditions, Myers/Aplex can supply "Light" valve springs which exert lower pressure on the valve disc. The use of "Light" valve springs may be limited by the choice of plunger size and/or limited by the chosen speed of the pump. "Light" valve springs may be impractical for pumps models fitted with their maximum plunger size, or which operate near top speed rating as disc bouncing and erratic seating may occur.

VALVE DISC OPTIONS

Myers/Aplex acetal resin discs made of DuPont "Delrin" are machined flat and smooth to produce perfect sealing on the lapped-flat face of the seat. Used successfully in thousands of applications these discs are light, slightly flexible under load, and seal well, even at high pump speeds, providing smooth pump action.

Acetal resins are very resistant to most corrodents, are not usually suitable where fluid temperatures above 120 degrees are met. Nor do they afford long life at extreme pressures. Pressure limitations depend on valve size. But continuous valve operation at pressures above 2,500 psi usually indicate the need of metal valve discs.

For higher temperatures or pressures, Myers/Aplex offers lapped flat, hardened Type 17-4PH stainless discs, or titanium alloy discs. These metal discs are less tolerant of any fine grit in the liquid and are noisier than the acetal resin disc.

PULLING THE VALVE SEAT

First drain the fluid end entirely. For Abrasion Resistant valves, use the cage wrench to unscrew the cage from the seat. For Disc Valves unscrew the stem from the seat. Remove the cage, spring and valve from the fluid end. Attach the Myers/Aplex puller head to the puller stem, tighten their tapered threads with a pipe wrench applied to the knurled areas of the puller stem and head. Lower the stem and head into the fluid end and engage the threads of the head onto the seat threads.

Using a 1/2" bar (or screwdriver) rotate the head clockwise, thread it fully onto the seat. But, do **NOT** tighten

Slide the bridge over the stem. Clean and oil the stem threads. Oil the face of the wing nut. Thread wing nut down onto the stem, seating it on the bridge top firmly. Extract the seat from the pump by striking the wing nut with a heavy hammer. A hydraulic ram may also be used. Stand clear of the pump when applying heavy tonnage, as the entire assembly will jump violently upwards when the pulling energy is suddenly released!

The Myers/Aplex puller/setting tool and gage tool are custom designed and built for each specific Myers/Aplex pump model. The same puller head is used on both suction and discharge seats. The bridge is made to fit each model and its proper use will not damage the valve cover gasket machined counterbore on the top of the fluid end.

SALVAGE OF WORN SEATS

Rough valve seat faces may often be renewed by lapping or grinding, if not deeply fluid-cut.

Perfect flatness is required. A surface grind, followed by lapping on a lapping plate provides excellent smoothness and the flatness needed for good sealing and smooth running. Metal valve discs may sometimes be salvaged by grinding or lapping, if not deeply cut or cracked.

Delrin discs are relatively inexpensive and salvage is seldom worthwhile. Replace the stem, if severely worn. Inconel valve springs rarely require replacement.

OTHER PUMP BRANDS

Myers/Aplex Industries can provide its unique (patented) valve to fit nearly all brands and models of multiplex pumps. An Myers/Aplex seat setting/puller tool is available, too!

TROUBLE LOCATION & REMEDY

Trouble	Possible Cause	Remedy
Pump fails to deliver required capacity.	Speed incorrect. Belts slipping.	Change drive ratio or tighten belts (if loose). Correct motor speed.
	Air leaking into pump.	Seal with compounds.
	Liquid cylinder valves, seats or plungers worn.	Reface or lap valves and seats; replace packing or plungers.
	Insufficient NPSHA.	Increase suction pressure.
	Pump not filling.	Prime pump.
	Makeup in suction tank less than displacement of pump.	Increase makeup flow. Reduce pump speed.
	Vortex in supply tank.	Increased liquid level in supply tank. Install vortex breaker.
	One or more cylinders not pumping.	Prime all cylinders. Allow pump to operate at low pressure through bypass valve to eliminate vapor.
	Suction lift too great.	Decrease lift. Raise tank level.
	Broken valve springs.	Replace.
	Stuck foot valve.	Clean.
	Pump valve stuck open.	Remove debris beneath valve.
	Clogged suction strainer.	Clean or remove.
	Relief, bypass, pressure valves leaking.	Repair.

TROUBLE LOCATION & REMEDY

Trouble	Possible Cause	Remedy
Suction and/or discharge piping vibrates or pounds.	Piping too small and/or too long.	Increase size and decrease length. Use booster pump. Use suction and/or discharge pulsation dampeners.
	Worn valves or seats.	Replace or reface.
	Piping inadequately supported.	Improve support at proper locations.
Pump vibrates or pounds.	Gas in liquid.	Submerge return, supply or makeup lines in suction supply tank.
		If operating under a suction lift, check joints for air leaks.
	Pump valve stuck open.	Remove debris beneath valve.
	Pump not filling.	Increase suction pressure.
	One or more cylinders not pumping.	Prime all cylinders. Allow pump to operate a low pressure through bypass valve to eliminate vapor.
	Excessive pump speed.	Reduce. Check drive ratio.
	Worn valves or seats.	Replace or reface.
	Broken valve spring.	Replace.
	Loose plunger.	Tighten.
	Loose or worn bearings.	Adjust or replace.
	Worn crossheads or guides.	Replace.
	Loose crosshead pin. Loose connecting rod cap bolts.	Adjust or replace.
	Pump running backwards.	Correct rotation.

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TROUBLE LOCATION & REMEDY

Trouble	Possible Cause	Remedy
	Water in power end, crankcase.	Drain. Refill with clean oil.
	Worn or noisy gear.	Replace.
Consistent knock.	Worn or loose main bearing, crank pin bearing, wrist pin bushing, plunger, valve seat, low oil level. **NOTE**: High speed power pumps are not quiet. Checking is necessary only when the sound is erratic.	Adjust or replace. Add oil to proper level.
Packing failure. (*excessive*)	Improper installation.	Install per instructions.
	Improper or inadequate lubrication.	Lubricate per instructions.
	Improper packing selection.	Change to correct packing.
	Scored plungers.	Replace.
	Worn or oversized stuffing box bushings.	Repair or replace. Check bore and outside diameter of bushings frequently. (Many times plungers are replaced and bushings ignored.)
	Plunger misalignment.	Realign. Plungers must operate concentrically in stuffing box.
Wear of liquid end parts.	Abrasive or corrosive action of liquid.	Check valves and seats frequently at start-up to determine schedule for replacing, etc. Eliminate sand, abrasive, air entering pump.
	Incorrect material.	Install correct materials.
Liquid end cylinder failure.	Air entering suction system.	Eliminate air. **NOTE**: Pitting often leads to hairline cracks which ends in cylinder failure.

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TROUBLE LOCATION & REMEDY

Trouble	Possible Cause	Remedy
Wear of power end parts. (*excessive*)	Poor lubrication.	Replace oil as recommended in instructions. Keep oil clean and at correct temperature. Be sure oil is reaching all bearings.
	Overloading.	Modify pump or system to eliminate overload.
	Liquid in power end.	Drain power end. Eliminate cause or source of liquid entering power end. Relubricate.
Excessive heat in power end. (*Above 180°F*)	Pump operating backwards.	Correct rotation.
	Insufficient oil in power end.	Fill to proper level.
	Excessive oil in power end.	Drain to proper level.
	Incorrect oil viscosity.	Fill with correct oil.
	Overloading.	Reduce load.
	Tight main bearings.	Correct clearance.
	Drive misaligned.	Realign.
	Belts too tight.	Reduce tension.
	Discharge valve of a cylinder(s) stuck open.	Fix valve(s).
	Insufficient cooling.	Provide adequate cooling for oil or reduce ambient temperature.
	Pump speed too low.	Increase speed.

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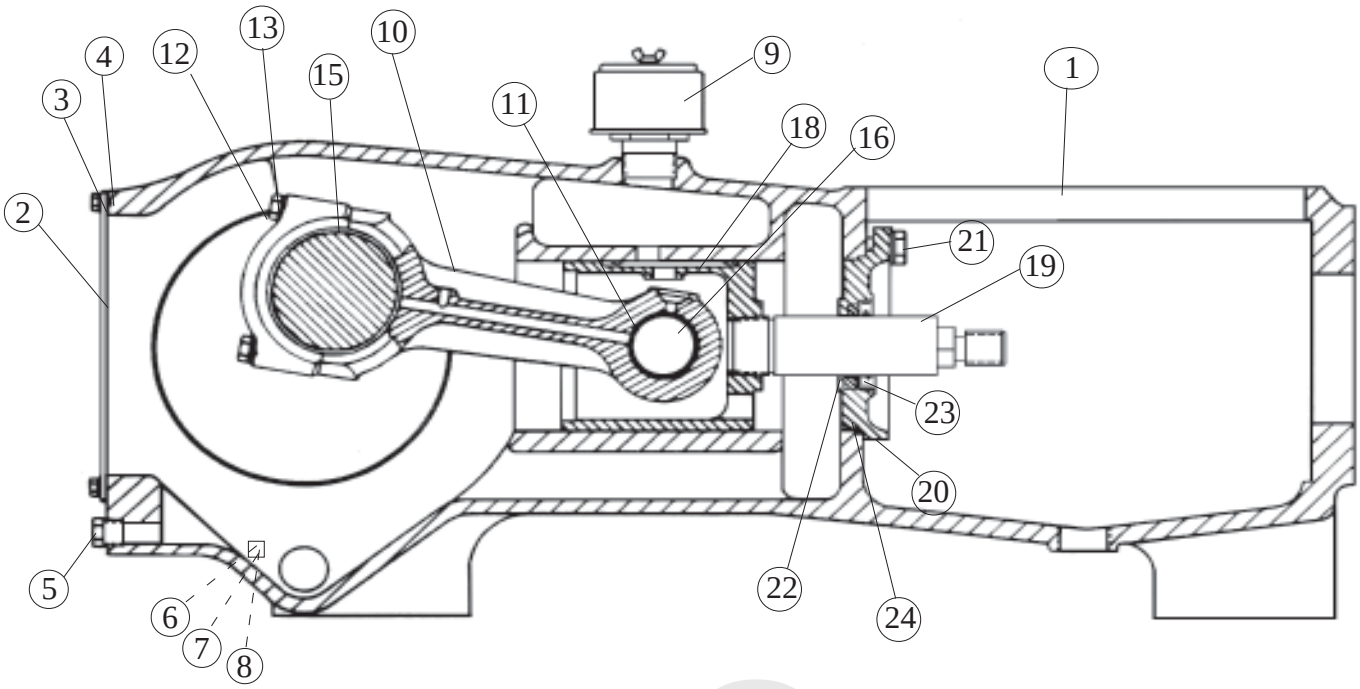
SC-170DD TRIPLEX



DESCRIPTION: Power Frame Assembly; Conn. Rod, Crosshead & Wiper Box Assembly

ITEM	QUANTITY	DESCRIPTION	PART NUMBER
1	1	Power Frame	7204-0305-00K
2	1	Crankcase Cover	7204-0304-00C
3	14	3/8” NC Hex Head Cap Screw X 3/4” Long	100-038034-273
4	1	Gasket, Crankcase Cover	7502-1035-00B
5	1	1/2” Pipe Plug, Hex Head	170-012002-250
6	1	Oil Level Sight Gage (not shown)	7602-3000-00A
7	1	1/4” Pipe Nipple, Std. Wt. - 2” Long	157-014200-235
8	1	1/2” Pipe Plug, Socket Head	170-012003-250
9	1	Breather, Crankcase, 3/4” NPTM	7602-3001-00A
10	3	Connecting Rod sub-assembly, which includes:	7204-0311-00D
11	1	Wrist Pin Bushing	7204-0310-00B
12	2	Connecting Rod Bolts	7204-0312-00A
13	2	1/2” Lockwashers, Spring Medium	154-012087-244
14	2	1/8” Pipe Plugs, Sq. Head (not shown)	154-012087-244
15	3	Crankpin Bearing Pair, w/Oil Groove	7204-0073-10K
16	3	Wrist Pin	7204-0005-00A
17	3	3/8”NC Socket Hd. Set Screw, Nylok-1/2” Long	119-038012-999
18	3	Crosshead	7204-0309-00C
19	3	Extension Rod	7204-0065-10B
20	3	Wiper Box	7204-0306-00C
21	6	5/8”Hex Head Cap Screw x 1 1/2” long	100-058112-273
22	3	Polypak Ring 2” ID. x 2 3/4” OD.	145-200234-999
23	3	Oil Seal	145-200300-999
24	3	O-Ring, Nitrile Rubber	110-000253-201

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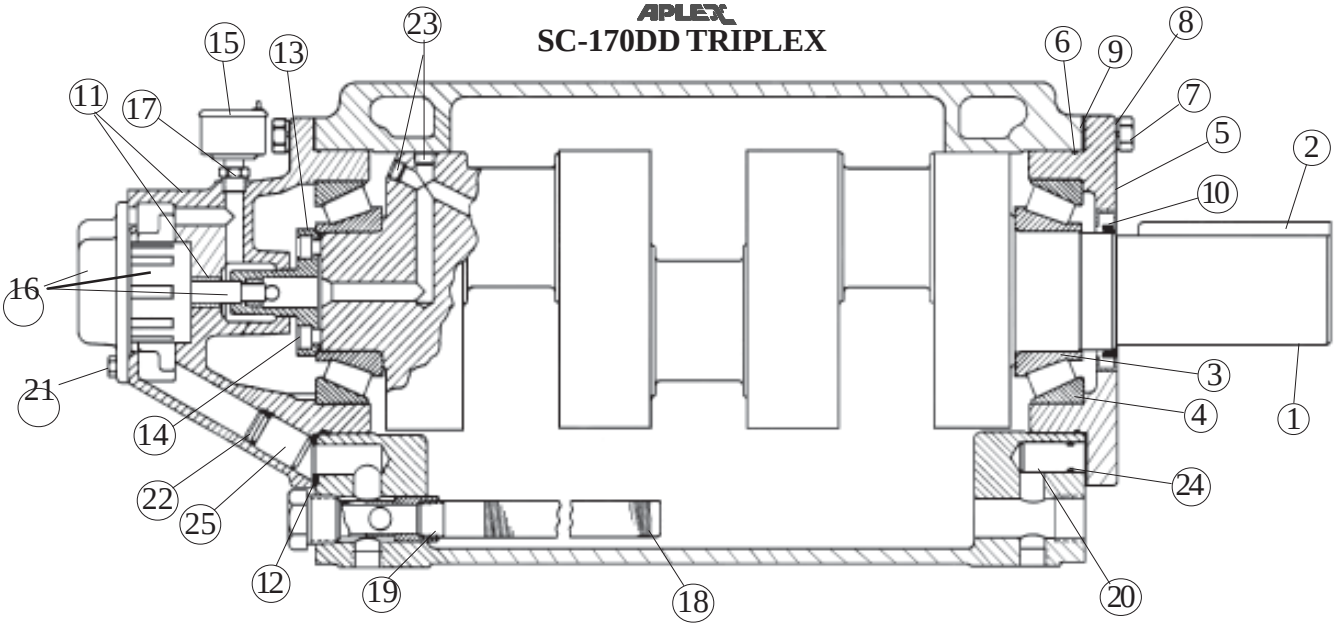

DESCRIPTION: Crankshaft Assy. 4 1/4" Stroke
Right Hand and Left Hand Drive (Right Hand Shown)

ITEM	QUANTITY	DESCRIPTION	PART NUMBER
		Crankshaft Assembly *(includes items 1 & 2)*	PE103K
1	1	Crankshaft	7204-0957-00D
2	1	Drive Key	146-078634-236
		OR	
		Crankshaft KIT *(includes items 1, 2, 3, & 4)*	PE103KB
3	2	Bearing Cone, Tapered Roller	203-168000-999
4	2	Bearing Cup	202-458000-999
5	1	Bearing Carrier, Drive Side	7204-0018-00B
6	2	O-ring, Nitrile Rubber	110-000271-201
7	12	5/8” NC Hex Head Cap Screw 1 3/4” Long	100-058134-273
8	12	5/8” Lockwasher, Spring Medium	154-058108-244
9	2	Shim Set	7502-0293-00A
10	1	Oil Seal, Drive Side	145-393538-999
11	1	Bearing Carrier, Lube Oil Pump Side Ass’y	7204-0324-00E
		includes Shaft Bushing	7204-0320-00A
12	1	Gasket	7204-0323-00A
13	1	Bearing Retainer & Lube Oil Pump Driver Ass’y	7204-0322-00B
14	4	1/2”NC x 1” Lg. Socket Hd. Cap Screw, Nylok	272-012100-999
15	1	Switchgage, Murphy	7509-0008-00A
16	1	Lube Oil Pump	7204-0325-00A
17	1	3/8” x 1/8” Hex Pipe Bushing, Hex, Iron	161-038018-451
18	1	1” x 15” Oil Filter	7602-3005-00A
19	1	1 1/4” Oil Filter Plug	7204-0314-00A
20	1	Frame Plug, Drive Side	7204-0315-00A
21	8	5/16”NC x 5/8” lg. Hex Hd. Cap Screw	100-516058-273
22	1	O-Ring, Nitrile Rubber	110-000210-201
23	2	3/8”Pipe Plug, Socket Hd.	170-038003-235
24	1	O-Ring, Nitrile Rubber	110-000023-201
25	1	Check Valve, Brass	7509-0012-00A

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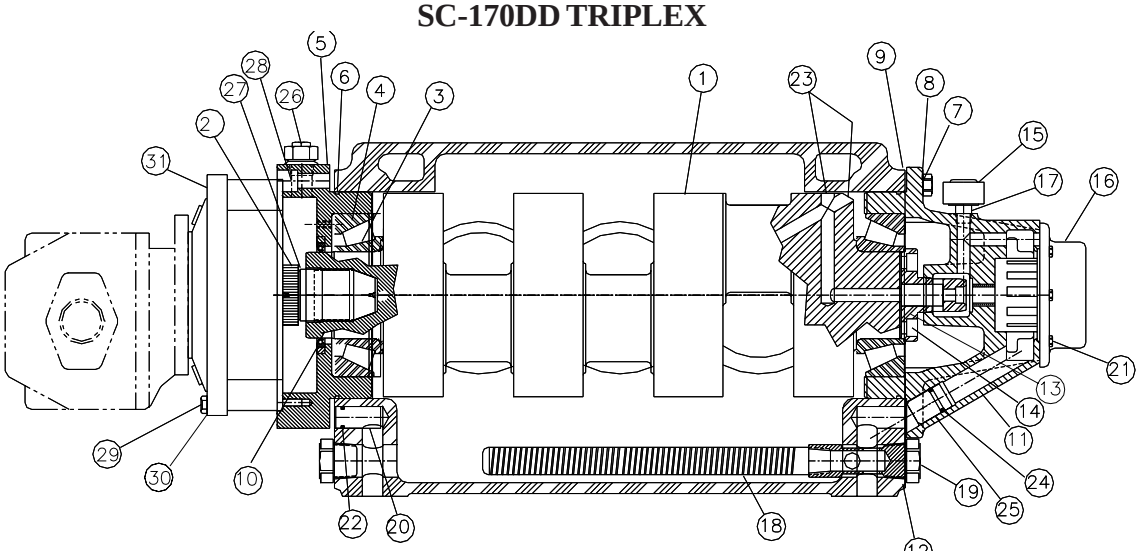

DESCRIPTION: Crankshaft Assy. 4 1/4" Stroke Auburn Gear #8 -- Left Hand Drive

ITEM	QUANTITY	DESCRIPTION	PART NUMBER
		Crankshaft Assembly *(includes items 1, 2 & 27)*	PE336K
1	1	Crankshaft	7204-1089-00A
2	1	Spline Adaptor	7204-1088-00A
27	1	Snap Ring	226-000237-999
		OR	
		Crankshaft KIT *(includes items 1, 2, 3, 4, & 27)*	PE336KB
3	2	Bearing Cone, Tapered Roller	203-168000-999
4	2	Bearing Cup	202-458000-999
5	1	Bearing Carrier, Gear Adaptor	7204-1087-00B
6	2	O-Ring, Nitrile Rubber	110-000271-201
7	6	5/8” NC Hex Head Cap Screw 1 3/4” Long	100-058134-273
8	6	5/8” Lockwasher, Spring Medium	154-058108-244
9	2	Shim Set	7502-0293-00A
10	1	Oil Seal, Drive Side	145-393538-999
11	1	Bearing Carrier, Lube Oil Pump Side Ass’y	7204-0324-00E
		includes Shaft Bushing	7204-0320-00A
12	1	Gasket	7204-0323-00A
13	1	Bearing Retainer & Lube Oil Pump Driver Ass’y	7204-0322-00B
14	4	1/2”NC x 1” Lg. Socket Hd. Cap Screw, Nylok	272-012100-999
15	1	Switchgage, Murphy	7509-0008-00A
16	1	Lube Oil Pump	7204-0325-00A
17	1	3/8” x 1/8” Hex Pipe Bushing, Hex, Iron	161-038018-451
18	1	1” x 15” Oil Filtert	7602-3005-00A
19	1	1 1/4” Oil Filter Plug	7204-0314-00A
20	1	Frame Plug, Drive Side	7204-0315-00A
21	8	5/16”NC x 5/8” Lg. Hex Hd. Cap Screw	100-516058-273
22	1	O-Ring, Nitrile Rubber	110-000210-201
23	2	3/8”Pipe Plug, Socket Hd.	170-038003-235
24	1	O-Ring, Nitrile Rubber	110-000023-201
25	1	Check Valve, Brass	7509-0012-00A
26	1	Breather, Filter	7602-3002-10A
28	6	5/8” Socket Head Cap Screw x 2 1/2”	105-058212-273
29	12	3/8” Hex Head Cap Screw x 3 1/4” long	100-038314-454
30	12	3/8” Washer “Stat-O-Seal’	156-038062-999
31	1	Auburn Gear #8 7.07:1	7503-0620-00A

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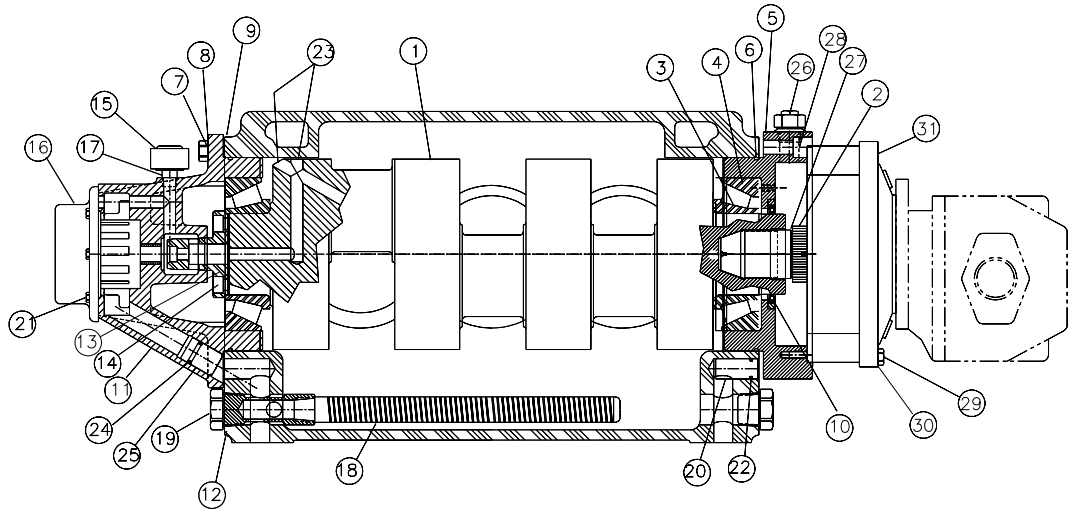

DESCRIPTION: Crankshaft Assy. 4 1/4" Stroke Auburn Gear #8 -- Right Hand Drive

ITEM	QUANTITY	DESCRIPTION	PART NUMBER
		Crankshaft Assembly *(includes items 1, 2, & 27)*	PE315K
1	1	Crankshaft	7204-1164-00A
2	1	Spline Adaptor	7204-1163-00A
27	1	Snap Ring	226-000237-999
		OR	
		Crankshaft KIT *(includes items, 1, 2, 3, 4, & 27)*	PE315KB
3	2	Bearing Cone, Tapered Roller	203-168000-999
4	2	Bearing Cup	202-458000-999
5	1	Bearing Carrier, Gear Adaptor	7204-1087-00B
6	2	O-Ring, Nitrile Rubber	110-000271-201
7	6	5/8” NC Hex Head Cap Screw 1 3/4” Long	100-058134-273
8	6	5/8” Lockwasher, Spring Medium	154-058108-244
9	2	Shim Set	7502-0293-00A
10	1	Oil Seal, Drive Side	145-393538-999
11	1	Bearing Carrier, Lube Oil Pump Side Ass’y	7204-0324-00E
		includes Shaft Bushing	7204-0320-00A
12	1	Gasket	7204-0323-00A
13	1	Bearing Retainer & Lube Oil Pump Driver Ass’y	7204-0322-00B
14	4	1/2”NC x 1” Lg. Socket Hd. Cap Screw, Nylok	272-012100-999
15	1	Switchgage, Murphy	7509-0008-00A
16	1	Lube Oil Pump	7204-0325-00A
17	1	3/8” x 1/8” Hex Pipe Bushing, Hex, Iron	161-038018-451
18	1	1” x 15” Oil Filtert	7602-3005-00A
19	1	1 1/4” Oil Filter Plug	7204-0314-00A
20	1	Frame Plug, Drive Side	7204-0315-00A
21	8	5/16”NC x 5/8” Lg. Hex Hd. Cap Screw	100-516058-273
22	1	O-Ring, Nitrile Rubber	110-000210-201
23	2	3/8”Pipe Plug, Socket Hd.	170-038003-235
24	1	O-Ring, Nitrile Rubber	110-000023-201
25	1	Check Valve, Brass	7509-0012-00A
26	1	Breather, Filter	7602-3002-10A
28	6	5/8” Socket Head Cap Screw x 2 1/2”	105-058212-273
29	12	3/8” Hex Head Cap Screw x 3 1/4” long	100-038314-454
30	12	3/8” Washer “Stat-O-Seal’	156-038062-999
31	1	Auburn Gear #8 6.0:1	7504-1162-00A

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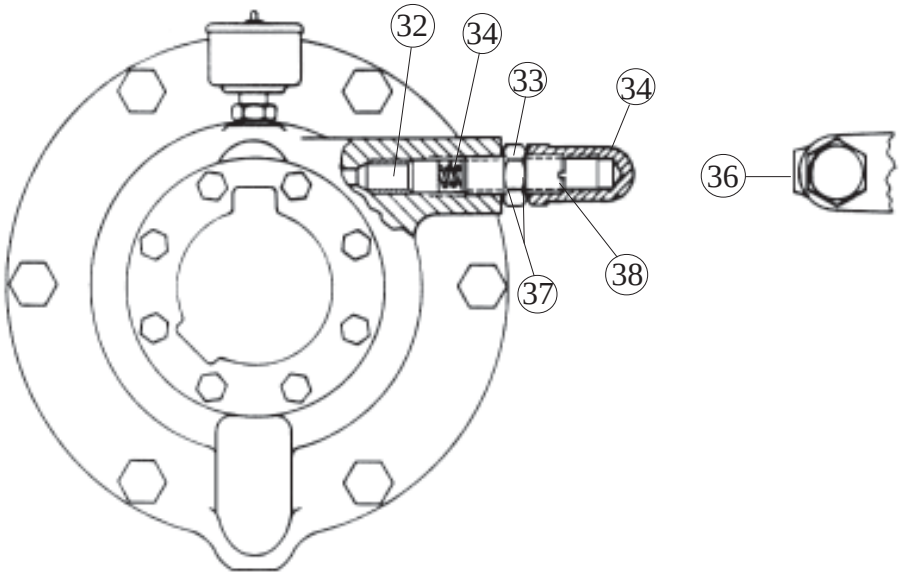

DESCRIPTION: Lube Assy. 4 1/4" Stroke
Right Hand and Left Hand Drive
Right Hand Shown

ITEM	QUANTITY	DESCRIPTION	PART NUMBER
32	1	Piston, Relief Valve	7204-0318-00A
33	1	Adjusting Screw, Relief Valve	7204-0317-00A
34	1	Spring, Relief Valve	7204-0319-00A
35	2	Washer	204-013009-206
36	1	1/8” Pipe Plug, socket Hd.	170-018003-235
37	1	7/8” x 14 Thread Jam Nut, Hex	130-078014-243
38	1	Cap, Relief Valve	7204-0316-00A

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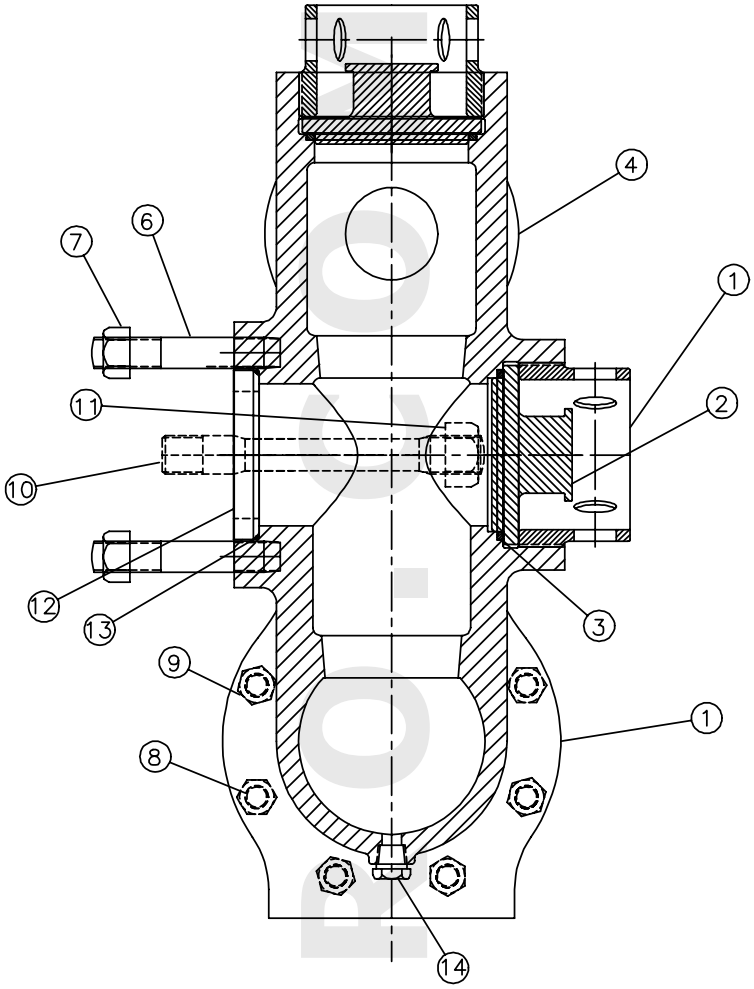
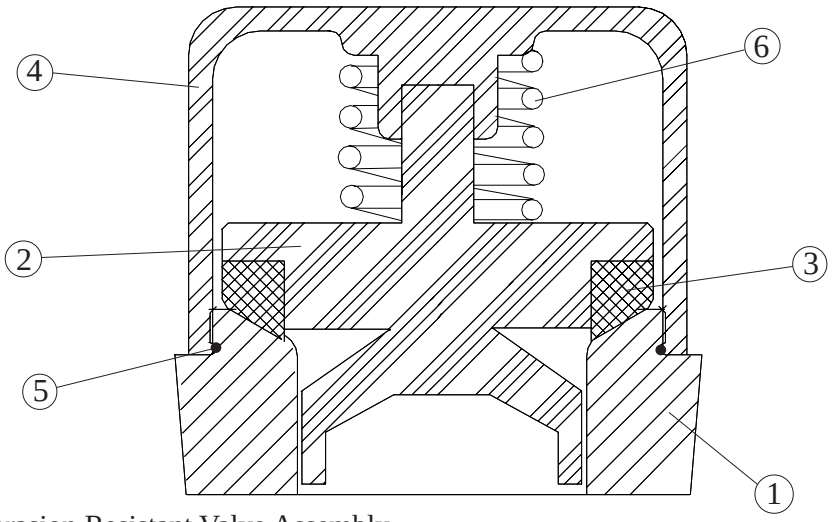


DESCRIPTION: Fluid End Assembly, Ductile Iron

ITEM	QUANTITY	DESCRIPTION	PART NUMBER
1	6	Valve Cover Screw, Ductile Iron	7204-0601-00B
2	6	Valve Cover, S.Steel	7204-1234-00B
3	6	Fluid Seal	7204-1235-10A
4	2	1/2” Hex Hd. Pipe Plug	170-012002-237
5	1	Liquid End, Ductile Iron	7204-1196-00D
6	12	1” x 6 1/8” Liner Stud	7204-1143-00A
7	12	1”-8NC Nut, Heavy Hex	133-100008-243
8	32	3/4” Stud, Flange	7507-2735-00A
9	32	3/4”-10NC Nut, Heavy Hex	133-034010-243
10	2	Stud, Power Frame to Fluid End	7204-1227-00A
11	2	1 1/4”-7NC Nut, Heavy Hex	133-114007-243
12	3	Seal Ring	7204-1237-00A
13	3	O-Ring, #252	110-000252-201
14	3	Pipe Plug, 3/4”	170-037002-237



DESCRIPTION: Abrasion Resistant Valve Assembly
Parts Assembly TS35-AR0-AC0882 Suction
Need 3 per pump

ITEM	QUANTITY	DESCRIPTION	PART NUMBER
1	1	Valve Seat, Suction	7204-1232-00A
2	1	Valve Body	7204-1229-00A
3	0	Polyurethane Insert (Included with 7204-1229-00A)	
4	1	Guide Cage	7204-1230-00A
5		Not Used	
6	1	Valve Spring	7204-1231-00A

DESCRIPTION: Abrasion Resistant Valve Assembly
Parts Assembly TS35-AR0-AC883 Discharge
Need 3 per pump

ITEM	QUANTITY	DESCRIPTION	PART NUMBER
1	1	Valve Seat, Discharge	7204-1233-00A
2	1	Valve Body	7204-1229-00A
3	0	Polyurethane Insert (Included with 7204-1229-00A)	
4	1	Guide Cage	7204-1230-00A
5		Not Used	
6	1	Valve Spring	7204-1231-00A

DESCRIPTION: Disc Valve Puller
Parts Assembly FE 873

QUANTITY	DESCRIPTION	PART NUMBER
1	Stem	7204-1151-00B
1	Wing Nut	7207-0037-00A
1	Bridge	7204-1207-00B
1	Puller Head	7204-1212-00B
2	Ball	7204-1213-00A
1	O-Ring	110-000228-201
1	Bolt Spacer	7204-1192-00A
1	Cage Wrench	7204-1210-00A
1	Puller Spacer	7204-1214-00A

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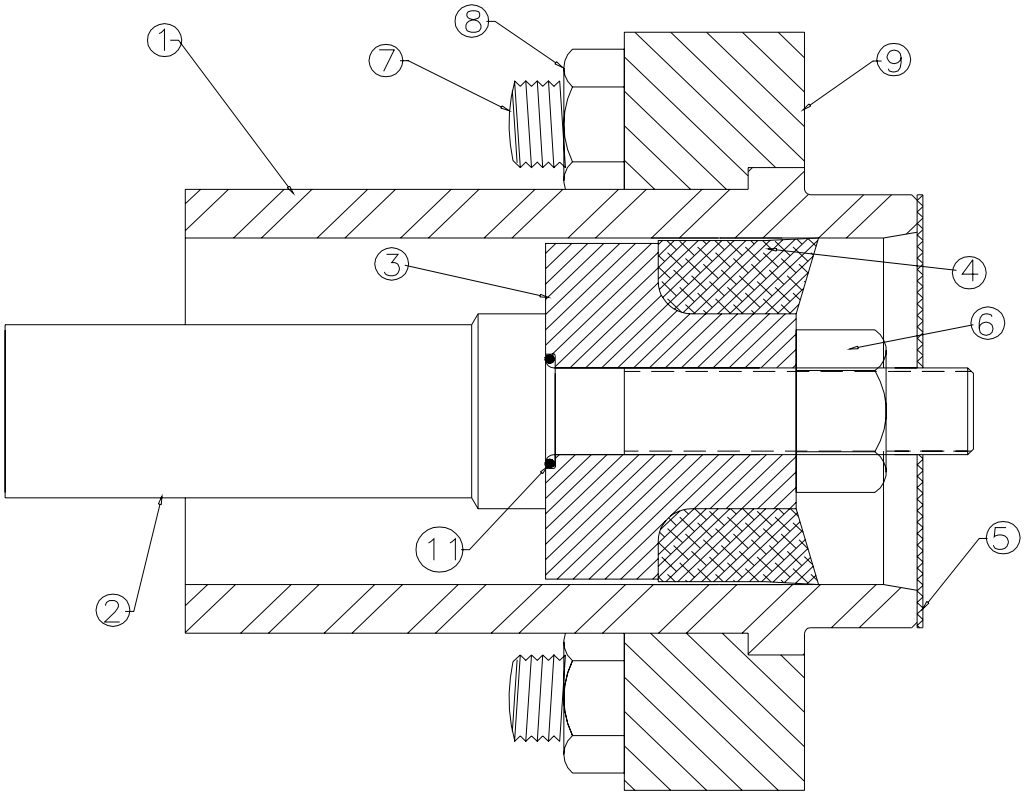

DESCRIPTION: 4” Piston Assembly
Quantity 3 per pump

ITEM	QUANTITY	DESCRIPTION	PART NUMBER
1	1	Piston Liner, 4” High Chrome Iron	7204-1106-00K
2	1	Piston Rod	7204-1056-00B
3	1	Piston Assembly (Black)	7204-1146-00K
4		Part of #3 Above	
5	1	Gasket, Liner	316-049042-508
6	1	Nut, Piston Rod, Self Locking	151-100008-273
7	4	Stud (included in FE350)	7204-1143-00A
8	4	Nut, 1”NC (included in FE350)	127-100008-243
9	1	Piston Liner Flange	7204-1054-00B
10	1	Baffle	7204-0016-00A
11	1	O-Ring, Furnished with item #3	110-000214-201