



DENISON HYDRAULICS

axial piston pump goldcup series

P24P/S E-mod., P30P/S B-mod.

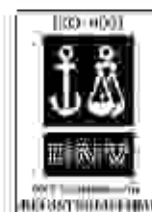
service information



Prod. L.T.000322-A

4/05

DENISON Hydraulics



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TECHNICAL CHARACTERISTICS

| specification | term | Goldcup 24 | Goldcup 30 | | |
|---|-----------------------|-----------------------|-------------------|-----------------------|-------------------|
| •displacement at max. angle | in ³ /rev. | 24.8 | 30.8 | | |
| | cm ³ /rev. | 800 | 971.4 | | |
| •pressure conditions | psi | 5000 | 5000 | | |
| | bar | 345 | 345 | | |
| •speed max. conditions at full stroke | rpm | 2100 | 1800 | | |
| consult DENISON HYDRAULICS for higher speeds | | | | | |
| •flow, ports A or B: (Reg. or max. disp.) | at 1500 rpm | gpm | 159.7 | 198.7 | |
| | | Lpm | 604.6 | 752.1 | |
| | at 1800 rpm | gpm | 191.7 | 238.4 | |
| | | Lpm | 726.6 | 902.6 | |
| | at 2100 rpm | gpm | 229.6 | | |
| | | Lpm | 868 | | |
| •aux. pump theoretical disp./rev. ⁵ | | P24P ⁶ | P30P ⁶ | | |
| | in ³ /rev. | | 2.81 | 2.81 | |
| | | cc/rev. | 48.1 | 48.1 | |
| | in ³ /rev. | | P24S ⁶ | P30S ⁶ | |
| | | cc/rev. | 1.08 | 1.08 | |
| | | | P24P ⁶ | P30P ⁶ | |
| •flow, auxiliary pump at 1500 rpm (internal, mod. flow) | at 1500 rpm | gpm | 18.2 | 18.2 | |
| | | Lpm | 69.1 | 69.1 | |
| | at 1800 rpm | gpm | 21.9 | 21.9 | |
| | | Lpm | 82.9 | 82.9 | |
| | at 2100 rpm | gpm | 25.5 | | |
| | | Lpm | 97.0 | | |
| at 1500 rpm | gpm | P24S ⁶ | P30S ⁶ | | |
| | | 6.5 | 6.5 | | |
| | Lpm | 24.5 | 24.5 | | |
| | at 1800 rpm | gpm | 7.8 | 7.8 | |
| | | Lpm | 29.5 | 29.5 | |
| | | P24S ⁶ | P30S ⁶ | | |
| •flow, auxiliary pump at 1500 rpm ⁶ (external - standard T6C case) | at 1500 rpm | gpm | 18.2 | 18.2 | |
| | | Lpm | 69.1 | 69.1 | |
| | at 1800 rpm | gpm | 21.9 | 21.9 | |
| | | Lpm | 82.9 | 82.9 | |
| | | P24P ⁶ | P24S ⁶ | P30P ⁶ | P30S ⁶ |
| | psi | 340-640 | 480-700 | 860-77.2 | 880-802 |
| bar | 23-44 | 34-54 | 25-53 | 34-56 | |
| *All. pump servo pressure range with pressure in port A or B labeled on O, B or 0 bar case pressure | | | | | |
| •Aux. pump replenishing pressure (labeled on O, B or 0 bar case pressure) | psi | P24P ⁶ | P24S ⁶ | P30P ⁶ | P30S ⁶ |
| | bar | 180-220 | 330-370 | 180-220 | 330-370 |
| | | 12-15 | 23-28 | 12-18 | 23-28 |
| •mounting | SAE | 477-4 (1P, 4 bolt) | | 477-4 (1P, 4 bolt) | |
| •main spline on keel | SAE | 50-1 A (1P) | | 50-1 A (1P) | |
| •weight | | P24P | P24S | P30P | P30S |
| | lbs | 680 | 758 | 710 | 787 |
| | kg | 313 | 344 | 322 | 357 |

⁵On P, S, Q chemical and oxidation inhibitor.

⁶Standard, other sizes available.

*Internal leakage provides servo flow and/or seal oil replenishment from external replenishing flow from external auxiliary pump.

⁷Any SAE 9C2 or SAE 10T-2 mounting pump may be used, with the corresponding adaptor.

refer to page 40 for specifications

SEAL KITS

seal kit P2430 complete (includes control seals)
 shaft seal kit (all)
 shaft seal kit
 shaft seal
 control seal kit (all - input & output)

see part (all)
 823-17338-0K
 see part (all)
 823-00015-5K
 823-17000-0K

Seal Kits for P24-30 Gold Cup Pumps

| CUP | MOD | SERIES | SHAFT TYPE | ROT | COMPLETE SEAL KIT | SHUTTLE | SHAFT SEAL KIT | |
|-------|--------------|--------|------------|-------|-------------------|--------------|----------------|--------------|
| 24/30 | E & B | F | M | R & L | 823-18006-0K | N/A | 823-11516-0K | |
| | | H | | | 823-18016-0K | | | |
| | | X | | | 823-11514-0K | | | |
| | | F | 7.8 | R | 823-17038-0K | | | 823-18332-0K |
| | | H | 7.8 | L | 823-17039-0K | | | 823-18333-0K |
| | | F | 7.0 | R | 823-18017-0K | | | 823-18332-0K |
| | | H | 7.8 | L | 823-18018-0K | | | 823-18333-0K |
| | | X | 7.0 | R | 823-18020-0K | | | 823-18332-0K |
| | | X | 7.8 | L | 823-18021-0K | | | 823-18333-0K |
| | | 24/30 | E & B | S | 2.5 | | | R & L |
| L | 823-18019-0K | | | | | | | |
| S | 7.0 | | | R | 823-17041-0K | 823-18332-0K | | |
| B | 7.8 | | | L | 823-17042-0K | 823-18333-0K | | |
| L | 7.8 | | | R | 823-18025-0K | 823-18332-0K | | |
| L | 7.8 | | | L | 823-18024-0K | 823-18333-0K | | |

Seal Kits for P24-30 Gold Cup Pumps with T6C Auxiliary Pumps

| CUP | MOD | SERIES | SHAFT TYPE | ROT | COMPLETE SEAL KIT | SHUTTLE | SHAFT SEAL KIT | |
|-------|-------|--------|------------|-------|-------------------|--------------|----------------|--------------|
| 24-30 | E & B | S | 2.5 | R & L | 823-18000-0K | 823-16088-0K | 823-11516-0K | |
| | | | | | 823-18001-0K | | | 823-18332-0K |
| | | | | | 823-18002-0K | | | 823-18333-0K |

Note: Add 4 FOR STEEL - 4 for EXE Rubber or 5 for VLD9 if replace it

The DENISON HYDRAULICS P24/S05 piston pump features advanced design concepts which maximize power and provide for enhanced pumping and control concepts. The instructions contained in this manual cover complete disassembly and reassembly of the unit. Before proceeding with the disassembly or reassembly of any unit, the manual should be studied in order to become familiar with proper order and parts nomenclature.

DESCRIPTION

The use of a rocker arm to control the pump displacement provides a compact package size, reduced weight, and speed control response. The internal cam/cam-follower eliminates linkage and backlash inherent in typical stroking cylinder designs. Standard controls for the Denison units are rotary servo and compressor over-ride. Additional control methods are also available.

MOUNTING

This pump is designed to operate in any position. The mounting flange and 4 ball mounting lugs are in full conformance with SAE standards. The pump shaft must be in alignment with the shaft of the prime mover and should be secured with a chain choker. The mounting pad or adapter into which the fluid pump axis must be concentric with the pump shaft to prevent bearing failure. This concentricity is particularly important if the shaft is rigidly connected to the prime mover without a flexible coupling.

REAR PUMP MOUNTING

Caution: P24/S05 ONLY

Shaft seal on coupling shaft isolates internal replenishing pressure from the external pump. As such, back in pumps equal to 4.0 x replenishing pressure, psi, or Newtons equal to 27.3 x replenishing pressure bar, will be exerted on the shaft of the rear mounted pump. Shaft bearing capacity of the external pump must be considered when applying external pump.

In any application, it is advisable to check the alignment of the pump shaft to the prime mover to avoid side-loading the pump shaft bearing and bending of the shaft.

The maximum allowable axial fit of the pump shaft and prime mover is 0.006 inch (0.15 mm T.I.R. (Total Indicator Reading)).

The maximum allowable angular misalignment is ± 0.02 inch per inch (0.002 mm per mm radius).

SHAFT INFORMATION

Spined: The coupling interface must be finished. DENISON HYDRAULICS recommends lithium-molybdenum disulfide or similar grease. The female coupling should be finished to 27-45 Ra and must conform to SAE-J496B (1974) class 1, but, not class II.

Keyed: High strength heat treated keys must be used. Replacement keys must be hardened to 27-34 Rc. The key corners must be chamfered 0.030" (0.040") 0.75-1 mm at 45° in chamfered radius at the keyway.

Note: Do not impact quill into face of the shaft. A fine key hole size M16 is provided in the end of the shaft.

Both types of shafts will accept a side load of 1000 lbs. (454 kg) at the center of the spline or key, with a B10 life of 2560 hours at 1800 rpm or 1185 hours at 1500 rpm.

PIPING

Connect inlet and outlet lines to the port block of the pump.

The maximum case pressure is 7.5 psi (5.7 bar) continuous, 125 psi (8.6 bar) intermittent. When connecting case drain line make certain that drain plumbing passes above highest point of the pump before passing to the reservoir. If not, install a 5 psi (0.3 bar) case pressure check valve to be certain the case is filled with oil at all times.

Note: High case pressure will result in wear and heat bearing 5:10 life.

The case leakage line must be of sufficient size to prevent back pressure in excess of 7.5 psi (5.7 bar) and return to the reservoir below the surface of the oil in the supply as possible. All fluid lines, whether pipe, tubing, or hose must be adequate size to resist free flow through this pump. We recommend 20 ft (6.09 meters) per second for main flow and 4 ft (1.4 m) max. limit per second for suction lines. The case drain flow can exceed the steady state rated pump flow during transient. Size the lines for 0.4 (3.05 m) max. per second. Pressure rating of piping must be adequate for service duty required. An undersize inlet line will prevent the pump from operating at full rated speed. An undersize outlet line will create back pressure and cause seal generation and improper operation. Flexible hose lines are recommended to connect the pump to system piping. If rigid piping is used, the workmanship must be accurate to eliminate stress on the pump port block or at the fluid connections.

Sharp bends in the lines must be eliminated wherever possible. All system piping must be cleaned with solvent or equivalent before installing pump. Make sure the entire hydraulic system is free of dirt, dirt, scale, or metal foreign material. Flushing with a large temporary high pressure loop filter is recommended. Piping must be cleaned so that the fluid cleanliness specified below is maintained.

Caution: Do not use galvanized pipe. Galvanized coating can flake off with continued use.

The fluid recommended for use in these pumps has a petroleum base and contains agents which provide oxidation inhibition and anti-rust, anti-foam and de-aerating properties as described in DENISON HYDRAULICS standard HF-A. Where anti-wear additive fluids are specified see DENISON HYDRAULICS standard HF-D.

VISCOSITY

Max. at 1000 rpm - 750 cSt; 1800 cSt
 (at 100% pressure, low flow, and if possible, low speed)
 Max. at full power - 750 cSt; 180 cSt
 Optimum for max life - 140 cSt; 30 cSt
 Minimum at full power - 80 cSt; 16 cSt

VISCOSITY INDEX

90 VI minimum. Higher values extend the range of operating temperatures but may reduce the service life of the fluid.

TEMPERATURE

Governed by the viscosity characteristics of the fluid used. Because high temperatures degrade seals, reduce the service life of the fluid and create varnishes, lumps (temperatures should not exceed 180° F, 82° C of the case drain).

ALTERNATE FLUIDS

Some applications require fire-resistant fluids. They will give good service if the system is originally designed for their use. Permissible fire-resistant fluids include:

| Type | DENISON HYDRAULICS Standard |
|--------------------------------|-----------------------------|
| Water-in-oil (water emulsions) | HF-3 |
| Water-glycol solutions | HF-4 |
| Phosphate esters | HF-5 |

Consult DENISON HYDRAULICS for design requirements and warranty limitations for service with this class of fluids.

See DENISON HYDRAULICS Bulletin SP0-444226 for more information.

FLUID CLEANLINESS

Fluid must be cleaned before and continuously during operation, by filters that maintain a cleanliness level of NAS (ISO Class 6) (max 9 for 15 micron and smaller). This approximately corresponds to ISO 7/14. The fluid level cleanliness can usually be accomplished by the effective use of 10 micron filters. Better cleanliness levels will significantly extend the life of the components. Its component generation may vary with each application. Each must be analyzed to determine proper filtration to maintain the required cleanliness level.

COMPARISON OF SOLID CONTAMINATION CLASSIFICATION SYSTEM

NATIONAL AERONAUTICS STANDARD (NAS) 1638

| | | class | | | | | | | | | | | | | |
|---------------------------|----------|-------|-----|-----|------|------|------|------|-------|-------|-------|--------|--------|--------|---------|
| | | 0/1 | 0/2 | 0/3 | 0/4 | 0/5 | 0/6 | 0/7 | 0/8 | 0/9 | 1/0 | 1/1 | 1/2 | | |
| particle range | 0-15µm | 138 | 350 | 300 | 4000 | 2000 | 4000 | 3000 | 10000 | 32000 | 84000 | 138000 | 355000 | 812000 | 1034000 |
| | 15-25µm | 22 | 44 | 69 | 178 | 388 | 710 | 1428 | 2856 | 5700 | 11400 | 22800 | 45600 | 91200 | 182400 |
| | 25-50µm | 4 | 8 | 14 | 28 | 58 | 116 | 232 | 468 | 936 | 1872 | 3744 | 7488 | 14976 | 29952 |
| | 50-100µm | 1 | 2 | 4 | 8 | 16 | 32 | 64 | 128 | 256 | 512 | 1024 | 2048 | 4096 | 8192 |
| total count per 100 ml | <5µm | 138 | 350 | 300 | 4000 | 2000 | 4000 | 3000 | 10000 | 32000 | 84000 | 138000 | 355000 | 812000 | 1034000 |
| | <15µm | 22 | 44 | 69 | 178 | 388 | 710 | 1428 | 2856 | 5700 | 11400 | 22800 | 45600 | 91200 | 182400 |

ISO/DIS 1406, SAE J1155

| | | iso solid contamination code | | | | | | | | | | | | | |
|--------------------------|-------|------------------------------|-----|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|
| | | 0/1 | 0/2 | 1/0 | 1/1 | 1/2 | 1/3 | 1/4 | 1/5 | 1/6 | 1/7 | 1/8 | 1/9 | | |
| maximum particle size | <5µm | 138 | 350 | 1000 | 2000 | 3000 | 4000 | 5000 | 6000 | 8000 | 10000 | 12000 | 15000 | 20000 | 25000 |
| particle size | <15µm | 22 | 44 | 130 | 260 | 400 | 500 | 600 | 800 | 1000 | 1200 | 1500 | 2000 | 2500 | |

NOTE: (a) measurements are for a 100 ml sample size.

INSTALLATION

It is essential to verify certain that the case (pump housing) is as full of hydraulic oil as possible and remains full during operation and at rest!

Always fill to the highest available point. Remove a plug or screw and allow the oil to escape through this point.

Recommended fill points:

- | | |
|---|--|
| <p>Mounting position vertical shaft up:</p> <p>Vertical shaft down ¹⁾ or horizontal shaft up ²⁾ to the side</p> | <p>D1 or D2 (drain) port in housing</p> <p>1) Vent D32 port in mounting flange (new units) or one of the upper screws which attach the unit to the frame. See installation drawing.</p> <p>D1 or D2 (drain) port in housing</p> <p>2) Vent D6 (case gauge) port in port block.</p> |
|---|--|

SERVICE INFORMATION

These hydraulic products are designed to give long operational life when properly applied and their systems properly maintained. These general instructions apply to two- and three-ported systems. Specific instructions for particular equipment can be developed from here.

MAINTENANCE

This pump is self-lubricating and preventive maintenance is limited to keeping system fluid clean by changing filters frequently, keep all fittings and screws tight. Do not operate at pressures and speeds in excess of the recommended limit. If the pump does not operate properly, check the troubleshooting chart before attempting to overhaul the unit. Overhauling may be accomplished by referring to the disassembly, rework limits of wear parts, and assembly procedures.

START UP PROCEDURES FOR NEW INSTALLATIONS

- Read and understand the instruction manual. Identify components and their function.
- Visually inspect components and lines for possible damage.
- Check reservoir for cleanliness and drain and clean as required.
- Check fluid level and filter, replace with filtered fluid at least as often as that recommended. **Fill pump case with clean oil prior to starting.**
- Check alignment of drive.
- Check silencers and activate it, if installed in circuit.
- Reduce pressure settings of relief valve or compensator. Make sure accurate pressure readings can be made at appropriate places.
- If solenoids are included in system, check for activation.
- Start pump drive first by jogging drive motor. Make sure pump and motor fit properly.

Caution: Ensure that the servo/pressure pump primes at startup. This is important on newly installed applications or one that did via the servo/pressure pump to force the prime during start-up. Failure to adequately prime can damage the main pump or the servo/pressure pump.

- Bleed system down. Re-check fluid level.
- Cycle in loaded machine at low pressure and observe activation (at low speed if possible).
- Increase pressure settings gradually in steps. Check for leaks in all lines, especially pump and pilot oil lines.
- Make correct pressure adjustments.
- Gradually increase speed. Be alert for trouble as indicated by changes in sounds, system shocks and oil in fluid.
- Commence normal operations.

Component problems and circuit problems are often interrelated. An improper circuit may operate with apparent success but will cause failure of a particular component within it. The component failure is the effect, not the cause of the problem.

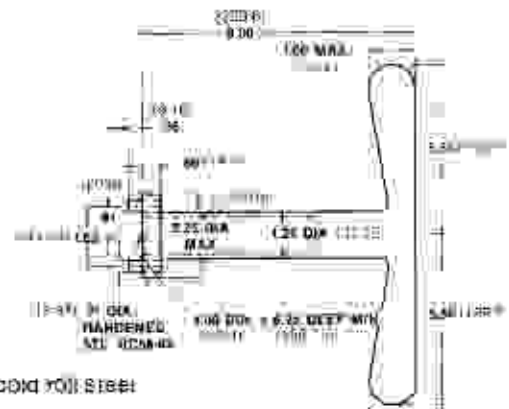
This general guide is offered to help in locating and eliminating the cause of the problem by attack of the effect.

| effect of trouble | possible cause | fault which needs remedy |
|---|---|---|
| noisy pump | oil in fluid | leak in suction line low fluid level (in filter) filter return lines above fluid level gas leak into accumulation excessive pressure drop in the lines (line from a pressurized reservoir) suction line strainer clogged as air trap |
| | contamination by bump or motor rotating gear | fluid too thick fluid too viscous fluid too heavy suction speed too high suction line too small suction line collapsed suction strainer too small or clogged suction strainer too dirty operating pressure too high load or relief (pressure) excessive (or) low replacement flow too small for dynamic operation |
| | misaligned shaft | faulty installation distortion in mounting axial interference faulty coupling excessive overhung load |
| | mechanical fault in pump | distortion and stress (excess) of fitting locking failure incorrect port plate selection of index embed or worn pump in the displacement control |
| precision barrel ports and bolt plate | oil in fluid distortion | see above see above |
| high wear in pump & motor | excessive load contamination particles in fluid | reduce pressure settings reduce speed improper filter maintenance filter too coarse introduction of dirty fluid to system reservoir openings improper reservoir treatment improper line replacement |
| | improper oil | fluid too thin or thick for operating temperature range breakdown of fluid with time/temperature/ bearing effect (rooms) additives in new fluid destruction of additive effectiveness with chemical aging |
| | | improper repair |
| | unwanted water in fluid | condensation faulty breathers/airlines heat exchanger leakage dirty clean-up practice water in make-up fluid |

TROUBLESHOOTING

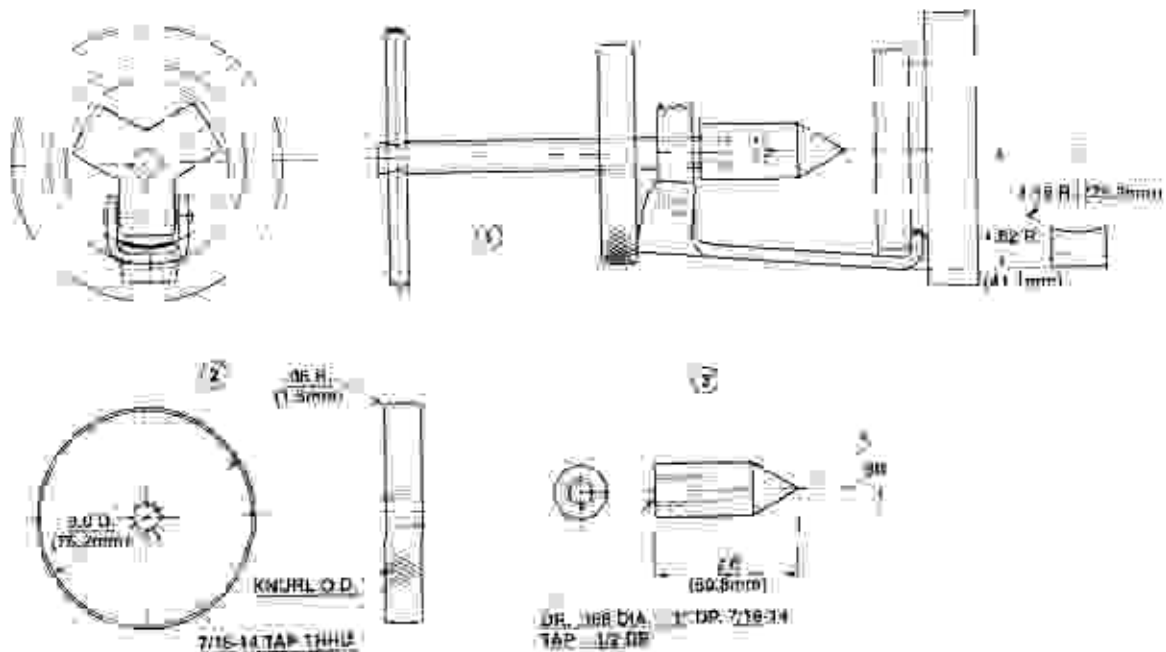
| effect of trouble | possible cause | fault which needs remedy |
|-------------------|---|---|
| pressure blocks | clogging load | mechanical considerations |
| | worn relief valve | needed repair |
| | worn compensator | needed repair |
| | blow response in relief valve | replace or relocate |
| | set up pressure too low to maintain firm control | increase pressure and check pressure drop through servo filter |
| | excessive de-compression relief | improve decompression control |
| | excessive life-capacitance (line volume, line stretch) accumulative effects | reduce the size of lines: eliminate hose |
| partial blow-off | re-check pump port-down (rotating group) dia (1) pressure | |
| heating of fluid | excessive pump torque/leakage | re-check case drain flow and repair as required fluid too hot improper assembly, port fitting |
| | relief valve | set too low compared to load or to compensation inability caused by back pressure, worn parts |
| | compensation | set too high (compared to relief) worn parts |
| | pump too large for fluid needs | select smaller pump displacement |
| | heat exchange | water turned off or too little flow water too hot fin clogged or restricted efficiency reduced by mud or scale deposits intermittent hydraulic fluid flow |
| | reservoir | too little fluid entrained air in fluid improper baffles returning air bubbles that prevent heat rejection heat pickup from adjacent equipment |

T2 Barrel H.D. adjustment tool



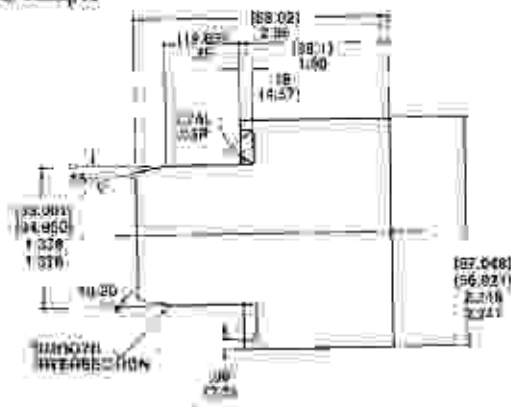
T2 Material - 4140 Steel

T3 Repeating and Servo pump remove tool



| ITEM | DESCRIPTION | PART NO. | QTY |
|------|---|----------|-----|
| 1 | Ø 1.50 (4mm) x 1.50 (6mm) Drill Bit 2 x 486 Carbide Steel Co. | | 1 |
| 2 | Ø 3.0 DIA 4140 Steel (76.2mm x 76.2mm) | | 1 |
| 3 | Ø 1.5mm DIA x 1.5mm 4140 Steel HDN GR | | 1 |

T4 Shaft Seal Installation tool - (see Adapte)



NOTES:
 1. Remove all burrs & dress sharp edges 2 with 60° or 25-45° chamfer
 2. Part to be heat treated to Rc 50-58
 3. Material 4140 or equivalent
 4. Dimensions in mm

The functional constraint of this section covers complete teardown of the hydraulic pump. Disassemble only as far as necessary for release or repair of any work parts.

DISASSEMBLY

CAUTION: On C4 Series units, barrel holddown may be removed for shaft seal or ball shaft. Failure to follow this procedure may result in pump failure.

NOTE: The four main assembly bolts (1, Figure 9) are torqued to 450 lbs-ft, 610± Nm. These bolts should be loosened prior to returning unit for disassembly.

Position pump motor (or the Valve Block assembly (1) (2, Figure 10)) from top. A bench or similar suitable surface capable of supporting unit should be used. Disassembly area should be clean.

VALVE BLOCK

See figure 10. Remove the eight hex head cap screws (13) and fit the entire block assembly into the port block.

See figure 13. Remove the four hex head cap screws (55) and four cap bolt screws (56) and fit the entire block assembly from the port block.

(After 7-23)

See figure 12. Remove rings (30), (21) and pin (21). Remove the B-32 nut from the bottom of block (1) to remove filter assembly (14). Do not remove the check valves (2)

Remove housing (8), O-ring (9), piston seal (10), O-ring (11), cover (6), nut (7) and boom pin (45) as a unit.

Remove spring (12) and cone (13). Remove seal (5) and O-ring (4).

NOTE: See the manual for new greasing. Use 1/2" air point socket with 1/4" cone.

Remove ring (25) and recharging relief valve (32).

Remove O-rings (37), (46) and (47). Remove four screws (43) and remove the control plate (42). Do not remove roll pin (48) unless replacements are needed.

Remove gasket (29) and seals (27) and (28). Remove poppets (30), (31) and springs (32), (33), (35) and retainer (34).

Inspect orifices (3) visually to ensure they are open. Do not remove unless damage or clogging is apparent.

CONTROL COVERS

See figure 7. Remove the four screws (13) with nylon washers (12) from the side cover (13) and remove the input control assembly.

NOTE: The nylon washers must be replaced at assembly.

Remove the four screws (13) with nylon washers (12) from the side cover (13). Remove the two screws (11) and the screw (10) and remove the balance plate (9).

See figure 6. Remove the nut screws (6) and remove the balance stem (7).

SERVO/REPLENISH PUMP AND BARREL HOLDDOWN

NOTE: P24305 units will require removing the shuttle valve assembly and external line pump assembly and tubing.

Removal of External Aux. Pump Shuttle Valve, Mounting Adapter and Internal Aux. Pump

See figure 10. Remove tubing between external pump and main pump.

Remove the screws holding pump. Remove pump from rear of the mounting pad.

Remove port screws holding shuttle (19) in place. Remove shuttle block.

Remove four screws (15) attaching an adapter (17) and remove adapter and O-rings (13) & (16).

Remove six screws (7) and mounting adapter (6), nutting (14), and gaskets (22).

On non rear drive units: Remove plug (9) and O-ring (6).

Remove eight screws (11) and end cover (5), two set screws (13) and O-rings (4) and (3).

Remove auxiliary pump assembly (2).

(Continued)

(24 series barrel holddown)

NOTE: The unit complete valve carriage assembly and removed. In one step, it pulls out T3 is reassembled.

Remove sealing washer (1).

See figure 4. Remove holddown lock retaining rod (2). Use internal rod rod pins (3) to prevent the rod from falling out.

See figure 9. Remove four screws (1) and two screws (8) **NOTE:** There is a metal top on the barrel holddown which will lift the port block approximately 1.8" (3.2mm) at release.

Carefully lift and remove port block (2) and port plate (9) **CAUTION:** The port plate may fall to the barrel face because of oil film. Do not allow the port plate to fall and become damaged.

See figure 6. Remove the face plate (2) and face plate pin (1) from the face of the barrel assembly.

See figure 5. Remove holddown adjusting screw lock (7) use an 1/8" hex type screwdriver with the handle grounded to clear holddown shaft.

See figure 7. Lock main shaft from turning.

See figure 4. Use special tool T2, slip over auxiliary shaft (2) and engage dowels into holddown adjusting screw (6). Loosen rod but do not remove.

See figure 1. Remove two bolts (5) being torqued and torqued together.

See figure 3. Push tubes (4) out of housing plate and to Ward barrel do not bend or damage them.

See figure 6. Lift housing (4) coil tubes and barrel assembly and remove. Mounting flange must be driven from housing due to tight fit.

NOTE: Do not damage gasket faces in this process. Do not remove the retaining screws or bearing from the housing unless bearing is damaged and replacement is necessary.

Barrel assembly can be removed by using with auxiliary shaft. The pistons will remain with the unit assembly. These parts are precision finished and must be treated with excellent care.

See figure 5. Using special tool T2, holddown assembly can be removed from barrel. Remove adjusting screw (6), spring (5), return (4), upper ball seat (3) and auxiliary shaft (2).

(25 series barrel holddown)

See figure 9. Remove four screws (1) and two screws (8) **NOTE:** There is a metal top on the barrel holddown which will lift the port block approximately 1.8" (3.2mm) at release.

Carefully lift and remove port block (2) and port plate (9).

CAUTION: The port plate may fall to the barrel face because of oil film. Do not allow the port plate to fall and become damaged.

See figure 6. Remove the face plate (2) and face plate pin (1) from the face of the barrel assembly.

See figure 4.1. Loosen six screws gradually in alternating sequence.

CAUTION: Holddown is under pressure. Do not remove screws completely.

Insert three #10-32 screws into the three #10-32 threaded holes. Alternately, drive in screws into the tapered retaining recesses. A loud knock sound should be heard when it releases.

See figure 7. Lock main shaft from turning.

See figure 4.1. Use special tool T2, slip over auxiliary shaft (2) and engage dowels into barrel holddown nutassy (5). Loosen rod but do not remove.

See figure 1. Remove two bolts (5) being torqued and torqued together.

See figure 3. Pull tubes (4) out of housing slots and toward frame, do not bend or damage them

See figure 6. Lift housing (4) over tubes and frame assembly and remove. Mounting flange must be driven from the housing due to tight fit.

NOTE: Do not damage gasket faces in this process. Do not remove the remaining screws or bearing from the housing unless bearing is damaged and replacement is necessary.

Panel assembly can be removed by lifting with auxiliary shaft. The pistons will remain with the cam assembly. These parts are precision finished and must be handled with extreme care!

PORT BLOCK

See figure 8. Remove the check valve assembly (7) from the port block

Remove plug (8) and (10)

Remove the screws (4), lock washers (5), check rings (6) and ramps (9)

DRIVE SHAFT

See figure 7. **NOTE:** Pump cam must be on center 0° angle before removing shaft.

Remove pin sleeves (5), seal retainers (3), bracket (4), and stationary part of shaft seal assembly (3). Refer to view of item (3)

Remove the carbon ring and the remainder of the shaft seal from the shaft

Remove shaft and bearing assembly (1)

ROCKER CAM AND CONTROL STROKING ASSEMBLY

See figure 3. Remove pressure feed tubes (4) from the circle. **DO NOT BEND THESE LINES!** Discard all seal O-rings

Remove the rocker cam assembly from the rotating flange by carefully lifting mounting flange on its side and using a 1/4-20 threaded rod to fit pillar. Remove plug (11) with O-rings (8) and then remove screws (9) attaching circle to mounting flange

Position rocker cam assembly in the clear stance with the override tubes (2) in a horizontal position and locked at the top.

See figure 2. Mark the cam (21) and cradle (16) as indicated. These marks will determine positioning of parts during assembly.

Position the assembly in a upright position on the flat surface of the cradle

Remove the retaining ring (1), thrust washer (2), detent rod shoe assembly (4) and creep plate (5) from the rocker cam (21).

Remove the lock screws (11) and four screws (12) from the control chamber covers (19A) and (19L).

Remove the control chambers (14). Remove the seals (7), four steel balls (16) and cover pins (15)

Remove the screw (13), valve seat cartridge (23), hold-down wires (22) from the rocker cam (21)

Remove the rocker cam from the cradle (11)

REWORK LIMITS OF WEAR PARTS

| wear part | max. rework from original dimension | min. dimension after rework |
|--------------------------|-------------------------------------|-----------------------------|
| port plate face | 0.010" 0.254 mm | 0.735" 18.67 mm |
| shoe retainer face | 0.005" 0.127 mm | 0.994" 25.55 mm |
| distal shoe face/booster | 0.010" 0.254 mm | 0.010" 0.254 mm |
| creep plate face | 0.010" 0.254 mm | 0.365" 9.27 mm |
| libe plate | none | replace |

*No rework allowed on 30° or 90° piston shoe face

(continued)

IMPORTANT:

The port plate finish must be 8 micrometers; 0.003 micrometer hole finish; flat within 0.0008", 0.0018 mm and parallel within 0.001", 0.0254 mm) for indicator reading.

The cross plate web finish must be 8 micrometers; 0.127 micrometer flat within 0.0005", 0.0127 mm and parallel to the backside within 0.001", 0.0254 mm) for indicator reading.

The shoe retainer wear face finish must be 32 micrometers; 0.13 micrometer and flat within 0.0009", 0.0127 mm. Must not be damaged.

The piston shoes wear face finish must be 32 micrometers; 0.762 micrometer and must be lapped in its set with the summer pass. All shoe sole thickness to be within 0.001" 0.0254 mm after lapping. The maximum permissible shoe to piston axial clearance is 0.010", 0.254 mm.

The special retaining ring service kit S23-12629 may be required to control shoe holddown clearance.

ASSEMBLY PROCEDURE

- All parts must be inspected and be free of major oil defects; dirt, scratches, dross, foreign matter etc.
- All parts must be cleaned with a suitable cleaning solvent and all holes and passages blown out with dry blast, (compressed air)
- After cleaning and inspection, all parts must be covered with a light film of oil and protected from dirt and moisture. Excessive handling of internal parts should be avoided prior to assembly.
- During assembly, upper and ground surfaces must be lubricated with clean oil and protected from nicks or surface damage.

DRIVE SHAFT AND BEARING ASSEMBLY

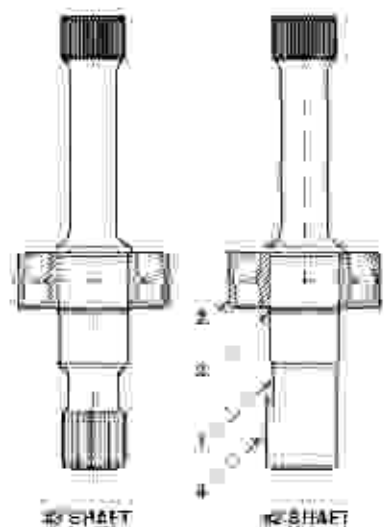


FIGURE 1

• See **Figure 1**. Slide the bearing (2) over the abott end of the shaft and seat against the shoulder. Support only the inner race of the bearing and press on the long end of the shaft. **Do not use excessive force.**

• **Do not use excessive force. Use extreme care passing the ring over the seal surface.**

• Install the retaining ring (3) in the groove. Be sure that the ring is fully seated.

PARTS LIST FOR FIGURE 1

S23-12474 DRIVE SHAFT #3 ASSEMBLY SPLINED.

S23-12475 DRIVE SHAFT #2 ASSEMBLY KEYS.

| Item | Description | part. no. | quantity | |
|------|-----------------|-----------|----------|----|
| | | | #3 | #2 |
| 1 | #3 spline shaft | 033-91189 | 1 | - |
| 2 | #2 lined ball | 033-91140 | - | 1 |
| 3 | Retain Ring | 230-82219 | 1 | 1 |
| 4 | Port O-ring | 033-71712 | 1 | 1 |
| 5 | Key | 033-71930 | - | 1 |

ROCKER CAM, PISTONS SHOES & RETAINER

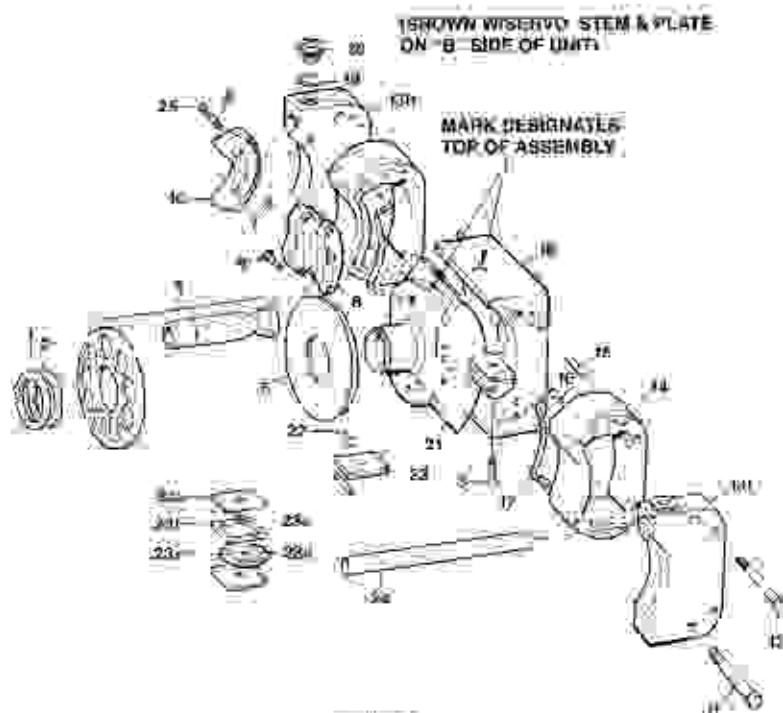


FIGURE 2

023-12478 is for RH CW rotation pumps with 'B' suffix input control on right side.⁷⁾

023-12479 is for LH CCW rotation pumps with 'B' suffix input control on right side.⁸⁾

023-12476 is for RH CW rotation pumps with 'A' suffix input control on left side.⁹⁾

023-12477 is for LH CCW rotation pumps with 'A' suffix input control on right side.¹⁰⁾

⁷⁾Viewed from shaft end of pump with Valve Block on top 12 o'clock position.

Figure 2

ROCKER CAM, PISTONS SHOES & RETAINER

PARTS LIST FOR FIGURE 2

| ITEM | DESCRIPTION | PART NO. | QUANTITY |
|------|---|-----------|----------|
| 1 | retaining ring-see shim size | | 1 |
| | 088-087 2.991-2.916mm thick with yellow dot | 033-71716 | |
| | 087-085 2.970-2.988mm thick with green dot | 033-71717 | |
| | 085-083 2.959-2.908mm thick with white dot | 033-81130 | |
| | 083-081 2.908-2.057mm thick with red dot | 033-71718 | |
| | 081-079 2.957-2.007mm thick with blue dot | 033-89745 | |
| | retaining ring-serve kit | 033-12829 | |
| 2 | throat washer | 033-89605 | 1 |
| 3 | socket head cap screw | 258-19180 | 2 |
| 4 | retainer plate-shoe assy. P24 | 313-44470 | 1 |
| | retainer piston-shoe assy. P30 | 023-12884 | |
| 5 | servo plate | 033-81853 | 1 |
| 6 | servo shim | 033-71712 | 1 |
| 7 | oil feed screw | 033-75819 | 2 |
| 8 | button head cap screw | 258-15023 | 2 |
| 9 | socket head cap screw | 358-10120 | 2 |
| 10 | servo plate | 033-83874 | 1 |
| 11 | flex. head cap screw 1/2-18 | 306-40174 | 4 |
| 12 | flex. head cap screw 3/8-16 | 306-40035 | 4 |
| 13R | right side chamber cover CW | 033-71598 | 1 |
| | right side chamber cover CCW | 033-71595 | 1 |
| 13L | left side chamber cover CW | 033-71597 | 1 |
| | left side chamber cover CCW | 033-71596 | 1 |
| 14 | control chamber | 033-71707 | 2 |
| 15 | cover pin | 204-00405 | 4 |
| 16 | steel ball | 201-00001 | 4 |
| 17 | control chamber seal | 896-25045 | 2 |
| 18 | rocker cradle | 033-84141 | 1 |
| 19 | O-ring | 891-00905 | 2 |
| 20 | needle roller plug | 488-35021 | 2 |
| 21 | rocker pin | 033-12482 | 1 |
| 22 | Hokkaido cone | 033-70819 | 4 |
| 23 | valve seat part lock | see below | 2 |
| 23a | valve seat pocket plate | 033-71725 | 1 |
| 23b | valve seat | 033-71714 | 2 |
| 23c | O-ring | 891-00128 | 2 |
| 23d | valve spacer | 033-71727 | 2 |
| 23e | spring | | 2 |
| | 2500-2495 5.35-5.337 mm blue | 033-89805 | |
| | 2576-2510 6.39-6.36 mm yellow | 033-89803 | |
| | 2530-2526 6.43-6.41 mm green | 033-53864 | |
| 24 | cover pin table P24 | 033-71721 | 2 |
| | cover pin table P30 | 033-57933 | 2 |
| 25 | flex. socket set screw | 312-00032 | 2 |

ASSEMBLY PROCEDURE

See figure 2. Position the annule (18) on a clean surface with the large flat side down.

Gently oil curved surface of annule. Position rocker cam (21) on top of annule, aligning notch marks made during disassembly.

Place O-ring (23a) on vane spacer (23b) and insert in the vane seat (23c).

Select spacer (23d) such that when installed in vane seat there is .0000-.0015" (.000-.036 mm) gap clearance between spacer and slot line. There are three different spacers available for this location. Each spacer is marked: 0.2500-0.2495" 6.35-6.357 mm color blue, 0.2516-0.2510" 6.39-6.36 mm color yellow, 0.2530-0.2525" 6.43-6.41 mm color green.

Install assembled vane seal cartridge in slotted boss on side of rocker cam as measured. Use a cam follower and lightly tap assembly in position after rocker cam is positioned in roller case.

Install lockwasher assembly (9) into cam eccentric through vane assembly. Torque to 30 lbf-ft, 40.7 Nm.

Install the four nylon hold-down cones (22) in the slots on each side of the vane seat, seal ridges (21).

Position both control chambers (14) on a clean surface with seal grooves facing up.

Insert one steel ball (16) in each of the counterbored holes at the end of each of the seal grooves. Don't fall in seat.

Install beads in grooves of the control chambers.

NOTE: The tapered side of the seal will be pushed into the groove and the angle must cover the steel balls.

Install the assembled control chamber (14) over the seal cartridge by sliding the chamber until they slip over the main seal cartridge. Then rotate in the opposite direction until the 3/32" dowel pin holes in the chamber align with the dowel pin holes in the rocker handle (18). Install dowel pins (15) through the control chambers and into the roller.

Install chamber covers (16R) and (16L) on the control chambers (14). The covers must be installed with the override tube (24) holes at the top. Note the marks made during disassembly to indicate the top of the rocker cam and cradle.

NOTE: Two sets of control oil in the system are available. The seal marked CW must be installed in the right hand rotation pump and the seal marked CCW must be installed in the left hand rotation pump. Rotation is determined from the shaft end of the unit.

Install two 1/2-13 hex. head cap screws (11) in each side. Torque to 75 lbf-ft, 101.75 Nm.

Install two 3/8-16 hex. head cap screws (12) in each side. Torque to 30 lbf-ft, 40.7 Nm.

Install O-ring (19) into hex socket (17) in each chamber cover.

Install override tubes (24) in holes in each cover. These tubes must be a tight fit. If tubes are loose, the ends may be expanded with a tapered punch. Tap the tubes in place with a plastic mallet.

Thread two orifice rings (7) into servo stem (8).

Determine the proper location of the servo plate and stem. Looking at the projecting center post of the roller cam with the override tube holes at the top, locate "A" mounted servo plate on right hand side or "B" on the left hand side.

Thread two #10-24 socket head cap screws (10) into the servo stem and into the roller cam (21). Torque to 7 lbf-ft, 9.5 Nm.

PISTON AND SHOE ASSEMBLY

Install servo plate (10) to stem (6) with two #10-24 bottom head screws (8). Torque to 20 lbf-in. 2.8 Nm. Install two seal cones (9) in servo plate. Torque to 25 lbf-in. 2.8 Nm.
NOTE: The servo plate cannot be assembled to the rocker cam until after the housing assembly installation. (See below) (See Figure 7)

Install creep plate (5) over center position rocker (2).

Insert piston and shoes into retainer and install entire assembly (4) against creep plate.

Install thrust washer (2) over center post of ram and against shoe retainer. Grooved side of washer must face shoe retainer.

Install the thickest retaining ring (1) that will fit in the groove of the rocker cam center post with an allowable maximum clearance of 0.002-0.005", 0.05-0.13 mm between the creep plate and shoe base. Touch the retaining ring with pressure, grasp one piston and fit until tight against shoe retainer. Insert thickness gage. If this clearance is not correct, select the appropriate retaining ring and repeat the checking procedure.

NOTE: If metallic thickness gage is used, caution should be exercised not to scratch groove face. There are five different retaining rings available for ring tolerance. Each retaining ring is marked: 0.081-0.093", 2.00-1.26 mm thick blue dot; 0.083-0.091", 2.08-2.05 mm thick red dot; 0.085-0.089", 2.159-2.108 mm thick white dot; 0.087", 0.086", 2.18-2.15 mm thick green dot and 0.095-0.097", 2.4-2.21 mm thick yellow dot. The final assembly must be checked to within 0.001" by hand.

See Figure 3, install two elbow fittings (3) into the threaded holes in the cradle.

NOTE: Check the feed tubes (4) and override tube (2) by fitting them into the contact port floor holes before assembling to the stroking assembly (5). They must be a snug, push fit as they rely on assembly to maintain contact with system pressure. If they fit loose or are damaged they must be replaced.

Install pressure feed tubes (4) to elbow fittings (3). Tighten the connectors with 40 lbf.

Position the mounting flange (7) with the large open end facing up and install two dowel pins (6) in the stroke mounting surface and one 3/8" 3.6mm diameter dowel pin (10) in the outer edge of the flange.

Install the roller cam and cradle assembly (5) over the dowel pins (6) in the mounting flange.

NOTE: Pressure feed tubes (4) go on the same side of mounting flange as the 3/8" 3.6 mm diameter dowel pin (10).

With cam and cradle installed, fit mounting flange on its side and secure with two lock cap screws (9). Torque to 50 lbf-ft. 67.8 Nm.

Insert plugs (11) with O-rings (8) into seal kit cap screw (9) holes. **Be sure tapered hole in plug (11) is visible after installation.** This is used for removal.

Install plugs (12) with O-rings (12).

metal shaft assembly

See Figure 7, install shaft and bearing assembly (7) either splined or keyed as specified by inserting shaft through bores. A few light taps are required on the outer side to completely engage and seat bearing.

NOTE: Do not tap on end of shaft, but on the bearing outer race only.

**MOUNTING FLANGE,
 CAM & CRADLE BARREL &
 AUXILIARY SHAFT ASSEMBLY**

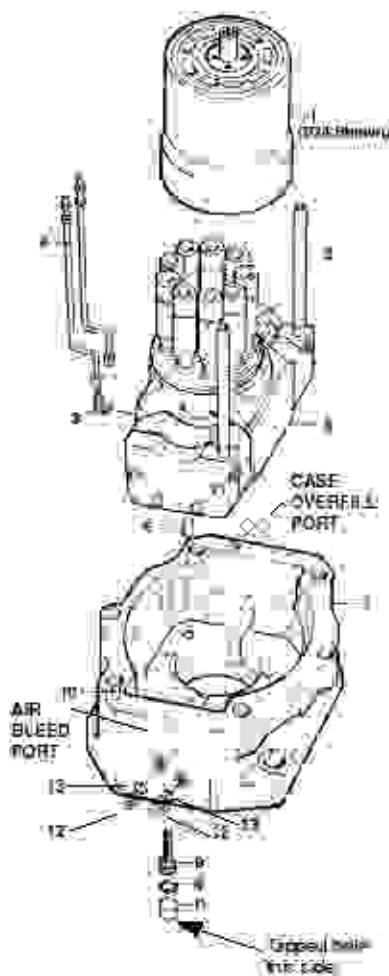


FIGURE 8

AUXILIARY SHAFT ASSEMBLY

(continued)

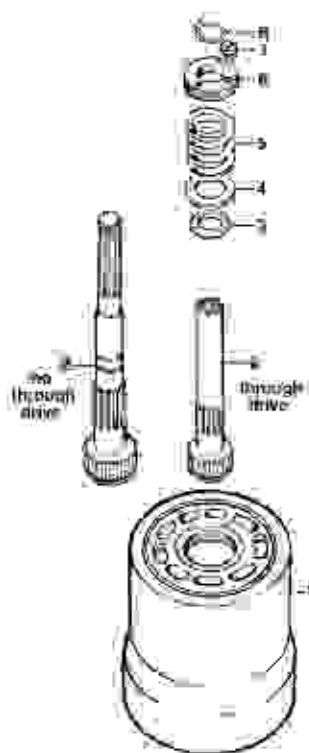
BARREL AND AUXILIARY
DRIVE SHAFT 24 SERIES

FIGURE 4

PARTS LIST FOR FIGURE 3

| item | description | part no. | quantity |
|------|------------------------------|--------------------|----------|
| 1 | barrel & aux. shaft assembly | see fig. 4 cr. 4.1 | 1 |
| 2 | auxiliary tube, item 2d | see fig. 2 | 2 |
| 3 | rocker elbow | 473-15041 | 2 |
| 4 | tube assembly P24 | S13-44469 | 2 |
| | tube assembly P30 | S23-12172 | 2 |
| 5 | locker cam 6-800KID 889 | see fig. 2 | 1 |
| 6 | power pin | 324-29028 | 2 |
| 7 | mounting flange | 023-51137 | 1 |
| 8 | O-ring | 01-100111 | 2 |
| 9 | set. lock cap screw | 888-18380 | 2 |
| 10 | power pin | 324-23416 | 1 |
| 11 | plug | 023-57173 | 2 |
| 12 | plug | 48R-25061 | 3 |
| 13 | O-ring | 691-00804 | 3 |

Return the mounting flange to an upright position and lift the rocker cam to either extreme attitude of the circle.

Position the cam assembly (1) directly over the piston. Starting with the uppermost piston, guide them one at a time into the barrel bores.

NOTE: Support the barrel & the main shafts in lines straightly to avoid load on the barrel lockup and fully engage the barrel and shaft splines. Now the lockdown assembly can be installed without any load against it.

See figure 4: Install auxiliary shaft (2) large square end first into counter bore in face of barrel spline.

Install spherical seat (3) into bore of spherical bore lip into counter bore in face of barrel.

Install spring retainer (4) socket side down into counter bore. Install spring (5) and seat against spring retainer.

Thread lockdown adjusting screw (6) into counter bore approximately four threads.

Fit barrel vertically and engage main shaft spline with the barrel spline allowing barrel lockup to engage.

Thread lockdown adjusting screw (6) into counter bore until it is flush to 0.005" (±.02 mm) maximum below surface.

PARTS LIST FOR FIGURE 4 (P24)

| item | description | part no. | P24 | quantity |
|------|--------------------------------------|---------------------|-----|----------|
| 1 | barrel & sleeve assembly | S23-12391 | 1 | |
| 2 | auxiliary drive shaft | 033-57267 | 1 | |
| | (no through drive) | | | |
| | auxiliary drive shaft, through drive | SAE-B=SS4-1744-0K | 1 | |
| | (through drive) | SAE-BB=323-1744B-0K | 1 | |
| | | SAE-C=323-1744B-0K | | |
| | | SAE-D=323-1744B-0K | | |
| 3 | spherical seat | 023-57147 | 2 | |
| 4 | spring retainer | 023-57135 | 1 | |
| 5 | spring | 023-57135 | 1 | |
| 6 | lockdown adjusting screw | 023-57139 | 1 | |
| 7 | lockdown set. screw lock | 023-57241 | 1 | |
| 8 | lockdown lock retaining ring | 023-57289 | 1 | |

ASSEMBLY PROCEDURE

See figure 4.1. Install auxiliary shaft (2) large spline end first into counter bore end of barrel and engage barrel splines.

Slide lockdown spring assembly (3) onto shaft (2). Install spring retainer (4) into counter bore.

Thread lockdown screw assembly (5) into barrel (4) clockwise approximately four turns.

Fit barrel vertically and engage main shaft splines with the barrel spline allowing barrel to drop in place.

Thread lockdown screw assembly (5) into counter bore until it is 25 mm (1.0 in) below barrel face.

PARTS LIST FOR FIGURE 4.1 (P30)

| Item | Description | Part No. | Quantity P30P | Quantity P30S |
|------|---|---------------------|---------------|---------------|
| 1 | Barrel & sleeve assembly | 322-12470 | 1 | 1 |
| 2 | auxiliary drive shaft | 020-91188 | 1 | 1 |
| | no through drive | | | |
| | auxiliary drive shaft B-coating (through drive) | SAE-B=323-17445-DK | | |
| | | SAE-BB=323-17446-DK | | |
| | | SAE-C=323-17447-DK | 1 | 1 |
| | | SAE-D=323-17451-DK | 1 | 1 |
| 3 | lockdown spring | 035-71713 | 5 | 5 |
| 4 | spring retainer | 033-91136 | 1 | 1 |
| 5 | barrel lockdown nut assembly | 329-12111 | 1 | 1 |

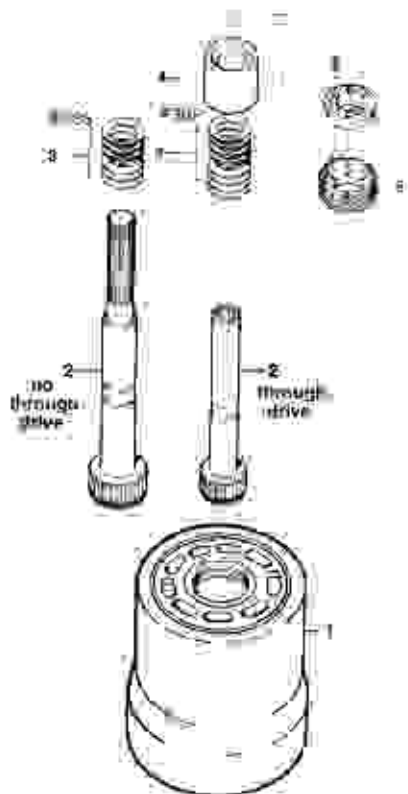


FIGURE 4.1

HOUSING ASSEMBLY

See figure 5. Clean housing (1) and position on a flat surface with the large open end up.

Apply Loctite® primer grade 17 & Loctite retaining compound #609 per A/P: 01433 to bearing I.D. & bearing bore of housing. Immediately align & press bearing into housing bore with a smooth steady force until seated. Install socket head cap screw (3) with washer (7). Typical two pieces. Torque to 30 lb-ft. 40.8 Nm.

Install two cover pins (4) in the pipe holes in the cap or cover pack. Repeat step above on the opposite side of the housing.

Install O-ring (5) and plug (6) in the bottom of housing.

PARTS LIST FOR FIGURE 5

| Item | Description | Part No. | Quantity |
|------|----------------------------|-----------|----------|
| 1 | Housing (P30) | 034-91150 | 1 |
| | Housing (P30S) | 034-91152 | |
| 2 | Bearing | 032-33346 | 1 |
| 3 | Screw, SOC, HD, SAE | #8-11106 | 2 |
| 4 | Cover pin | 329-12108 | 4 |
| 5 | O-ring | 331-00001 | 1 |
| 6 | Plug | 338-05018 | 1 |
| 7 | Washer 1.125 x 0.75 mm SAE | 345-10001 | 2 |

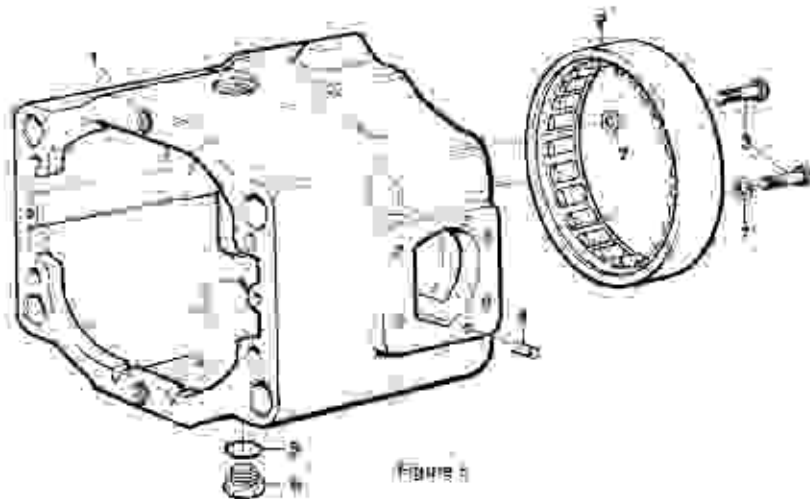


FIGURE 5

ASSEMBLY PROCEDURE

See figure 6. Install new gasket (2) over the dowel pin in the mounting flange. Do not use gasket compound.

Insert two screws (or cap screws) (7) through holes in flange stem (7). Attach flange stem to stroking control assembly. Torque to 70-lbs-in, 9.5 Nm.

Install the housing assembly (4) over the barrel/auxiliary unit assembly. Carefully guide the female filter and pressure feed tubes (items 2 and 4, figure 3) through the housing assembly. Position the pressure feed tubes in the slots in the housing face.

NOTE: Lightly force the pressure feed tubes downward toward the stroking assembly. Do not bend or crimp the tubes enough so that they must be pulled up a little to snap into the housing slots. This will hold them in position for assembling the part back to the housing.

Insert two hex nut cap screws (5) through mounting flange and into housing. Torque to 100-lbs-in, 13.5 Nm. These must be fully torqued later when main filter and in place.

Install face plate pins (1) in the holes provided in the barrel face.

Apply clean heavy grease to the surface of the barrel and install the face plate (2) over the face plate pins. The surface must be absolutely free of scratches, dust, dirt, or preservatives to prevent excessive leakage. Lubricate piston with stock system fluid through the holes in the face plate.

CAUTION: The face plate has a black finish coating on top of bronze which is bonded to a steel backing. Lightly sand the edge of the plate to identify the bronze coated side. The bronze side should go toward the part plate.

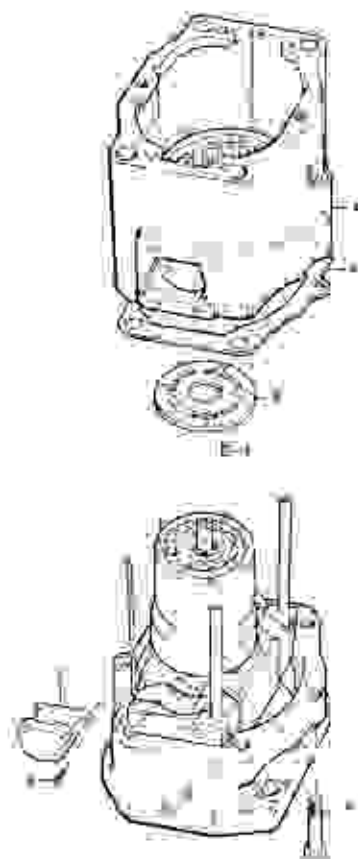
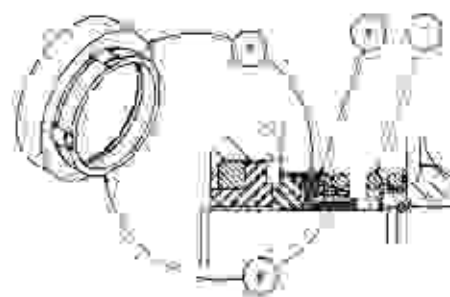


FIGURE 6

PARTS LIST FOR FIGURE 6

| item | description | part no. | quantity |
|------|-----------------------|------------|----------|
| 1 | face plate pins | 033-89747 | 3 |
| 2 | barrel face plate P29 | 033-71748 | 1 |
| | barrel face plate P30 | 033-67571 | |
| 3 | housing gasket | 033-91782 | 1 |
| 4 | housing assembly | see fig. 3 | 1 |
| 5 | hex nut screws | 303-40003 | 2 |
| 6 | hex nut cap screws | 388-110120 | 2 |
| 7 | flange stem | 033-74774 | 1 |



MECHANICAL SHAFT SEAL ASSEMBLY PROCEDURE

CAUTION: When installing a new mechanical shaft seal, exercise care to insure that all of the parts fit together properly. This is particularly important if the seal was once assembled and disassembled for some reason. If the rubber boot, item 4, grips the shaft and does not slide on the shaft, and it is assembled, then the spring, item 7, can disengage the shell, item 5, from the wand, item 6, so that they do not re-engage properly when reassembled. Be sure the shells and the wand are properly engaged before assembling the seal. And, never engaged during assembly.

NOTE: Re-using shaft seal is not recommended practice.

NOTE: Lubricate seal and shaft with clean hydraulic fluid of the same type that will be used in the system.

See figure 7.

NOTE: 24 series only - to replace shaft seal only:

Remove unit for disassembly.

Some units require removing an external bearing and external pump.

Follow steps removing the internal auxiliary pump and seal case see figure 10.

Remove retaining ring (8), figure 4.

Remove shaft seal. Follow seal assembly in reverse order.

Describe new shaft seal per instructions below.

After seal is replaced re-install retaining ring (8) figure 4 and reassemble auxiliary pump and unit per assembly instructions.

CAUTION: Failure to follow these instructions may result in pump failure.

SEAL ASSEMBLY

Procedure for Installation of Mechanical Shaft Seals

Use only clean hydraulic fluid from the test stand or system to lubricate the seal. The fluid must be compatible with the type of seals being installed. Ensure that you always use clean oil at all times when installing seals.

Install the shaft into the unit per procedure.

Ensure that the seal faces of the stator and carbon ring remain clean throughout the installation. These parts have highly polished finishes which must be maintained to seat properly.

Lubricate the seal ring on the outside of the seal stator (carbon) and install the seal retainer. Inspect the back of the retainer to ensure that the seal ring and stator are inserted completely and squarely into the retainer and the stator is not tipped. Care must be taken to ensure that the stator is not damaged. Avoid any impact on the piece.

Install O-rings into grooves on the seal retainer as required.

Lubricate the ends of the seal stator, the ID of the Polybor back, the face of the stator and the face of the carbon ring. **Without touching the face of the carbon seal**, slip the assembled spring and rubber boot onto the shaft until the spring retainer bottoms out. Align the seal retainer and mounting flange bolt holes and push the assembly down with the seal stator face against the carbon face until the seal retainer is in the mounting flange pilot. Taking care to keep the parts as level as possible. **Do not use impact tool** with 4 screws and torque to required specification.

Allow the unit to rest for a minimum of **one hour** before running to allow time for the seal retainer ring to adhere to the shaft.

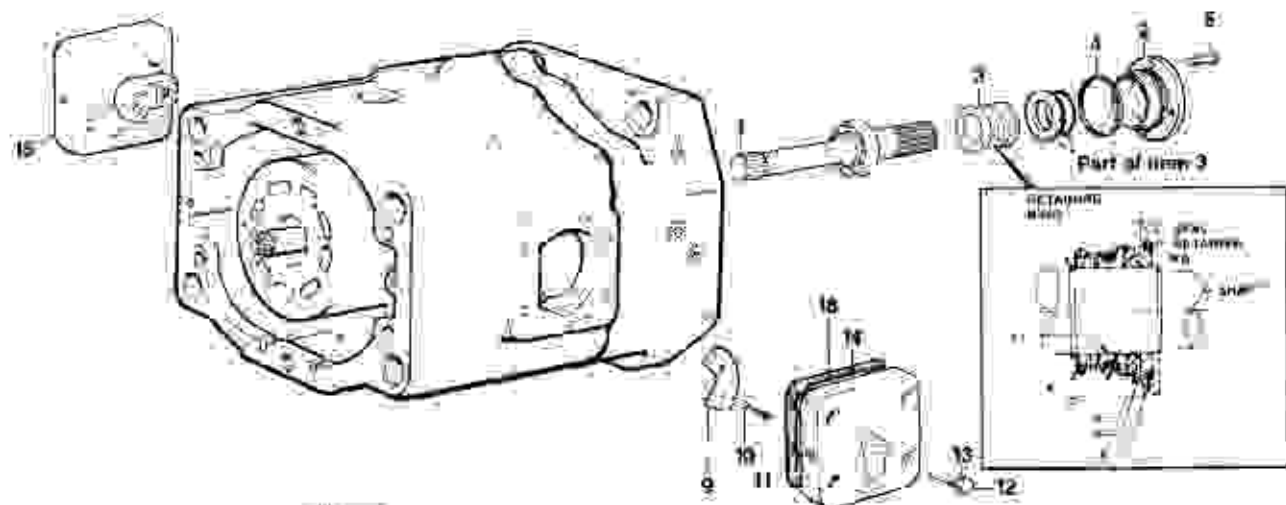


FIGURE 7

"B" mounting position shown

PARTS LIST FOR FIGURE 7

| Item | Description | part no | quantity |
|------|---------------------------|-----------|----------|
| 1 | No. 2 nipples (steelassy) | 322-12474 | 1 |
| | see figure 4 | | |
| | No. 2 hexed (steelassy) | 524-12476 | 2 |
| | see figure 1 | | |
| 2 | seat retainer | 004-57472 | 1 |
| 3 | o-ring seal | 623-00015 | 1 |
| 4 | seat retainer O-ring | 671-00246 | 1 |
| 5 | hex. thread screw | 206-40129 | 4 |
| 6 | not used | | |
| 7 | not used | | |
| 8 | not used | | |
| 9 | grease paste | 033-70548 | 2 |
| 10 | greaser | 633-71247 | 2 |
| 11 | loc. hd. cap screw | 259-02180 | 2 |
| 12 | nylon® washer | 631-45007 | 8 |
| 13 | hex. hd. washer screw | 359-25018 | 8 |
| 14 | control assy. output | see below | 1 |
| 15 | control assy. input | see below | 1 |
| 16 | Not used | | |
| 17 | Not used | | |
| 18 | Greaser | 033-91056 | 1 |

OPTIONAL CONTROLS

See page 64. Also see catalog ST-ZAM-7501-A.

COUNTERBALANCE PLATE ASSEMBLY

See figure 7. Place the two spacers (10) on the screws (11) and install through the grease paste (9).

Tighten screws with the appropriate tools in the correct order and tighten. Torque to 70 ft.-in. (9.6 Nm).

SERVO PLATE ASSEMBLY

Replace servo plate that was removed. See the assembly page 17 to get the name.

CONTROL COVER ASSEMBLY

Install gaskets (18) on covers.

PORT BLOCK ASSEMBLY

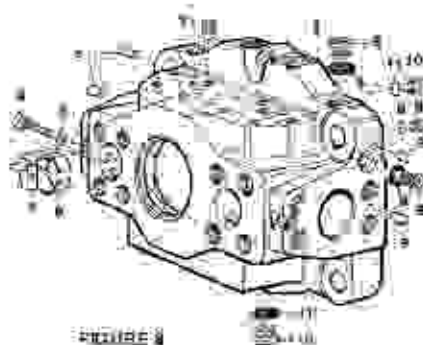


FIGURE 8

Install the cover assemblies (14) & (15) over the cover pins on the housing plate and secure with seal (12) and screws (13). Torque to 33 lbs-ft, 45.6 Nm

See Figure 8. Position the port block (1) on a clean flat surface with two open ports up. The O-Ring faces must not be scratched or damaged.

Compress the ring effects (7) and install in the two system ports and align holes in the ring with the side holes in the port walls.

Place lockwashers (8) on screws (4) and install screws through port wall and ring effects and tighten into (3). Torque to 10 lbs-ft, 13.55 Nm

Install two check valve assemblies (7) in valve face of port block. Torque to 33 lbs-ft, 45.6 Nm

Install two hex. socket plugs (9) and O-rings (10) into port block. Torque to 10 lbs-ft, 13.55 Nm

Install hex. socket plugs (10) and O-rings (11) into port block. Torque to 30 lbs-ft, 40.7 Nm

Install AVSEAL® plugs (2) into port block

PARTS LIST FOR FIGURE 8

| Item | Description | Part no. | (P24-30F) S23-15105 Quantity | (P24-30S) S23-15127 Quantity |
|------|--------------------------|-----------|------------------------------------|------------------------------------|
| 1 | port block | 003-81564 | 1 | — |
| | port block whiskette (3) | 003-81894 | — | 1 |
| 2 | ring check | 033-72355 | 2 | 2 |
| 4 | sec. flat cap screw | 359-11140 | 2 | 2 |
| 5 | lockwasher | 442-1001R | 2 | 2 |
| 6 | ring check ball | 003-72398 | 2 | 2 |
| 7 | check valve assembly | 519-40366 | 2 | 2 |
| 8 | O-ring | 691-00906 | 8 | 8 |
| 9 | hex socket plug | 488-3504d | 13 | 13 |
| 10 | hex socket plug | 488-3501R | 3 | 6 |
| 11 | O-ring | 691-00908 | 3 | 6 |

PORT BLOCK INSTALLATION

See Figure 9. Position the pump with open end of the coupling assembly (8) facing up. Install new gasket (5) on the housing. Do not use gasket putty.

Install two port plate pins (3) in the face of the port block assembly (2) and the cover pins (7) into mounting surface of port block.

Insert lifting eyes into stepped holes in each system port mounting surface.

Apply heavy grease to the seal of the port plate (4) and install over the port plate pins.

Temporarily attach port plate to port block by inserting bolt through one of the 2" (50.8 mm) diameter ports down through the port block bolt through slots in the port plate and bolt back through port block and the ends of the slot to lifting eye. Repeat this step to the other side of the port plate.

Install the port block assembly over the auxiliary shaft and position onto tubes and cover pins while engaging pressure-feed tubes.

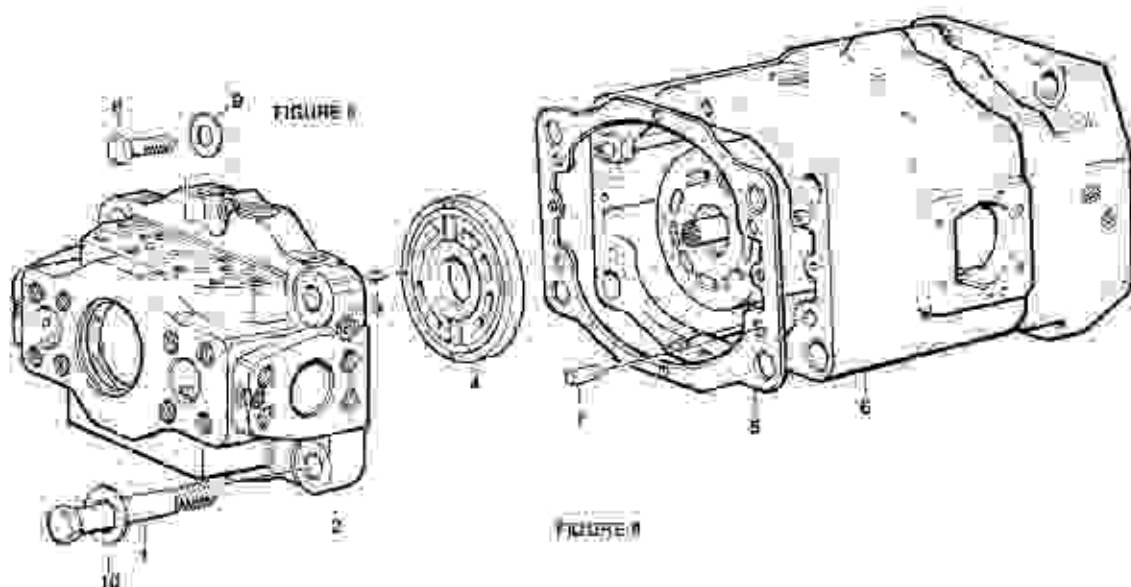
CAUTION: Use extreme care and slowly lower the port block carefully onto the four tubes which are precision fit in the port block. Check when the block is within 1/2" (12.7 mm) of seating that the tubes are square in the holes and the port plate is seated firmly against the block. Lower the block until the joint is closed.

Install the six bolts and washers (11) & (9) & (11) & (11). Do not drop the bolts in place as the threads will be damaged. Torque bolts evenly. Torque bolts (11) in 60 in, 67.8 Nm increments to 450 lbs-ft, 610 Nm and the two bolts (9) to 120 lbs-ft, 163 Nm, tighten ring nuts on all six bolts. Torque two bolts, Figure 9 to 120 lbs-ft, 163 Nm.

CAUTION: Exercise extreme care to prevent damage to the valve mounting surface while installing and torquing the last bolts.

PARTS LIST FOR FIGURE 9

| Item | Description | Part No | Quantity |
|------|--------------------------------|-----------|----------|
| 1 | hex. hd. cap screw P2WP | 805-40221 | 4 |
| | hex. hd. cap screw P2WP | 905-40230 | |
| 2 | port block assy. | S23-15105 | 1 |
| | port block assy. w/strutle 181 | S23-15127 | |
| 3 | port plate din. | 324-23610 | 2 |
| 4 | R.H. port plate 29 | 033-71732 | 1 |
| | R.H. port plate 29 | 033-91238 | |
| | L.H. port plate 29 | 033-71733 | |
| | L.H. port plate 29 | 033-91237 | |
| 5 | port block gasket | 033-91085 | 1 |
| 6 | housing assembly 24 | S22-12588 | 1 |
| | housing assembly 25 | S22-12178 | |
| 7 | cover pin | 324-24832 | 2 |
| 8 | hex. hd. cap screw | 805-40022 | 2 |
| 9 | washer lch. 331 | 360-10138 | 2 |
| 10 | washer lch. 331 | 360-10135 | 4 |



BARREL HOLDDOWN 24 SERIES

See figure 9 & 10. Use special tool T2 and improve an auxiliary shaft and engage the holes in the hold-down adjusting screw (8), figure 10. Carefully tighten until screw bottoms out.

NOTE: The main drive shaft must be held to prevent barrel assembly from turning. If barrel assembly turns, the adjustment cannot be made.

Remove special tool T2 and sight through hold-down screw and note where both of auxiliary shaft spline is located.

Back off hold-down screw (8) to (6) spline teeth on auxiliary shaft approx. 18°

NOTE: Top of hold-down screw must line up with space between spline teeth.

Barrel lift-off is now about 0.007-0.036" (75-91 mm).

Use a large screw driver with the sides of the blade ground down so it passes along side the aux. shaft and engaged the screw slot. Thread hold-down adjusting screw (8) (7), figure 10 into hold-down adjusting screw. Torque to 30 (lb.-ft. 40.7 Nm)

Barrel hold-down lock (retaining ring) (10), figure 10 over auxiliary shaft into groove which is located 5.512" (140.05 mm) from end of shaft.

ASSEMBLY PROCEDURE

See **Figure 4.1 & 10**. Use special tool TC to remove auxiliary shaft and engage drive pin into hold-down cone assembly (5). **Figure 4.7** Carefully tighten lockwile until hold-down screw assembly bottoms out.

NOTE: The main drive shaft must be held to prevent barrel assembly from rotating. If barrel assembly turns, the adjustment cannot be made.

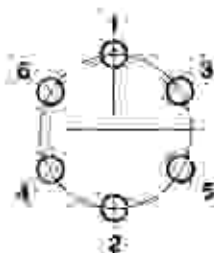
Back off hold-down screw assembly 1/40" counter-clockwise.

Barrel lift-off is now about 0.002" (0.01mm).

Remove cone wrench. Rotate drive shaft to check if drive binding occurs.

Lock hold-down screw assembly (1) plates by tightening the six (6) lockwile screws gradually in the following torque sequence until 65 lbs-in (7.4 Nm) torque is reached.

NOTE: If barrel hold-down pins to be used for any reason (HSA sockets) used on cones, must be loosened gradually in the same order they were tightened. Do not remove screws completely. Use the #10-32 UNF threaded tool in the insert (4) to disengage insert from hold-down cone assembly. Insert must be loose before reattaching barrel hold-down.



Torque sequence for locking hold-down screw assembly

AUXILIARY PUMP

See **Figure 10**. Slip sealing washer (1) into bore in port block, over auxiliary shaft and seat at bottom of bore.

With the yoke block face of the port block seated at 12 o'clock position, the dowel pin hole for cone carriage assembly (2) in the port block is located between 1 o'clock and 3 o'clock position.

Grease O-rings on yoke carriage assembly (3).

Install cone carriage assembly into port block, making sure dowel pin in cone carriage assembly is seat against sealing washer (1).

NOTE: Distance from end of cone carriage assembly to face of port block: 82 ± 0.001 in 20.6 ± 0.05 mm

Wipe cone locking end plate and remove.

END COVER

Apply a light film of oil or grease to O-ring (3), (4) and (5) and (6) and place O-rings (3) and (4) and a pilot of end cover (5) plate tetraquat (6) in groove in face of end cover.

Apply a light film of oil or grease to O-ring (11), and place on plug (10). Thread plug into end cover and tighten.

Engage pilot of end cover into bore of port block. Refer to figure 10 for (3) port positioning. Align holes and secure with screws (7). Torque to 350 lbs-in (47.43 Nm).

Apply a light film of oil or grease to O-ring (8), and place on plug (9). Thread plug into end cover and tighten.

Apply a light film of oil or grease to O-ring (21) and place on plug (20). Thread plug into end cover.

ASSEMBLY PROCEDURE

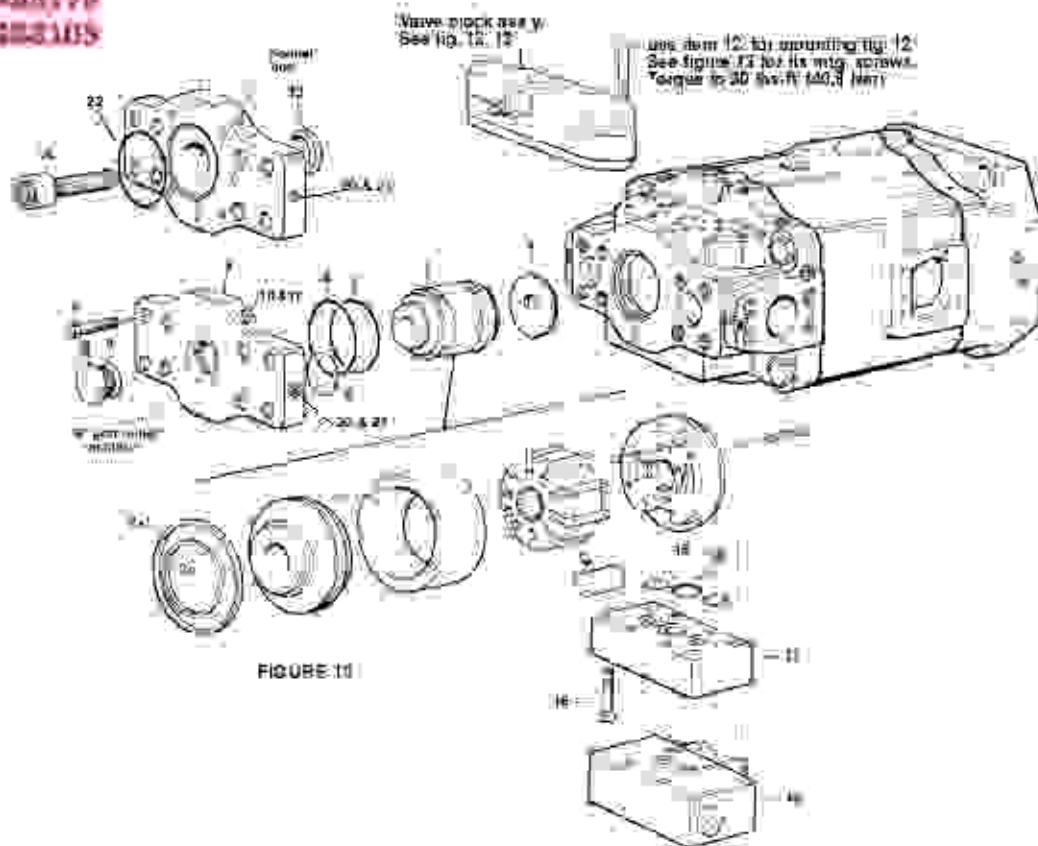


FIGURE 10

PARTS LIST FOR FIGURE 10

| ITEM | DESCRIPTION | PART NO | QTY. |
|------|---|-------------|------|
| 1 | Sealing washer | 033-61073 | 1 |
| 2 | cartridge assembly CW 2.91 in ³ /rev, 46.1 cc/rev | S24-11918 | 1 |
| | cartridge assembly CW 2.91 in ³ /rev, 46.1 cc/rev | S24-08562 | |
| | cartridge assembly CW 1.34 in ³ /rev, 21.9 cc/rev | S24-11788 | |
| | cartridge assembly CW 1.34 in ³ /rev, 21.9 cc/rev | S24-81298 | |
| | cartridge assembly CW 1.06 in ³ /rev, 17.2 cc/rev | S24-11697 | |
| | cartridge assembly CW 1.06 in ³ /rev, 17.2 cc/rev | S24-11778 | |
| | cartridge assembly CW 3.56 in ³ /rev, 58.2 cc/rev | S24-06842 | |
| | cartridge assembly CW 3.56 in ³ /rev, 58.2 cc/rev | S24-06568 | |
| | cartridge assembly CW 4.84 in ³ /rev, 79.3 cc/rev | S24-06508 | |
| | cartridge assembly CW 4.84 in ³ /rev, 79.3 cc/rev | S24-06510 | |
| | cartridge assembly CW 5.42 in ³ /rev, 88.8 cc/rev | S24-69882-D | |
| | cartridge assembly CW 5.42 in ³ /rev, 88.8 cc/rev | S24-69844-D | |
| | cartridge assembly CW 6.10 in ³ /rev, 100.0 cc/rev | S24-69589-D | |
| | cartridge assembly CW 6.10 in ³ /rev, 100.0 cc/rev | S24-69584-D | |
| | cartridge assembly blank | S24-15102 | |
| 2a | O-ring | 69-10028 | 1 |
| 2b | Retainer | 69-10029 | 1 |
| 3 | O-ring | 67-10028 | 1 |
| 4 | O-ring | 67-10042 | 1 |
| 5 | Retainer | 69-10026 | 2 |
| 6 | End cover STD | 033-61535 | 1 |
| | End cover W/SAE-10-3 (B) | 033-61508 | |
| | End cover W/SAE-127-3 (Q) | 033-61524 | |
| 7 | Screw, cap, std. size | 360-26247 | 8 |
| 8 | O-ring sub | 69-10032 | 1 |
| 9 | Ring, std | 48-25559 | 1 |
| 10 | Ring, std | 48-25524 | 1 |
| 11 | O-ring std | 69-10016 | 1 |
| 12 | hex. hd. cap. screw | 806-40168 | 8 |
| 13 | subl SAE-B only | R21-82066 | 1 |
| 14 | coupling SAE-22-4 (B spline) | 033-57214 | 1 |
| | coupling SAE-30-4 (D spline) | 033-57316 | |
| 15 | retainer (P24-30S) | 69-10014 | 2 |
| 16 | O-ring (P24-30S) | 67-10023 | 1 |
| 17 | adaptor (P24-30S) | 033-57185 | 1 |

PARTS LIST FOR FIGURE 10 (continued)

| Item | Description | Part No. | Qty |
|------|------------------------|-----------|-----|
| 18 | screw 1/2-12 x 2-1/2 | 288-00283 | 4 |
| 19 | shuttle valve assembly | 822-14968 | 1 |
| 20 | plug of fit | 448-35341 | 2 |
| 21 | O-ring | 891-00308 | 2 |
| 22 | O-ring SAE-B | 871-00455 | 1 |
| | O-ring SAE-C | 871-00198 | |

rear drive adapter

See figure 10: A special tool T4 (refer assembly tools) is required to press shaft seal (13) into SAE-B adapter. Place adapter on a clean surface with pilot facing up. Use special tool to drive seal into position. Make certain that the white lip of seal is oriented side to toward inside of the adapter.

Apply a light film of grease on O-ring (21), install in plug (20) and thread into adapter code ports and tighten.

Apply a light film of grease in seating groove on adapter mounting face into O-ring port block face. Place O-ring (21) in groove in adapter and O-ring (11) in groove in port block face.

Apply a light film of oil or grease on O-ring (13) and place around protrusion of adapter. Engage pilot or adapter into port or port block. Align hoses and secure with screws (18). Torque to 49 lbs-ft (66.4 Nm).

Install coupling (14) into valve cartridge (23) and install auxiliary drive shaft (24) fig. 9 or 11.

shuttle valve assembly

See figure 11: Insert seal (2-6) into cup (2-9) and seat in bottom of bore.

Install small end first of piston (2-5) into block (2-7), install small end first of block (2-7) into bore and install seal.

Install spacer (2-3) and secure in place with set screw (2-4).

Install spring (2-11) onto cone (2-8). Install spring (2-10) over spring (2-11).

Install O-ring (2-14) on piston (2-5), insert small end into spring, and insert into cup (2-9) and seal (2-6).

Install plug (2-15), screw (2-17) and nut (2-16). See set requirements and notes with acorn nut (2-18).

Insert plug (2-9) into block and plug into cup.

Insert O-ring plug (2-1) in center bore in cup. Grease and install O-rings (2-2).

control valve assembly

See figure 11: Lube spool (3) and insert it into valve body (1). When the spool is fully engaged, raise the spool back and forth a few times (backlash or smooth operation). Spool must move freely in body bore.

Install spring stop (4) into one end of valve body (1). Make sure it is seated properly.

Install spring (8) into valve body (1) over the spool (3), install plug (12) and O-ring (15) into the valve body (1). Repeat this on the other end of valve body.

Lube O-ring (9) and place over the sleeve (5) and install into bore of valve body (1). Be certain that O-ring sleeve is lube.

Install piston (6) into sleeve (5) and place spring (7) into piston (6).

Lube O-ring (10) and place onto the sleeve (5).

Lube O-rings which come on pilot valve sub-assembly (2).

Mount pilot valve cap sub-assembly (2) onto shuttle block (1). Use three sets of nuts (screws (14) and one drilled head screw which comes with the pilot valve sub-assembly. Make sure that the screw that comes with the valve cap sub-assembly is positioned on end closest to acorn nut. Torque to 60 lbs-ft (88 Nm). Run lead wire which comes with valve cap sub-assembly through hole in special screw and acorn nut. Twist leads together.

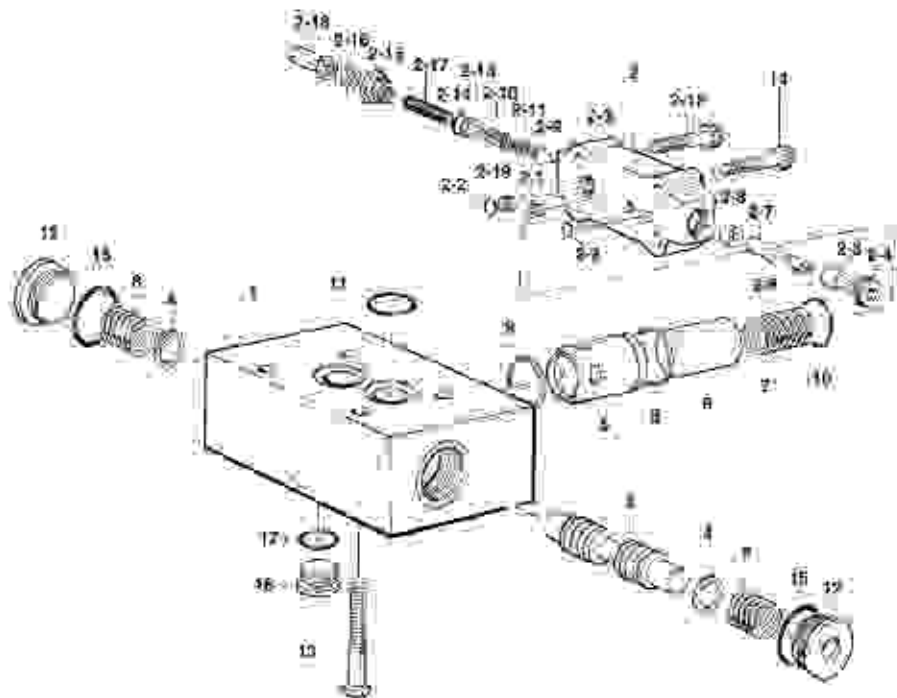


FIGURE 11 EXPLODED VIEW OF SHUTTLE VALVE
EXPLODED VIEW OF PILOT VALVE EXT. DRAIN

PARTS LIST FOR FIGURE 11, S23-11966

| item | description | part no | quantity |
|------|-----------------------------------|-----------|----------|
| 1 | shuttle block | 033-57752 | 1 |
| 2 | pilot valve external drain | S23-22863 | 1 |
| 3 | spool | 033-57180 | 1 |
| 4 | spring wip washer | 033-57182 | 2 |
| 5 | alcohol | 033-27548 | 1 |
| 6 | hisher | 033-32902 | 1 |
| 7 | spring | 033-27847 | 1 |
| 8 | spring | 033-57181 | 2 |
| 9 | O-ring | 891-00126 | 2 |
| 10 | O-ring | 891-00025 | 1 |
| 11 | leakseal | 891-16221 | 2 |
| 12 | plug | 488-25824 | 2 |
| 13 | screw hex hd cap 1/2-16 x 3-1/2 | 306-40224 | 1 |
| 14 | screw soc. hd. cap 3/8-24 x 1-3/4 | 359-16220 | 8 |
| 15 | O-ring | 891-00916 | 2 |
| 16 | plug | 488-25814 | 1 |
| 17 | O-ring | 891-00812 | 1 |

PARTS LIST FOR FIGURE 11, S23-11966 ITEM 2

| | | | |
|------|---|-----------|---|
| 2-1 | orifice | 033-25325 | 1 |
| 2-2 | O-ring | 891-00013 | 2 |
| 2-3 | ball | 033-88943 | 1 |
| 2-4 | set screw | 312-35951 | 1 |
| 2-5 | spacer | 033-27548 | 1 |
| 2-6 | piston | 033-11594 | 1 |
| 2-7 | block | 033-11310 | 1 |
| 2-8 | seal | 033-11682 | 1 |
| 2-9 | cover | 033-12208 | 1 |
| 2-10 | spring | 033-23395 | 3 |
| 2-11 | nut | 033-85514 | 1 |
| 2-12 | screw soc. hd. cap 3/8-24 x 1-3/4 w / wire flow | 033-36748 | 1 |
| 2-13 | piston | 033-21787 | 1 |
| 2-14 | O-ring | 875-00012 | 3 |
| 2-15 | plug | 033-27385 | 1 |
| 2-16 | hex nut 5/16-24 | 333-43001 | 1 |
| 2-17 | screw soc. hd 5/16-24 x 1-5/8 | 312-18807 | 1 |
| 2-18 | spring ball | 033-59474 | 1 |
| 2-19 | hex soc. plug | 431-80104 | 1 |

See **Figure 10** Lubricate retainer (15) and o-ring (16) and place in C-bore of shuttle valve adapter (17) mounting surface.

Carefully attach shuttle adapter to port block using socket cap screws (18). Torque to 75 lbs-in. (102 Nm).

Note: Bolt pattern for shuttle adapter is non-symmetrical and can be mounted only one way.

See **Figure 11** Lubricate retainer (11) and place in C-bore of shuttle valve mounting surface.

Carefully attach shuttle valve to shuttle valve adapter using screws (13). Torque to 75 lbs-in. (102 Nm).

Note: Bolt pattern for shuttle adapter is non-symmetrical and can be mounted only one way.

shuttle valve mounting

VALVE BLOCK ASSEMBLY

Figure 12

NOTE: Prior to assembly of reconditioned parts, check finish of gasket surface on valve block and retainer. Must have 60 rms finish with no grinding marks which might carry oil to outside surface. If lapping is necessary, effect gentle of pockets to valve seats after lapping. Must be .005" - .016 mil minimum after lapping to provide clear ance on valve seats.

NOTE: Do not use impact tools to over tighten threaded parts.

Wash and dry all parts. During assembly, lapped and ground surfaces should be kept lubricated with clean oil and protected from nicks or surface damage.

Place valve block (1) with the six poppet valves facing up in order to press the ball pins (26) in position. Ball pins to be .12" (3.04 mm) below surface of valve block. (Not required after 8-26)

Install four orifice rings (3) into valve block (1) and tighten in place.

Disassemble the attached assembly (14) and disassemble per the following steps:

Install the orifice screw of the strainer assembly into valve block. Thread elastic stop nut onto the orifice screw and torque to 23 lbs-in. (2.6 Nm).

Install clean filter screen on terminal support and secure it place with lock washer and screw. 6-82 X 1/4" lg. Torque #6-82 screw to 13 lbs-in. (1.47 Nm).

Place valve block with poppet valve cores facing up. Position gasket (29) on valve block. Lubricate cores with clean hydraulic fluid.

Place springs (33) 1.43" (36.32 mm) into outer most bore of each end of the valve block. Place sequence poppet (30) over these springs. Position seats (27) small shrouded side first over poppet.

Place springs (35) 1.09" (27.68 mm) lg. into bore next to the sequence poppet valves of two steps previous. Place clutch relief poppet (31) over these springs. Position seats (29) with the groove side facing up over poppet.

Place spring (32) into bore next to compensator valve side of block. Install replenish poppet over spring. Position seat (28) with the groove side facing down over poppet.

Insert spring (35) into the remaining bore. Place spring retainer (34) in spring. Place servo poppet (31) over the retainer and spring. Position seat (28) with the groove side facing down over poppet.

Carefully position the retainer plate over seats and poppets. Pressing with one hand on the valve compress seats, depress and pry up as enough to accurately thread two button head cap screws (44) in far enough to hold the retainer plate. Install the other two screws and alternately tighten screws. Torque to 50 lbs-in. (5.53 Nm).

Lubricate o-ring (4) and install in to seal (5), thread bear in valve block. Be careful not to damage bore in the seat. Torque to 15 lbs-in. (20.34 Nm).

Apply grease to shaft of cone (13) and install spring (12) on cone. Carefully insert cone and spring into valve block positioning point of cone into bore of seat.

Lubricate o-ring (11) install in groove of piston (10) and insert end of piston into spring (12).

Lubricate o-ring (9) and install on housing guide (8) and thread into valve block. Tighten in place.

Thread nut (7) on poppet cap screw (6) and thread screw into housing guide (8) with nut and spring to compress spring.

(continued)

ASSEMBLY PROCEDURE

Using a small bladed screw driver, thread the protruding relief valve assembly (28) into valve block and lightly tighten it in place. Do not over tighten. Over tightening can cause sides of bolt to break now or at next removal.

Lubricate o-ring (4) and install on plug (25) and tighten plug in place.

Thread check valve (2) into valve block and lightly tighten in place. Do not over tighten. Lubricate o-ring (22) and install on plug (23) and tighten in place. Repeat steps on other side of valve block.

Lubricate o-ring (18) and install on plug (20) and tighten plug in place.

Install pin (21), Lubricate o-ring (23) and install on plug (23) and tighten plug in place.

Lubricate o-ring (4) and install on plug (25) and tighten in place.

Lubricate two o-rings (22) and install over two plugs (25) and tighten in place.

Using a small hammer carefully tap roll pins (46) into and thru the retainer plate (42). The pins should bottom out in hole every 1/4" enough length sticking out for clearing into the port block.

Lubricate o-rings (47) (48) and (37) and install in the bottom of retainer plate (42).

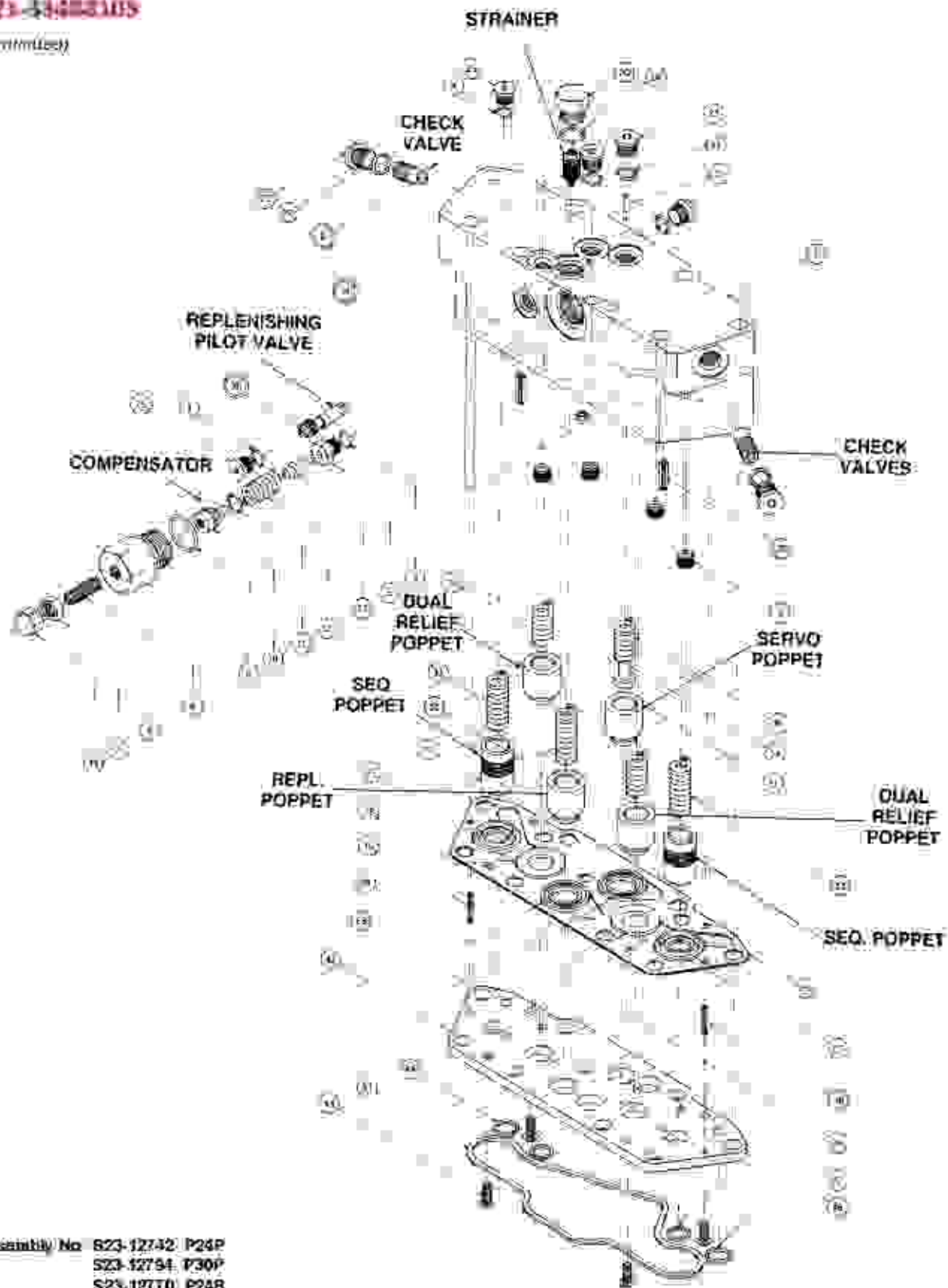
Valve is ready to install on pump.

PARTS LIST FOR FIGURE 12:

| item | description | part no | quantity |
|------|--|-----------|----------|
| 1 | valve block P24P/S | 025-91221 | 1 |
| | valve block P20P/S & P24Q/Q w/BA control | 025-91324 | |
| 2 | check valve assembly | S13-40036 | 2 |
| 3 | o-ring plug | 033-81249 | 4 |
| 4 | o-ring | 831-00903 | 3 |
| 5 | seal | 033-71606 | 1 |
| 6 | lock lid screw 5/16-24 x 1 1/2" | 312-13160 | 1 |
| 7 | hex. pin nut 3/16-24 | 335-13100 | 1 |
| 8 | housing grade | 033-70845 | 1 |
| 9 | o-ring | 831-00910 | 2 |
| 10 | seal piston | 036-21167 | 1 |
| 11 | o-ring | 811-00012 | 1 |
| 12 | spring | 025-91198 | 1 |
| 13 | o-ring | 025-12201 | 1 |
| 14 | servo amplifier assembly | S13-43240 | 1 |
| 15 | o-ring | 831-00906 | 1 |
| 20 | plug | 488-25001 | 1 |
| 21 | roll pin 1/8 x 5/8" Lg. P24P/S | 324-26810 | 1 |
| | roller P30P/S & P24/QP w/BA control | 230-82170 | |
| 22 | o-ring | 831-00904 | 3 |
| 23 | plug | 488-25001 | 3 |
| 24 | plug | 488-25048 | 2 |
| 25 | roll pin | 325-15120 | 3 |
| 27 | seal/piston seal | 033-71607 | 2 |
| 28 | replacement of service part | 025-71604 | 3 |
| 29 | valve block gasket | 033-91190 | 1 |
| 30 | sequence poppet | 033-12378 | 3 |
| 31 | slit & replace poppet | 033-12379 | 4 |
| 32 | replace spring | 033-22141 | 3 |
| 33 | sequence & servo spring | 033-71512 | 3 |
| 34 | spring retainer | 025-71482 | 1 |
| 35 | slit & replace spring | 033-11088 | 3 |
| 38 | flat replace valve | S23-12859 | 1 |
| | pilot replace valve P24/QS | S23-12813 | |
| | pilot replace valve P24/QP w/BA control | S23-12814 | |
| 37 | o-ring | 811-00050 | 1 |
| 42 | retainer plate | 033-91422 | 1 |
| 43 | piston bolt screw #11-24 x 3/4" Lg. | 359-26078 | 4 |
| 45 | nut on roll pin 3/24 | 321-25005 | 1 |
| 46 | roll pin 1/8 x 3/4" Lg. | 325-08120 | 3 |
| 37 | o-ring | 811-00013 | 2 |
| 48 | o-ring | 811-00014 | 3 |

*Not required after 8-96

(continued)



- Assembly No 823-12742 P24P
- 823-12754 P30P
- 823-12770 P24B
- 823-12795 P30S
- 823-12796 P2430P w/9A control

FIGURE 12:

Figure 19

ASSEMBLY PROCEDURE

NOTE: Prior to assembly of reconditioned parts, check finish of gasket surface on valve block and retainer. Must have 60 rms finish with no grinding marks which might carry oil to outside surface. If lapping is necessary, check depth of pockets for valve seals after lapping. Must be .005", 2.16 mm minimum after lapping to provide clearance for valve seals.

NOTE: Do not use impact tools or over tighten threaded parts.

Wash and dry all parts. During assembly, lapped and ground surfaces should be kept lubricated with clean oil and protected from oxidation, surface damage.

Place valve block (1) with the six poppet valves bored up in order to press two roll pins (26) in position. Roll pins to be .12" 3.04 mm below surface of valve block. (Not required after R-38).

Install four orifice plugs (3) into valve block (1) and tighten in place.

Disassemble the mainline assembly (14) and reassemble per the following steps:

Install the orifice screw of the mainline assembly into valve block. Thread slightly stop but onto the orifice screw and torque to 23 lbs-in., 2.6 Nm.

Install clean filter screen on mainline support and secure in place with lockal thread cap screw. 6-32 X 1/4" lg. Torque #6-32 screw to 13 lbs-in., 1.47 Nm.

Place valve block with poppet valve bores facing up. Position gasket (29) on valve block.

Place springs (31) 4 #2 26.02 mm lg. into bores next to each end of the valve block. Place sequence poppet (30) over these springs. Position seats (27) small groove side first over poppets.

Place springs (35) 1 #8 27.98 mm lg. into bores next to the sequence poppet valve of two steps previous. Place dual relief poppet (31) over these springs. Position seats (29) with the groove side facing up, one poppet.

Place spring (32) 1 #5 38.0 mm into bore next to compensator valve side of block. Install relief (36) poppet over spring. Position seat (29) with the groove side facing down, over poppet.

Insert spring (33) 1 #3 26.9 mm into the remaining bore. Place relief poppet (34) over the retainer and spring. Position seat (44) with the tapered bore facing down, over poppet.

Carefully position the retainer plate over seats and poppets. Pressing with one hand on the valve block, compress seats, poppets and springs to ensure full contact. Thread two nuts (each) covers (43) in far enough to hold the retainer plate. Install the other two screws and alternately tighten screws. Torque to 30 lbs-in., 3.39 Nm.

Lubricate O-ring (4) and install on bore (5), install seal on valve block. Be careful not to damage bore in the seat. Torque to 15 lbs-in., 1.67 Nm.

Apply mainline to shank of cone (13) and install spring (12) on cone. Carefully insert cone and tubing into valve block positioning point of cone into bore of seat.

Lubricate O-ring (11) install in groove of piston (10) and insert end of piston into spring (12).

Lubricate O-ring (9) and install on housing guide (8) and thread into valve block, tighten in place.

Thread nut (7) on pocket set screw (6) and thread screw into housing guide (8) until it starts to compress spring.

Using a small bladed screw driver, thread the pilot spring/relief valve assembly (38) into valve block and lightly tighten in place. Do not over tighten. Over tightening can cause sides of pilot to break down (not next step).

Lubricate O-ring (41) and install on plug (25) and tighten plug in place.

Thread check valve (2) into valve block and lightly tighten in place. Do not over tighten. Lubricate O-ring (22) and install on plug (23) and tighten in place. Repeat step on other end of valve block.

Figure 13
(continued)

ASSEMBLY PROCEDURE

Lubricate O-ring (19) and install on plug (20) and tighten plug in place.

Lubricate O-ring (22) and install on plug (23) and tighten plug in place.

Lubricate O-ring (4) and install on plug (25) and tighten plug in place.

Lubricate O-ring (18) install on plug (26) and tighten plug in place.

Lubricate O-ring (47) and install in underside of manifold block (15). Carefully, place manifold block (16) on top of the valve cover (1) making sure the O-rings are correctly seated. Secure with two (2) hex cap screws (41) and the lock (25).

Insert spring (16) and spacer (8) into manifold (15) with the spring gauge and spring towards the left side of the manifold (15) when viewing from the top rear. Install orifice plug (6) in manifold (15).

Install temporary plug (59) in 1/4" & 3/8 mm size port. Insert O-ring (19) and plug (20) in alternate drain port.

Using a small hammer carefully tap the pins (48) into and thru the retainer plate (42). The pins should bottom out in hole leaving enough length sticking out for pivoting into the port block.

Lubricate O-ring (47) (48) and (37) and install in the bottom of retainer plate (42).

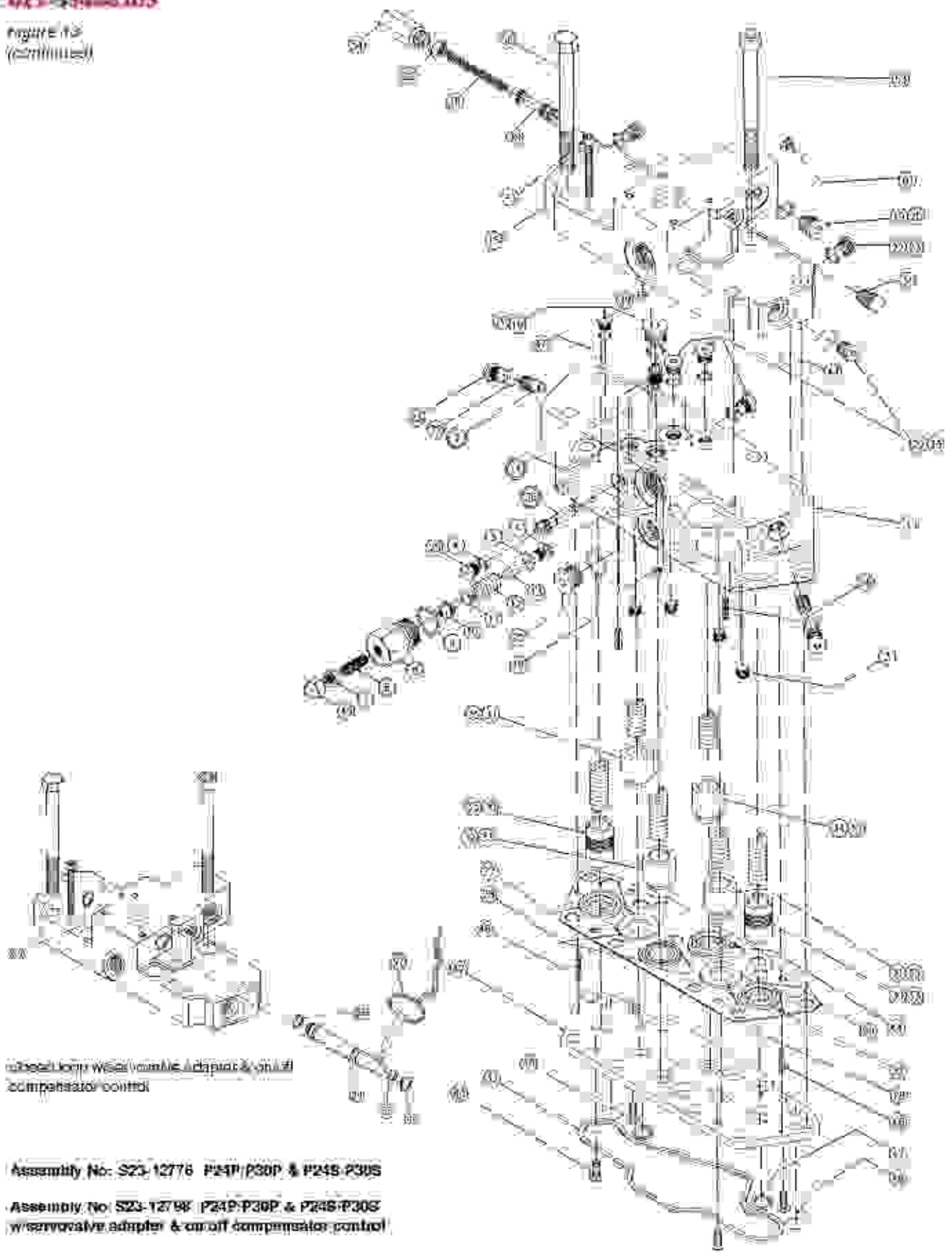
Make all ~~the~~ connections on pump.

PARTS LIST FOR FIGURE 15

| Item | Description | part no | quantity |
|------|--|-----------|----------|
| 1 | valve block | 033-91936 | 1 |
| 2 | check valve assembly | 513-40288 | 3 |
| 3 | orange plug | 033-97249 | 4 |
| 4 | O-ring | 891-00909 | 2 |
| 5 | seal | 033-70508 | 1 |
| 6 | sock hd screw #19-24 x 1" lg | 312-18180 | 1 |
| 7 | hex flm nut 5/16-24 | 325-11100 | 1 |
| 8 | housing guide | 033-70545 | 1 |
| 9 | O-ring | 891-00810 | 1 |
| 10 | seal plate | 033-21781 | 1 |
| 11 | O-ring | 871-00012 | 1 |
| 12 | spring | 033-93138 | 1 |
| 13 | bolts | 036-12288 | 1 |
| 14 | servo swivel assembly | 513-33240 | 1 |
| 15 | manifold | 033-54889 | 3 |
| | manifold servovalve-use W/F or T/G controls | 033-54446 | |
| 16 | spring | 033-93383 | 1 |
| 19 | O-ring | 891-00906 | 3 |
| 20 | plug | 488-25041 | 2 |
| 22 | O-ring | 891-00804 | 16 |
| 23 | plug | 488-25001 | 19 |
| 24 | spool servovalve-use w/ r, rny & control | 033-54445 | |
| 25 | plug | 488-25043 | 2 |
| 26 | roll pin | 325-12320 | 2 |
| 27 | sequence seat | 033-70507 | 2 |
| 28 | replenish & relief seat | 033-71300 | 1 |
| 29 | valve body gasket | 033-93130 | 1 |
| 30 | sequence poppet | 033-72378 | 2 |
| 31 | roll & replenish poppet | 033-72379 | 2 |
| 32 | replenish spring | 033-92111 | 1 |
| 33 | sequence & seal spring | 033-70512 | 3 |
| 34 | servo relief bobbin | 033-54888 | 1 |
| 35 | roll relief spring | 033-71085 | 3 |
| 36 | roll replenish valve | 871-12699 | 1 |
| 37 | O-ring | 871-00060 | 1 |
| 38 | spool | 033-54992 | 1 |
| 39 | O-ring | 891-00906 | 1 |
| 41 | sock hd screw #19-24 x 1-1/4" lg | 333-16180 | 4 |
| 42 | retainer plate | 033-91322 | 1 |
| 43 | screw | 333-26073 | 4 |
| 44 | servo relief seat | 033-54889 | 1 |
| 45 | spring nut 5/16-24 | 327-26008 | 1 |
| 46 | roll pin 1/8 x 3/4" lg | 325-08120 | 3 |
| 47 | O-ring | 871-00013 | 3 |
| 48 | O-ring | 871-00014 | 2 |
| 50 | plug 7/16-20 | 448-00013 | 1 |
| 53 | sock hd screw 3/8-16 x 4" lg | 358-16360 | 4 |
| 54 | plug | 033-93132 | 3 |
| 55 | plug servovalve-use w/ r, rny & G controls | 033-54445 | 2 |
| 56 | O-ring servovalve-use w/ r, rny & G controls | 891-00011 | 2 |
| 57 | pin servovalve-use w/ r, rny & G controls | 323-02308 | 1 |
| 58 | hex hd cap screw | 305-40132 | 4 |
| 61 | spring #53 0.9425" x 1.18mm | 033-98528 | 1 |

*Not required after 8-85

Figure 13
 (continued)



cylinder with valve, adapter & cutoff
 compressor control

Assembly No: S23-12776 P24P/P30P & P24S-P30S

Assembly No: S23-12798 P24P/P30P & P24S-P30S
 w/ servovalve adapter & cutoff compressor control

FIGURE 13

TEST PROCEDURE

Maximum in/out between pump, inlet and outlet, max. dia. (0.03" (0.8 mm, max) indicate testing

Electro motor speed: 1800 rpm

Inlet temperature = 120°-140°F 50C-580C

Inlet condition - inlet pump: 24 series 193 psi min. 10.4 bar min.
30 series 225 psi min. 15.5 bar min.

Internal case pump: 40" Hg @ 5 psi 254 mm Hg @ 3.4 bar (a cap at 2" version)

Case pressure 65-75 psi 3.61-5.17 bar

Fluid = 200 SBU at 100°F 46 cSt at 40°C

BASIC PUMP TEST

Mount pump on test stand. Connect system lines and internal (external with auxiliary drive) case pump inlet to pump. Fill pump case with clean oil. Dry all oil from pump to permit checking for external leaks.

Start motor, motor, stop several times before continuous running.

Rotate pump input control shaft. The servo control should control pump displacement (through to full range. Set pump displacement to full volume, and adjust system pressure @ 1000 psi, 69 bar. Check and record system flow and case drain flow with case above and below center. Monitor loop temperature.

Maximum system flow: 24 series 194 gpm, 724 Lpm
30 series 241 gpm, 912 Lpm

Maximum case drain flow: 24 series 4.6 gpm, 17 Lpm
30 series 6.6 gpm, 21 Lpm

Back out compression adjusting screw until (if fully compressed) 1000 turns of turns. Observe volume indicator and stroke rotary servo input shaft from full to full position on each side of center. Torque should remain on or very near zero position. If compression insufficient, rotate (compressor adjusting screw) to its original position and proceed with next step.

Caution: Do not over tighten cap screw.

Cycle pump to second increase full volume above center to full volume below center as follows:

10 minutes at 1000 psi, 69 bar
10 minutes at 5000 psi, 17.2 bar
10 minutes at 6000 psi, 24.5 bar

*Pumps with screw adjustment controls do not need to be cycled.

Adjust system pressure to 5000 psi, 34.5 bar and set pump displacement to full volume. Check and record system flow and case drain flow above and below center.

Minimum system flow: 24 series 160 gpm, 608 Lpm
30 series 220.69 gpm, 385 Lpm

Maximum case drain flow: 24 series 12 gpm, 45.4 Lpm
30 series 13 gpm, 49 Lpm

Set pump to 6000 psi, 24.5 bar. Servo pressure should be at least 600 psi, 34.5 bar. Check and record internal case pump flow.

Model: P*P-xxxx-xxx-xx-xx-

| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|------------------|----------|------|------|------|------|-------|-------|-------|
| Volume pump flow | lit./rev | 2.31 | 4.61 | 7.05 | 9.68 | 12.34 | 15.02 | 17.73 |
| | cc/rev | 46.1 | 26.4 | 17.2 | 38.3 | 79.3 | 88.8 | 100.0 |

| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---------------------|-----|------|------|------|-------|------|-------|-------|
| Maximum at 1800 rpm | gpm | 31.3 | 41.8 | 51.4 | 61.5 | 71.6 | 81.5 | 91.8 |
| | Lpm | 80.8 | 44.7 | 28.0 | 102.2 | 140 | 167.1 | 177.3 |

TEST PROCEDURE

Set pump to compensate at minimum psi, check and record replenishing and servo pressures

Servo pressure - minus replenish pressure:
20/24 series: 160 to 220 psi, 11 to 15 bar

*Replenish pressure - minus case pressure:
Str-30/24 series: 180 to 220 psi, 12.4 to 15.2 bar
S" version: 200 to 270 psi, 13.8 to 19 bar

If pressures are incorrect, remove replenishing relief valve, pilot and increase or decrease pressure as required. One full turn on adjusting screw will cause pressure to increase approximately: 25 psi, 1.7 bar. Re-torque locknut to 27-28 lbs-ft, 2.3-2.8 Nm

*Replenish pressure may be set to customer requirements, but to exceed 450 psi (31 bar)

NOTE: There is no servo relief valve adjustment, increasing or decreasing replenishing pressure will cause both servo and replenishing pressure to change by the same amount.

Set the pump to compensate at 3000 psi, 345 bar, record replenishing and servo pressures

Servo pressure - minus replenish pressure:
24 series: 360 to 420 psi, 24.8 to 29 bar
30 series: 472 to 532 psi, 32.8 to 37 bar

Replenish pressure - minus case pressure:
Str-24 series: 180 to 220 psi, 12.4 to 15.2 bar
30 series: 200 to 240 psi, 14 to 17 bar
S" version: 230 to 270 psi, 15.8 to 19 bar

Set pump to compensate at minimum psi. When each step should return to the value of the previous step.

NOTE: After completing last step, proceed with pump control test. Refer to control service manual S1-AM030. Continue with the next steps after control testing

Adjust pump displacement for full volume and adjust system pressure to 3000 psi, 345 bar. **Adjust compressor to: 5000 psi, 345 bar to minimum pressure in 1000 psi, 69 bar increase. At each pressure, stroke rotary servo input shaft to the full position on each side of center. Cam indicator should remain on top very near the zero position with no oscillation. System pressure should not vary from port "A" to port "B" more than 150 psi, 10.3 bar and no oscillate

CAUTION: Do not hold pump at 5000 psi, 345 bar for longer than one minute at any time. This is only an intermittent pressure setting

Maximum compressor pressure should be under 800 psi (55 bar)

Increase compressor adjustment to 1000 psi, 70 bar and increase and decrease system pressure above and below compressor setting. When system pressure is above compressor setting, the pump should de-stroke and not oscillate. When the system pressure is below the compressor setting the pump should stroke a full volume. Repeat at 3000 psi, 345 bar.

Check pump for external leaks. No external leaks permitted.

After all tests are completed re-torque main housing bolts to 380 lbs-ft, 476 Nm.

ALTERNATE TEST PROCEDURE

GENERAL REQUIREMENTS

The following test procedure may be used if the standard tested oil is not available

Maximum limit between pump shaft and servo is maximum 0.002" (0.076 mm) total indicator reading

Electric motor speed = 1800 rpm.

Initial temperature = 120°-140° F, 50°-60°C

Test condition - full pump - 24 series: 150 psi min, 10.3 bar
30 series: 225 psi min, 15.5 bar

Internal valve drain = 10" 254 mm Hg to 5 bar, 0.34 bar

Case pressure: 85-7.5 psi, 5.8 bar to keep S" pump

Fluid = 200 SSG at 100° F, 46 cSt; at 40°C

TEST PROCEDURE

Manually pump oil test stand. Connect system lines and internal case pump filter to pump. Fill pump case with case oil. Cycle oil from pump to permit bleeding to external lease.

Start external motor. Jog several times. Leave continuous running.

Rotate pump input control knob. The servo control should control pump displacement through its full range. Set pump displacement for full volume, and adjust system pressure to 1000 psi, 69 bar. Check and record system flow and case drain flow with dam above and below center. Monitor job temperature.

Maximum system flow: 24-series 194 gpm, 734 Lpm
30-series 241 gpm, 912 Lpm

Maximum case drain flow: 24-series 4.6 gpm, 17 Lpm
30-series 4.5 gpm, 17 Lpm

Back out compensator adjusting screw until unit is fully compensated count number of turns. Observe volume indicator and stroke master servo input shaft from full to full position (in each side of center). Indicator should remain 0% of way, near zero position. If compensator functions normally, return compensator adjusting screw to its original position and proceed with next step.

Caution: Do not over tighten cap screw.

Cycle pump at 10 second intervals. Full volume above center to full volume below center, as follows:

10 minutes at 1000 psi, 69 bar
10 minutes at 2500 psi, 172 bar
10 minutes at 5000 psi, 345 bar

Adjust system pressure to 5000 psi, 345 bar and set pump displacement for full volume. Check and record system flow and case drain flow above and below center.

*Pumps with screw adjustables (controls do not need to be cycled)

Minimum system flow: 24-series 109 gpm, 408 Lpm
30-series 230.69 gpm, 880 Lpm

Maximum case drain flow: 24-series 12 gpm, 45 Lpm
30-series 12 gpm, 45 Lpm

Install special adjusting screw over top of valve block. Center pump adjust special adjusting screw to zero 500 psi, 34.5 bar set to pressure. Read case drain flow as internal valve output flow. See chart. Next basic pump test.

CONTROL TEST

Please refer to control service manual No. 34-AM030 for control information.

| Item | Description |
|------|---|
| 1 | piston pump |
| 2 | Yam chambers |
| 3 | main servo |
| 4 | auxiliary pump |
| 5 | servo pressure relief valve (included by operating pressure) |
| 6 | replaceable pressure relief valve |
| 7 | sequence valve |
| 8 | compensator pilot valve |
| 9 | override pressure valve of servo pressure sequence valve |
| 10 | replaceable pilot valve |
| 11 | external auxiliary boost pump |
| 12 | shuttle valve |

FLUID CONNECTIONS

| specification | term | Goldcup P2430P | Goldcup P2030S |
|---|-----------------|----------------|----------------|
| A/B system SAE code 62 spill flange | 1/2 in mm | 20 80.8 | 20 80.8 |
| A01, B01, A/B system gage straight thread, O-ring seal | SAE | 18 | 18 |
| A02, B02, A/B system gage straight thread, O-ring seal | SAE | 18 | 18 |
| C aux. pump inlet, servo & rest SAE code 61 spill flange | 1/2 in mm | 20 80.8 | 20 80.8 |
| D1, D2, case drain | SAE | 30 | 30 |
| D3, shuttle drain | SAE | 18 | 18 |
| F/G, case gage straight thread, O-ring seal | SAE | 16 | 16 |
| F/G2, case filling for vertical mounted units, straight thread, O-ring seal | SAE | 14 | 14 |
| F/V, external case, pilot valve | SAE | 14 | 14 |
| FA, FB, control pressure gage straight thread, O-ring seal | SAE | 16 | 16 |
| H/C, aux. pump outlet, servo & rest to external filter | SAE | 12 | 12 |
| H/D, aux. pump inlet, servo & rest from external filter to bid. O-ring seal | SAE | 12 | 12 |
| H/E, servo gage straight thread, O-ring seal | SAE | 18 | 18 |
| K, external replaceable filter, inlet, straight thread, O-ring seal | SAE | 32 | 32 |
| KA, 2/1000 relief inlet | SAE | 10 | 10 |
| KG, replaceable gage, straight thread, O-ring seal | SAE | 16 | 16 |
| y, compensator vent, VA, x-side vent, VB, B-side vent, straight thread, O-ring seal | SAE | 14 | 14 |

¹⁾Reference: viewing from shaft end of pump the port is located 5 o'clock in the simplified drawings and at 11 o'clock position in the real machine.

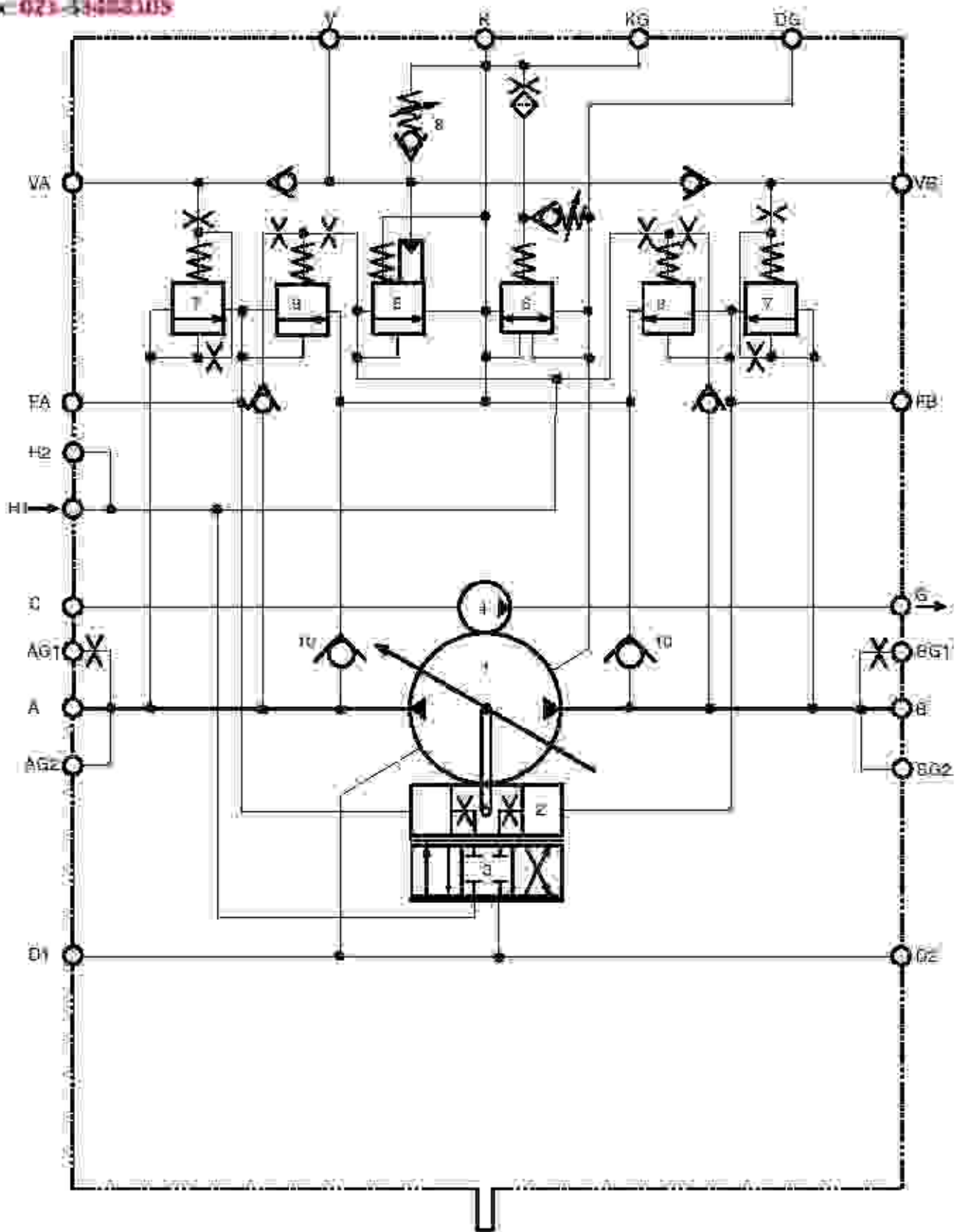


Figure 14
P2100P

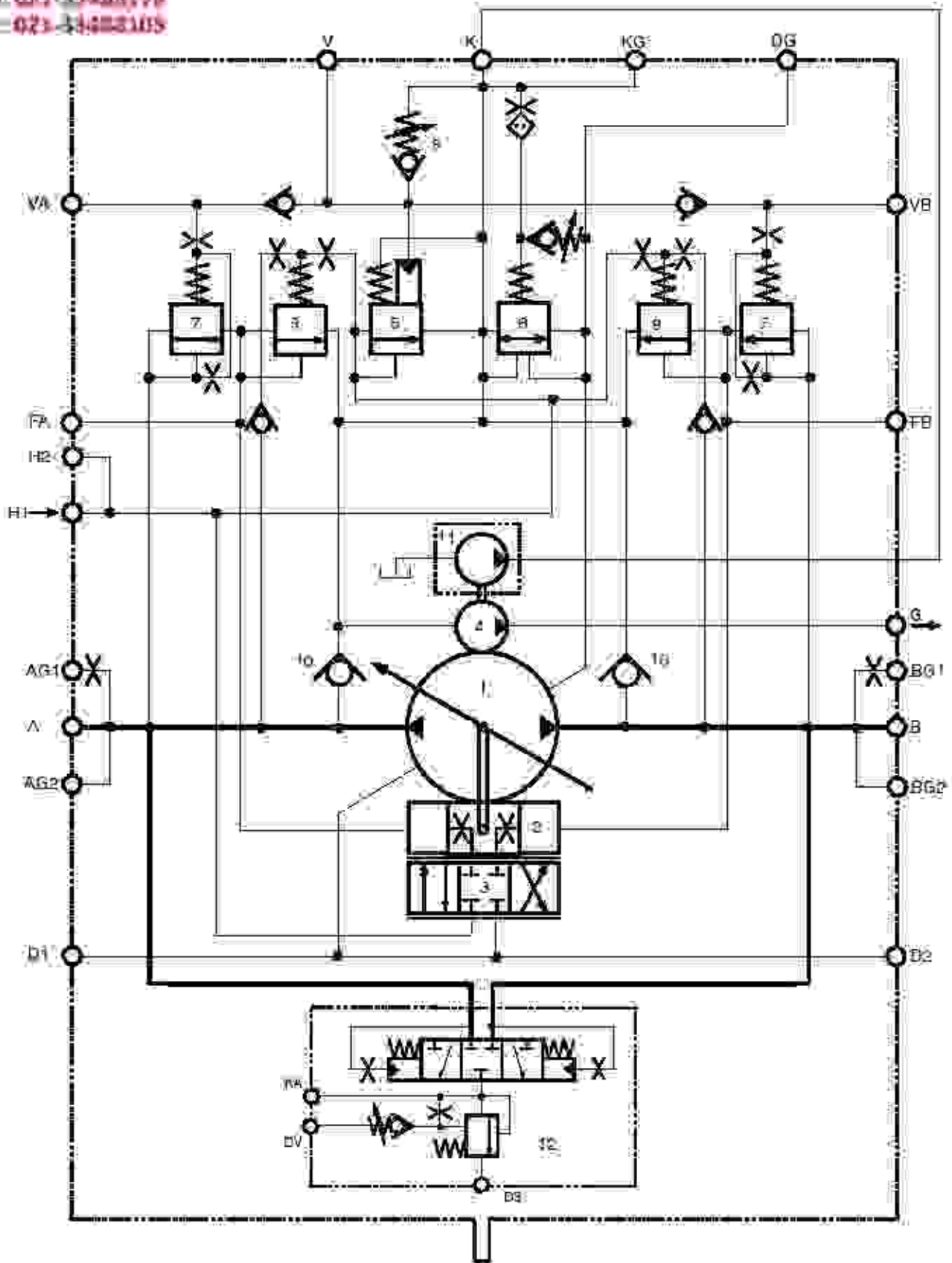
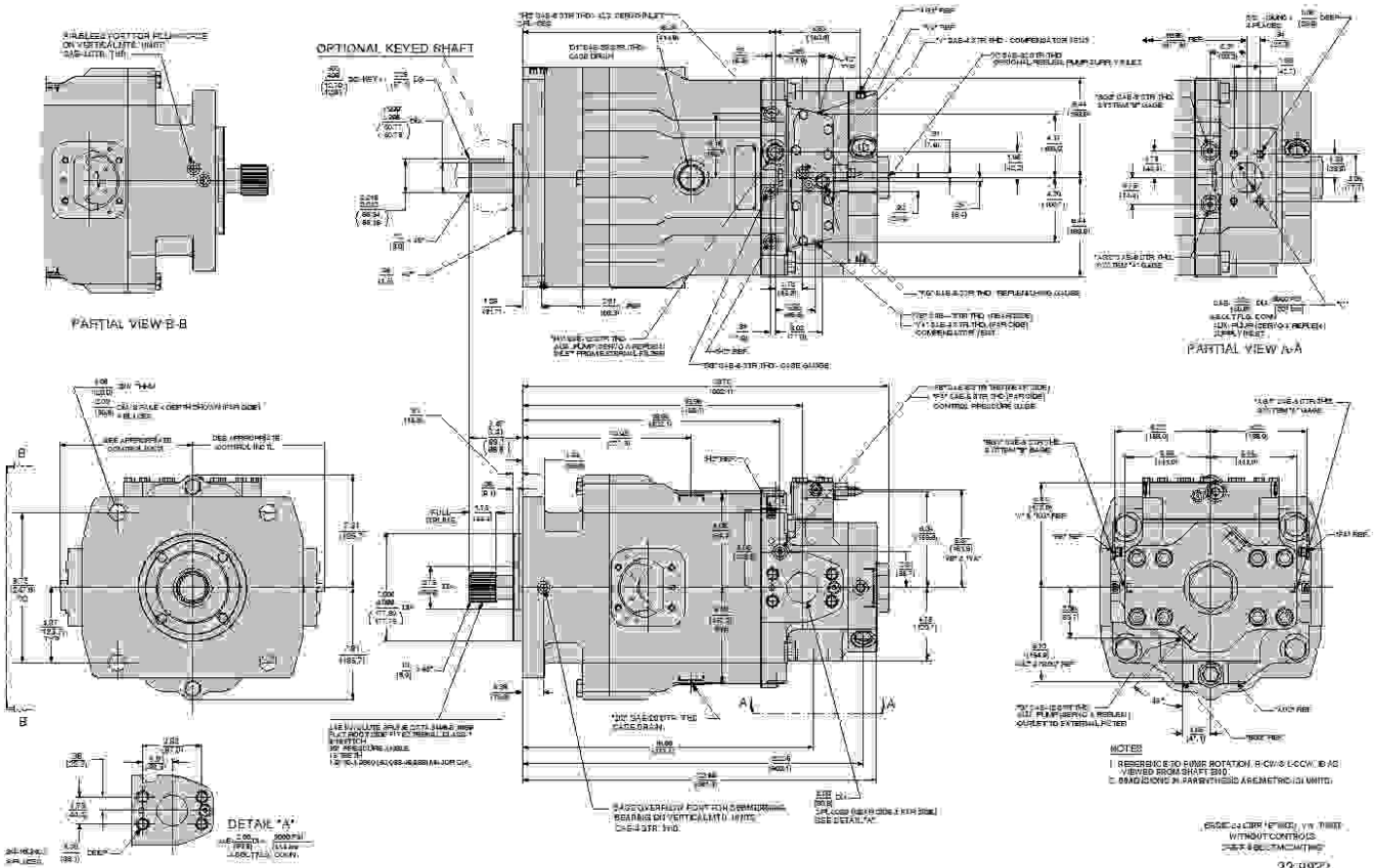
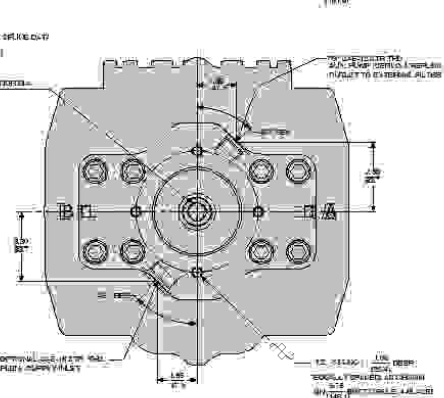
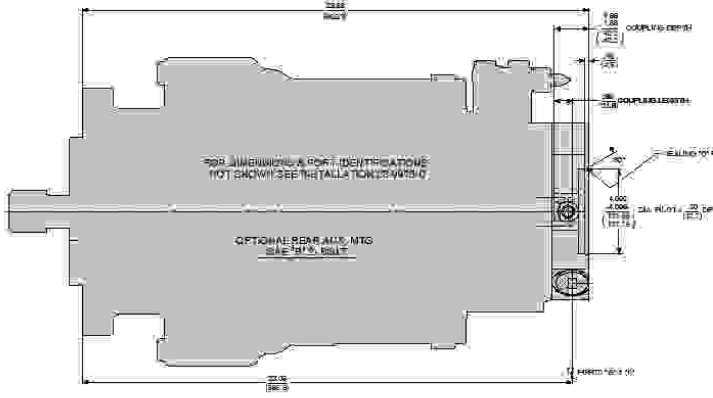
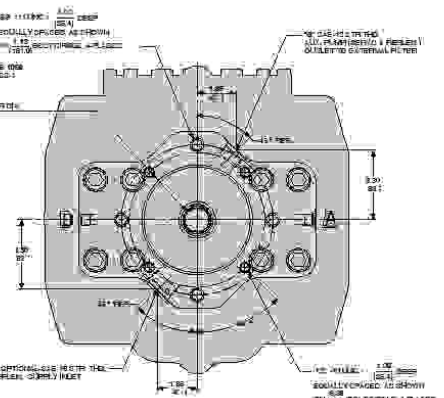
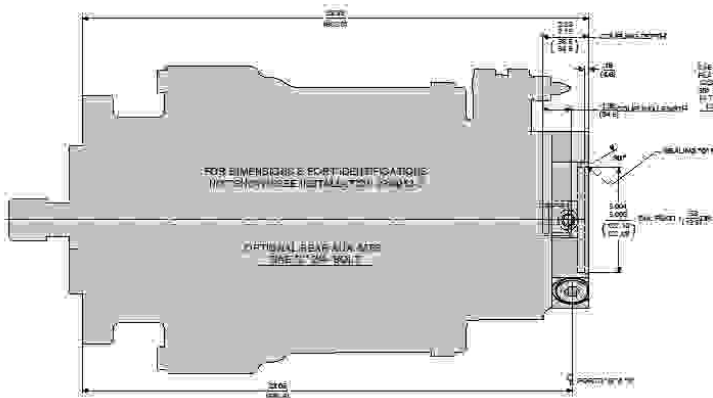


Figure 18
 P24606

INSTALLATION DRAWING



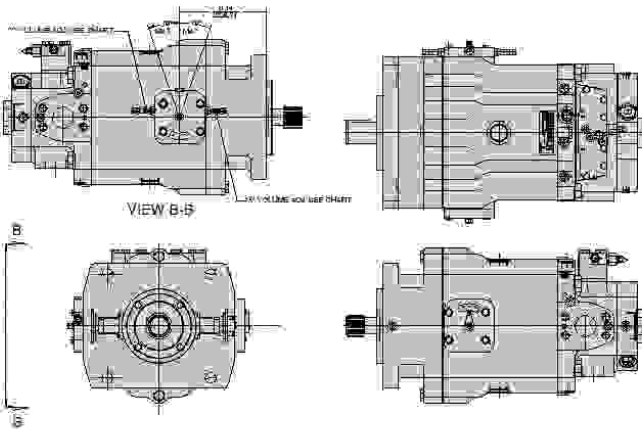
INSTALLATION DRAWING



NOTES
1. REFER TO PUMP MOUNTING HOW & CORRECTLY
FROM DRAWING AND
CONSTRUCTION PARTS (NUMBER & IDENTIFICATION)

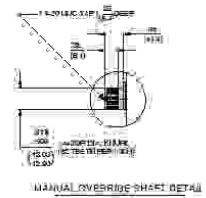
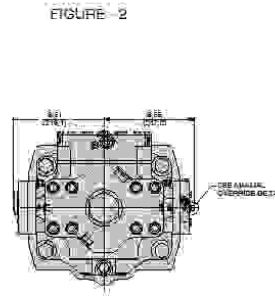
2. REFER TO PUMP HOW & CORRECTLY
FROM DRAWING AND
CONSTRUCTION PARTS (NUMBER & IDENTIFICATION)

INSTALLATION DRAWING



| A: CONTROL MTS. POSITION | | | | | | | | | | |
|--------------------------|--------------|------------|-----------|--|----------|--------|-------|--------|------------------|------------------|
| CONTROL OPTION | PUMP RANGE | PUMP RANGE | PUMP ROT. | ROTARY SERVO HEAT SHNK. OFFSET TO FULL | HOSE CO. | PORT | INLET | OUTLET | MAX. VOLUME CTOR | MAX. VOLUME CTOR |
| 1/162 | P24P P30P | 2 | CCW | CCW ROT. FULL TO MIN | INLET | OUTLET | INLET | OUTLET | MIN. VOLUME CTOR | MAX. VOLUME CTOR |

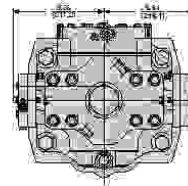
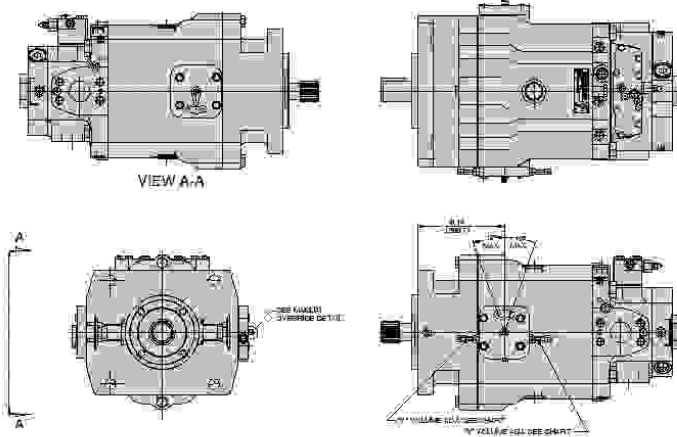
FIGURE - 2



- NOTES
- * FOR DIMENSIONS & PORT IDENTIFICATION NOT SHOWN SEE THE APPROPRIATE BASIC PUMP ROTARY LATCH
 - ** FOR B-C/D INSTALLATION (LESS CONTROL) SEE B-C/D PORTS BOOK INSTALLATION (LESS CONTROL) SEE B-C/D
 - 3 REFER TO PUMP ROTARY LATCH A-C/D A-L-C/D A-L-S/D VIEWED FROM OUTSIDE
 - 4 DIMENSIONS IN PARENTHESIS ARE MINIMUMS

FIGURE - 1

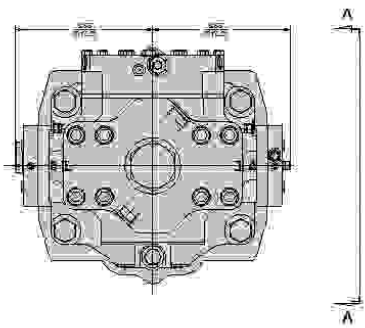
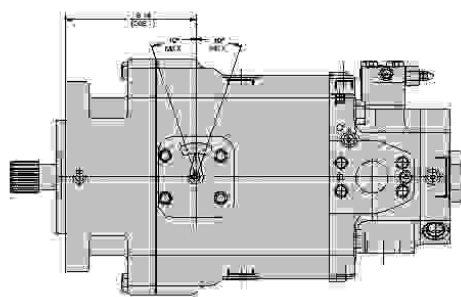
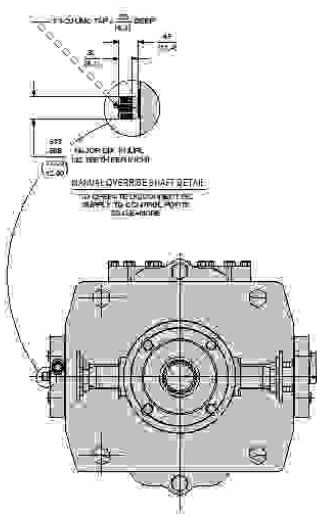
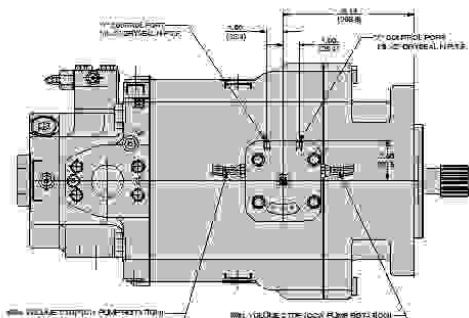
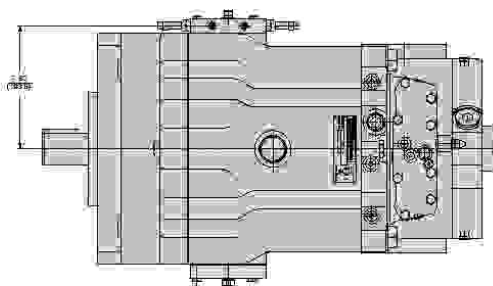
| B: CONTROL MTS. POSITION | | | | | | | | | | |
|--------------------------|--------------|------------|-----------|--|----------|--------|-------|--------|------------------|------------------|
| CONTROL OPTION | PUMP RANGE | PUMP RANGE | PUMP ROT. | ROTARY SERVO HEAT SHNK. OFFSET TO FULL | HOSE CO. | PORT | INLET | OUTLET | MAX. VOLUME CTOR | MAX. VOLUME CTOR |
| 1/162 | P24P P30P | 1 | CCW | CCW ROT. FULL TO MIN | INLET | OUTLET | INLET | OUTLET | MIN. VOLUME CTOR | MAX. VOLUME CTOR |



- BASE IS PAIR WITH "B" CONTROL WITH INTERNAL CARTRIDGE
- ALL CCW ROTATED (BASE) & BOLT MTS
- 23-9033

INSTALLATION DRAWING

- NOTE**
- FOR CONNECTIONS & POWER ELECTRICAL CONNECTIONS USE THE INFORMATION IN OUR MANUALS.
 - FOR SAFETY INSTALLATION, USE ONLY QUALIFIED PERSONNEL.
 - FOR TECHNICAL INFORMATION, CONTACT US AT 021-55882711.
 - SEE THE MANUAL FOR MORE INFORMATION.
 - SEE THE MANUAL FOR MORE INFORMATION.



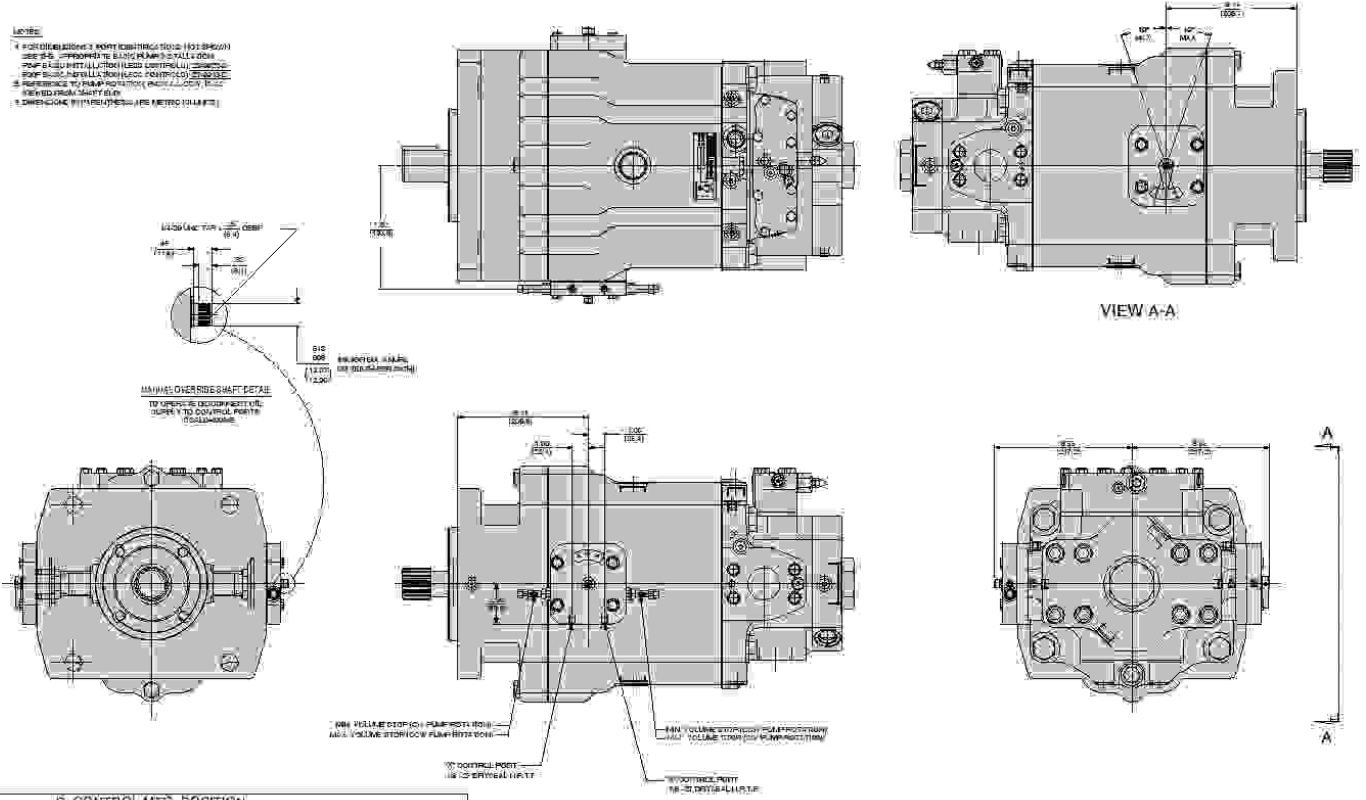
A-CONTROL MFG POSITION

| CONTROL OPTION | PUMP IN/OUT | PUMP | CONTROL PRESSURE TO | | MANUAL OVERRIDE | PORT | PORT |
|----------------|-------------|--------|---------------------|--------|-----------------|--------|--------|
| | | | RESET | RESET | | | |
| ON/OFF | ON/OFF | ON/OFF | ON/OFF | ON/OFF | ON/OFF | ON/OFF | ON/OFF |
| RESET TO ZERO | ON/OFF | ON/OFF | ON/OFF | ON/OFF | ON/OFF | ON/OFF | ON/OFF |

FOR MORE INFORMATION CONTACT US AT 021-55882711
 WWW.KHADAMATHYDRAULIC.COM

INSTALLATION DRAWING

NOTE:
 1. FOR DIMENSIONS & PORT CONNECTIONS SEE PAGES 20, 21, 22 & 23.
 2. THIS IS APPROVED BY SAUDI STANDARDS ORGANIZATION.
 3. PUMP IS SUPPLIED WITH INTERNAL CONTROL VALVE.
 4. REFER TO PUMP INSTRUCTIONS MANUAL FOR MORE DETAILS.
 5. DIMENSIONS ARE IN MILLIMETERS (PER METRIC STANDARD).

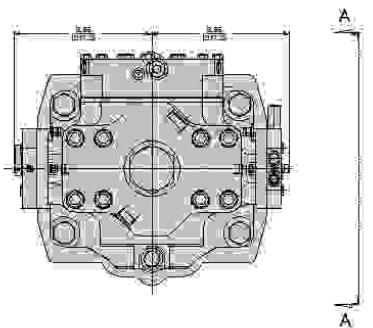
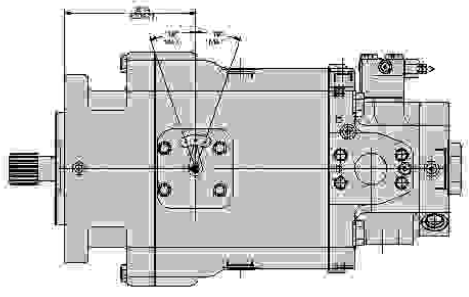
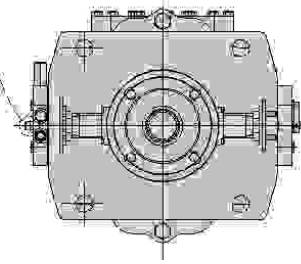
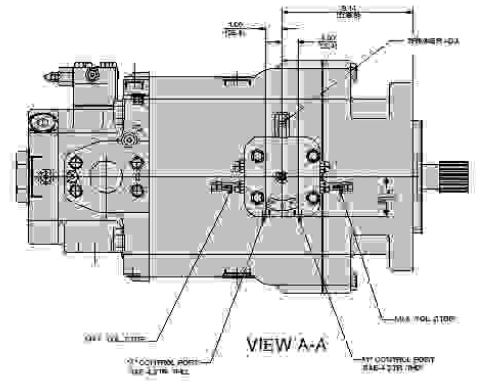
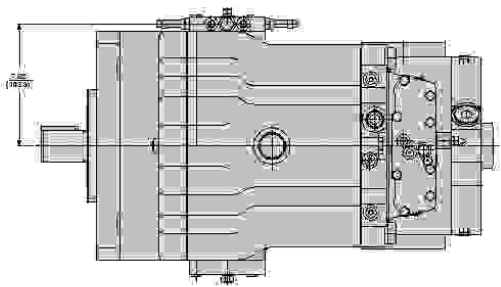
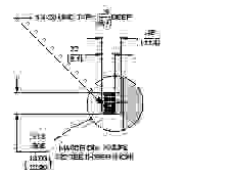


| CONTROL POSITION | PUMP OPERATION | PUMP PORT | CONTROL PRESSURE TO | | ANNUAL OVERRIDE (SHAFT ROTATION) | PORT 'A' | PORT 'B' |
|------------------|----------------|-----------|---------------------|---------|----------------------------------|----------|----------|
| | | | RELIEF | RELEASE | | | |
| Stop | STOP | R | REL | REL | REL | REL | REL |
| Forward | FORW | L | REL | REL | REL | REL | REL |
| Reverse | REVS | R | REL | REL | REL | REL | REL |

PUMP PUMP WITH PUMP CONTROL
 WITH INTERNAL CARTRIDGE
 SLOWLY ROTATION - SAUDI STANDARDS
 23-4834 - 2 of 2

INSTALLATION DRAWING

NOTES
 1. FOR OVERHAULING PORTS VIEWING PORTS DO NOT OPEN WITH
 THE VALVE. APPROXIMATE 1/8" HOLES FOR FULLY TIGHT
 PORTS. USE METALLIC TIGHTENING CONTROLS. CHECKED
 PORTS AND FULLY TIGHTENED. CHECKED. TIGHTENED
 REFER TO PORTS WITH 1/8" HOLES. 2. CONTROL PORTS
 SHOULD BE OPEN. 3. PORTS SHOULD BE OPEN. 4. PORTS
 SHOULD BE OPEN. 5. PORTS SHOULD BE OPEN.



-A- CONTROL MTG POSITION

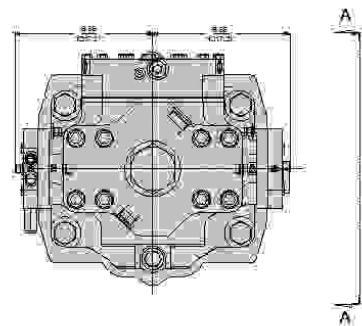
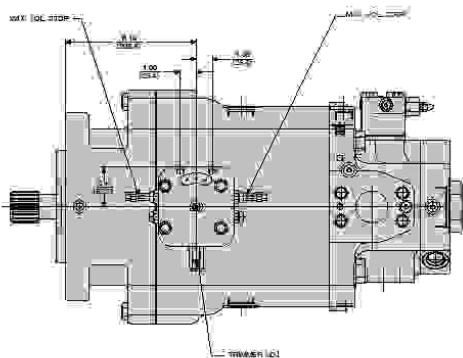
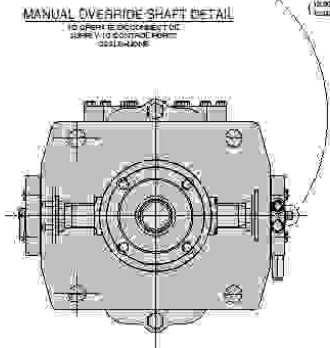
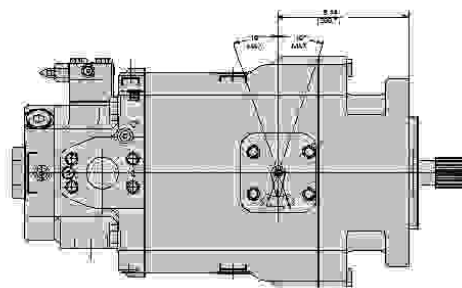
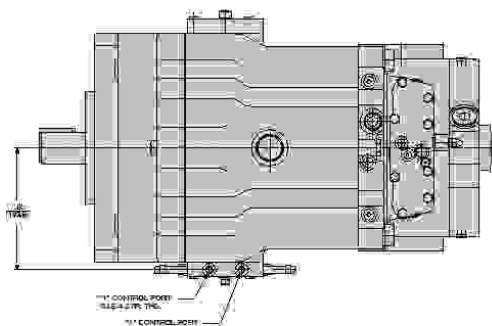
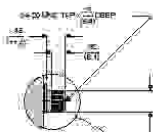
| CONTROL POSITION | FLUID PORTS | FLUID PORTS | CONTROL PORTS (1) - 1/8" (1/8" IN. IN.) | MANUAL OVERRIDE SHAFT ROTATION | PORT 1 | PORT 2 |
|------------------|-------------|-------------|---|--------------------------------|--------|--------|
| 1 | H | H | 1/8" | 1/8" | INLET | 1/8" |
| 2 | H | H | 1/8" | 1/8" | INLET | 1/8" |
| 3 | H | H | 1/8" | 1/8" | INLET | 1/8" |
| 4 | H | H | 1/8" | 1/8" | INLET | 1/8" |

FOR PORT WITH 1/8" HOLES
 WITH INTERNAL CARTRIDGE
 WITH NOTATION GAE-F-80L-413
 23-882B 1 of 2

INSTALLATION DRAWING

NOTES

- 1. FOR DIMENSIONS & POSITIONS, SEE DRAWING
- 2. SEE APPROPRIATE SECTION OF DRAWING FOR PORTS
- 3. PORTS DO NOT EXCEED 1/2" IN DIAMETER
- 4. SEE SECTION FOR PORTS
- 5. REFER TO PORTS FOR PORTS
- 6. REFER TO PORTS FOR PORTS
- 7. REFER TO PORTS FOR PORTS
- 8. REFER TO PORTS FOR PORTS
- 9. REFER TO PORTS FOR PORTS
- 10. REFER TO PORTS FOR PORTS



| -B- CONTROL MTG POSITION | | | | | | |
|--------------------------|----------------|------------|----------------------------------|--------------------------------------|-------|--------|
| CONTROL PORT | PLUM. POSITION | PLUM. PORT | CONTROL PRESSURE TO CONTROL PORT | MANUAL OVERRIDE (SUPERVISOR CONTROL) | PORT | PORT |
| -B- | P S O | Oil | Oil | Oil | INLET | OUTLET |
| | | Oil | Oil | Oil | INLET | OUTLET |
| | | Oil | Oil | Oil | INLET | OUTLET |
| | | Oil | Oil | Oil | INLET | OUTLET |

PC4F OR PC4FV17H -B-B CONTROL
 WITH INTERNAL CARTRIDGE
 WITH ROTARY SHAFT 4 BOLT M/TG
 Z3-882E 2 of 2

INSTALLATION DRAWING

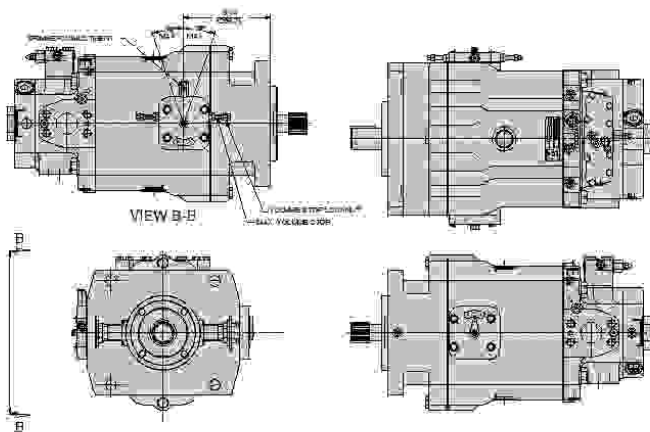


FIGURE - 2

| -A- CONTROL MTG POSITION | | | | | | |
|--------------------------|--------------|---------------|-----------|-----------------------------------|----------|----------|
| CONTROL OPTION | PUMP PACKAGE | PORT POSITION | PUMP PORT | INTERNAL CARTRIDGE SHAFT ROTATION | PORT "A" | PORT "B" |
| "A" | P&P or P&P | 1 | CV | CCW | INLET | OUTLET |
| | | 2 | CCW | CCW | INLET | OUTLET |
| | | 3 | CV | CCW | OUTLET | INLET |
| | | 4 | CCW | CV | OUTLET | INLET |

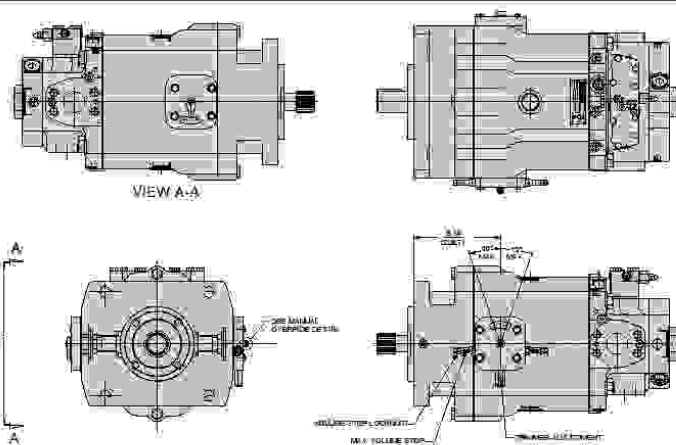
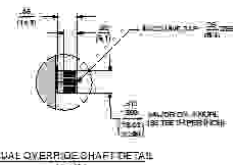
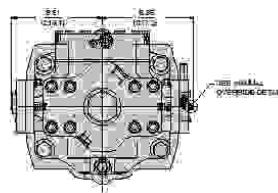


FIGURE - 1

NOTES:
 1. USER CHANGES A PORT IDENTICAL DOWNLIST CAN USE THE APPROPRIATE BACK PLATE OPTION
 2. P&P OR P&P WITH P&P CONTROL, ROTATED PROGRAM IN ALL AVAILABLE CONTROLS DESIGNED FOR USER USE TO MEET YOUR P&P ALL CONTROLS BE IDENTIFIED BY THE
 3. CONTROL IDENTIFIED BY THE USER IDENTIFIED

| -B- CONTROL MTG POSITION | | | | | | |
|--------------------------|--------------|---------------|-----------|-----------------------------------|----------|----------|
| CONTROL OPTION | PUMP PACKAGE | PORT POSITION | PUMP PORT | INTERNAL CARTRIDGE SHAFT ROTATION | PORT "A" | PORT "B" |
| "B" | P&P or P&P | 1 | CV | CCW | INLET | OUTLET |
| | | 2 | CCW | CV | INLET | OUTLET |
| | | 3 | CV | CV | OUTLET | INLET |
| | | 4 | CCW | CCW | OUTLET | INLET |

P&P OR P&P WITH P&P CONTROL WITH INTERNAL CARTRIDGE CONTROL IDENTIFIED BY THE USER IDENTIFIED

INSTALLATION DRAWING

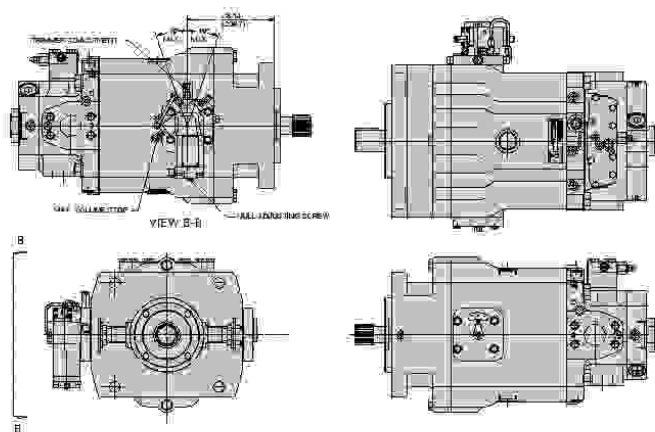


FIGURE - 2

A- CONTROL MTG. POSITION

| CONTROL OPTION | PORT PACKAGE | INLET | OUTLET | ROTATION | DISPLACEMENT | PORT "A" | PORT "B" |
|----------------|--------------|-------|--------|----------|--------------|----------|----------|
| 18AC | P244 P202 | 1 | 2 | CW | CCW | INLET | OUTLET |
| | | 1 | 2 | CCW | CCW | INLET | OUTLET |
| | | 1 | 2 | CW | CCW | OUTLET | INLET |
| | | 1 | 2 | CCW | CW | OUTLET | INLET |

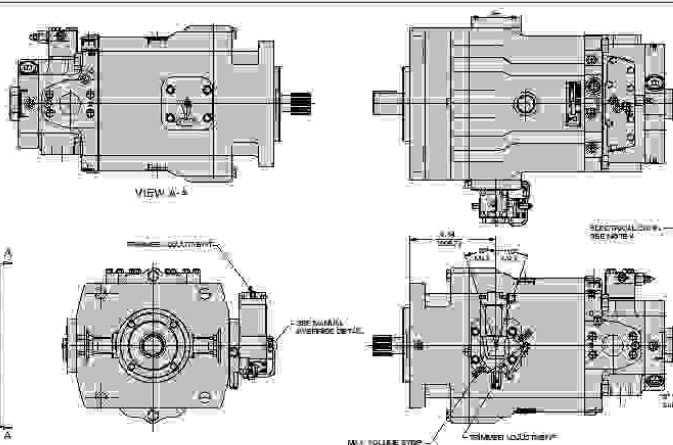
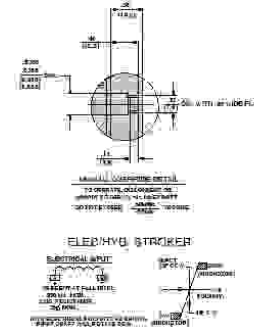
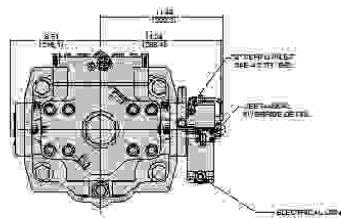


FIGURE - 1

- NOTES**
1. IDENTIFICATION PORT IDENTIFICATION NOT SHOWN. USE THE APPROPRIATE IDENTIFICATION PORT IDENTIFICATION.
 2. SUPPLY PORT IDENTIFICATION NOT SHOWN. USE THE APPROPRIATE IDENTIFICATION PORT IDENTIFICATION.
 3. ROTATION IS FROM THE FRONT VIEW OF THE PUMP.
 4. DISPLACEMENT IS FROM THE FRONT VIEW OF THE PUMP.
 5. PORTS ARE IDENTIFIED BY THE LETTERS A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z.
 6. PORTS ARE IDENTIFIED BY THE LETTERS A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z.
 7. PORTS ARE IDENTIFIED BY THE LETTERS A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z.
 8. PORTS ARE IDENTIFIED BY THE LETTERS A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z.
 9. PORTS ARE IDENTIFIED BY THE LETTERS A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z.
 10. PORTS ARE IDENTIFIED BY THE LETTERS A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z.

B- CONTROL MTG. POSITION

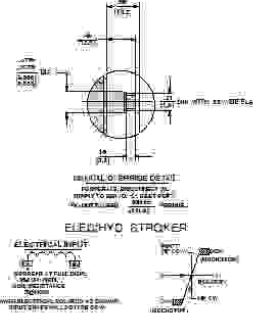
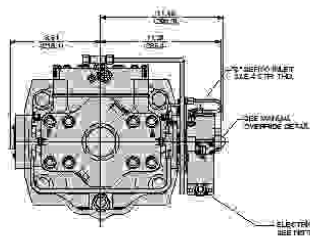
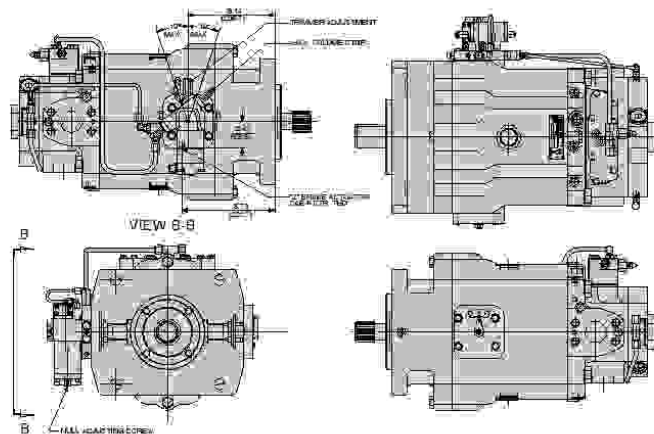
| CONTROL OPTION | PORT PACKAGE | INLET | OUTLET | ROTATION | DISPLACEMENT | PORT "A" | PORT "B" |
|----------------|--------------|-------|--------|----------|--------------|----------|----------|
| 18AC | P244 P202 | 1 | 2 | CW | CCW | INLET | OUTLET |
| | | 1 | 2 | CCW | CCW | INLET | OUTLET |
| | | 1 | 2 | CW | CCW | OUTLET | INLET |
| | | 1 | 2 | CCW | CW | OUTLET | INLET |

PERFORM PUMP WITH "A" CONTROL WITH INTERNAL CARTRIDGE
 (PUMP, ROTATION/AE = A/ECL) AND
 23-8914

INSTALLATION DRAWING

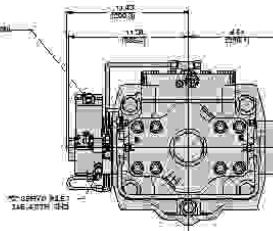
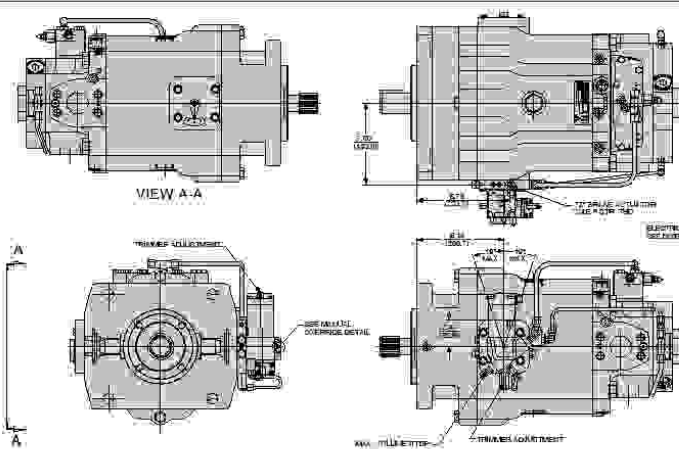
FIGURE - 2

| -A- CONTROL MTG. POSITION | | | | | | |
|---------------------------|---------------|--------------|-----------|-------------------------------------|----------|----------|
| CONTROL OPTION | PUMP ROTATION | PUMP PACKAGE | PUMP ROT. | ROTARY SEWAGE UNIT (SMALL ROTATION) | PORT "A" | PORT "B" |
| SCC 4 PORT | 1 | CCW | CCW | INLET | OUTLET | |
| | 2 | CCW | CCW | INLET | OUTLET | |
| | 3 | CCW | CCW | OUTLET | INLET | |
| | 4 | CCW | CCW | OUTLET | INLET | |



NOTE:
 1. FOR 6M3/3000-6 PORT IDENTIFICATION NOT SHOWN
 SEE THE APPROPRIATE BASIC PUMP INSTALLATION
 2. PUMP BREAK IDENTIFICATION (LEGS CONTROL) IS BASED ON
 PUMP BASIC IDENTIFICATION (LEGS CONTROL) IDENTIFIED
 3. REFER TO PUMP ROTATION, R.O.M. & LOGIC OF ALL
 VIEWS FROM WHICH BEL.
 4. PUMPING WITH INTERNAL OVERRIDE IS LIMITED TO
 1.5% OF THE PUMP'S CAPACITY
 5. SEE THE ELECTRICAL COIL CONNECTIONS IN THE
 MOUNTING CONNECTOR WIRING DIAGRAMS (SEE NOTE 4)

FIGURE - 1

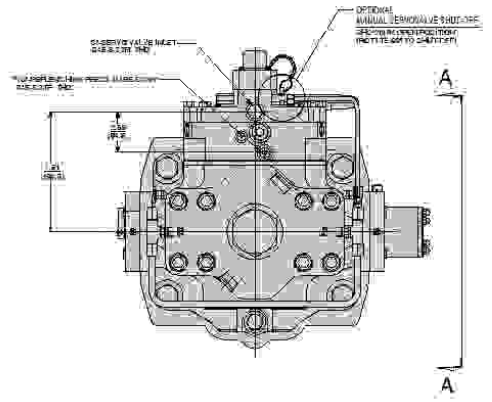
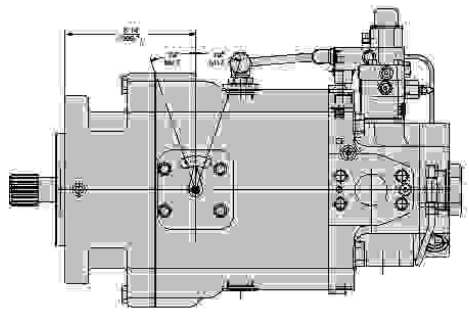
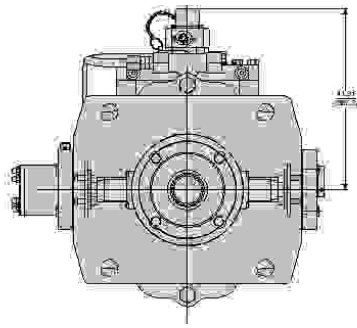
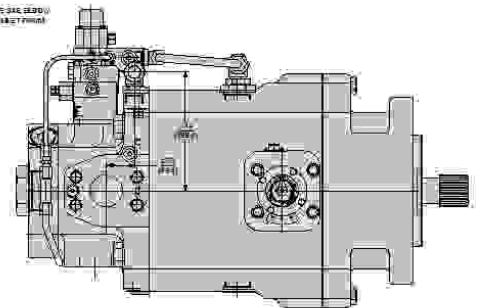
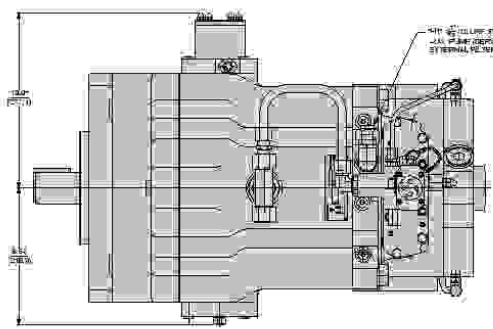
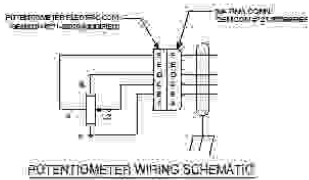


| -B- CONTROL MTG. POSITION | | | | | | |
|---------------------------|--------------|-----------|-------------------------------------|----------|----------|--|
| CONTROL OPTION | PUMP PACKAGE | PUMP ROT. | ROTARY SEWAGE UNIT (SMALL ROTATION) | PORT "A" | PORT "B" | |
| SCC 4 PORT | 1 | CCW | CCW | INLET | OUTLET | |
| | 2 | CCW | CCW | INLET | OUTLET | |
| | 3 | CCW | CCW | OUTLET | INLET | |
| | 4 | CCW | CCW | OUTLET | INLET | |

FOR PUMP WITH "SCC" CONTROL
 WITH INTERNAL OVERRIDE
 CCW ROTATION AS A "4" PORT MTR.

ZB-8836

INSTALLATION DRAWING



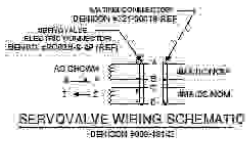
B. CONTROL MTG POSITION

| CONTROL OPTION | PLUMP POSITION | PLUMP POS | PLUMP POS/UP | PLUMP POS/DN | PORT 'A' | PORT 'B' |
|----------------|----------------|-----------|--------------|--------------|----------|----------|
| 700 | 1 2 3 | 000 | 000 | 000 | INLET | OUTLET |
| | | 000 | 000 | 000 | INLET | OUTLET |
| | | 000 | 000 | 000 | SUPPLY | INLET |
| | | 000 | 000 | 000 | OUTLET | INLET |

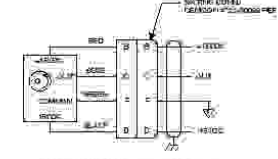
NOTES
 1. THIS DRAWING IS FOR THE POTENTIOMETER POSITION ONLY. USE THE APPROPRIATE BASIC PUMP NOTATION.
 2. IF BASIC INDUSTRIAL/LESC CONTROLS, USE THE D 8000 BASE INSTALLATION ALSO CONTROLS. REFER TO 2. REFER TO PUMP ROTATION AND ALL LOW RATE FLOW FROM CHART 210.
 3. ALL DIMENSIONS IN MILLIMETERS AND METRIC UNITS ONLY.

FOR THE POTENTIOMETER POSITION, THE POTENTIOMETER IS MOUNTED ON THE VALVE BODY.
 23-8828

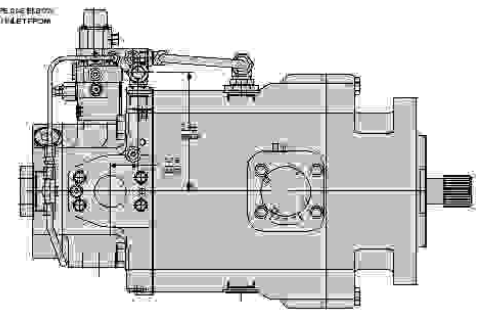
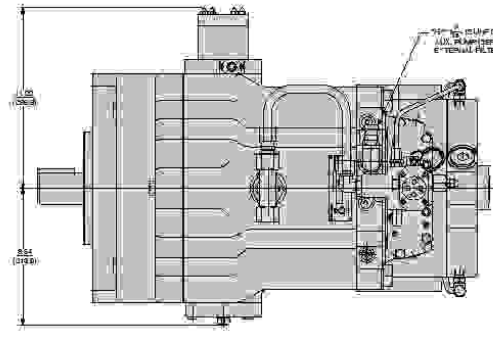
INSTALLATION DRAWING



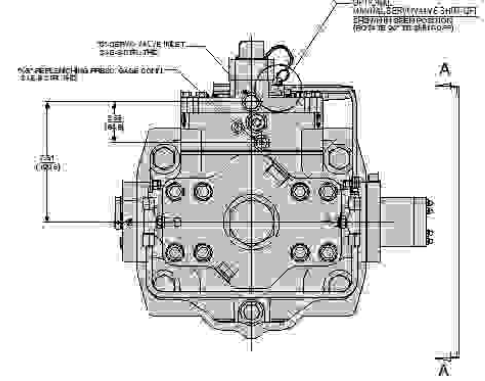
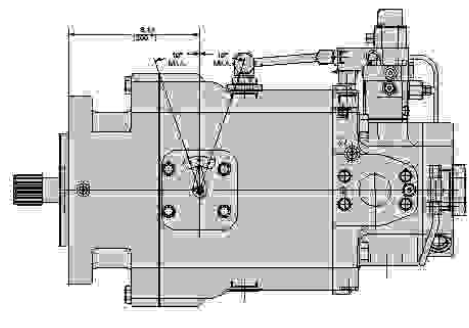
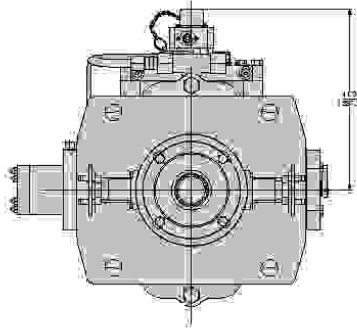
SERVOVALVE WIRING SCHEMATIC
 (DSICOM 4000-40142)



RVET WIRING SCHEMATIC
 (DSICOM 4000-40142)



VIEW A-A



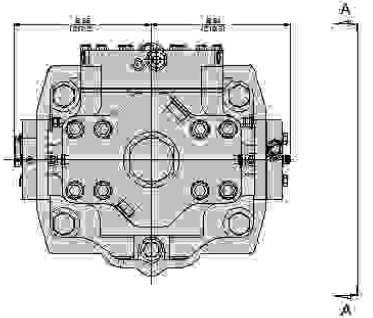
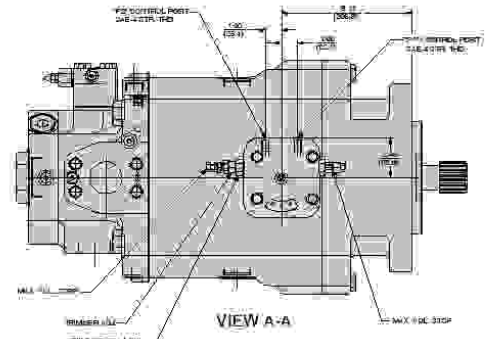
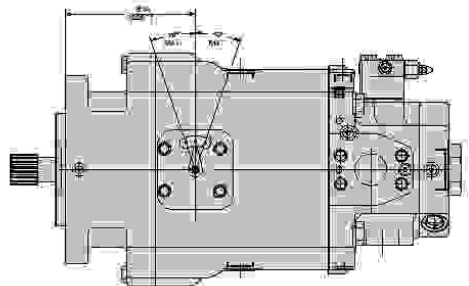
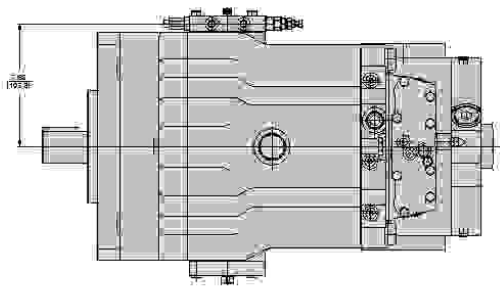
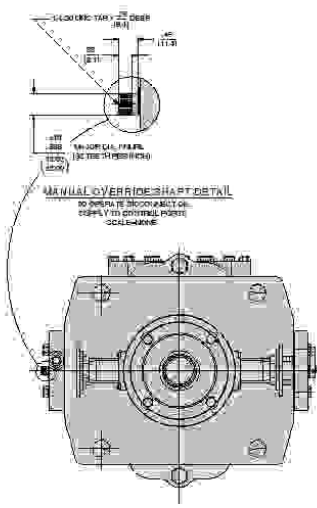
NOTES:
 1. PORT ORIENTATION & PORT IDENTIFICATION MUST BE FOLLOWED.
 2. THE APPROXIMATE PUMP SERVICE POINTS MUST BE IDENTIFIED.
 3. THE APPROXIMATE PUMP SERVICE POINTS MUST BE IDENTIFIED.
 4. THE APPROXIMATE PUMP SERVICE POINTS MUST BE IDENTIFIED.
 5. THE APPROXIMATE PUMP SERVICE POINTS MUST BE IDENTIFIED.

| B- CONTROL MTG POSITION | | | | | |
|-------------------------|----------------|-------|--------|--------|--------|
| ORIENT. CODE | PAUSE POSITION | INLET | RETURN | PORT 1 | PORT 2 |
| 00 | 00 | 00 | 00 | 00 | 00 |
| 01 | 01 | 01 | 01 | 01 | 01 |
| 02 | 02 | 02 | 02 | 02 | 02 |
| 03 | 03 | 03 | 03 | 03 | 03 |
| 04 | 04 | 04 | 04 | 04 | 04 |
| 05 | 05 | 05 | 05 | 05 | 05 |

FOR MORE INFORMATION CONTACT WITH THE MANUFACTURER.
 THE APPROXIMATE PUMP SERVICE POINTS MUST BE IDENTIFIED.
 THE APPROXIMATE PUMP SERVICE POINTS MUST BE IDENTIFIED.

INSTALLATION DRAWING

- NOTES:
1. REFER TO THE LIFT PORT DIMENSIONAL DRAWING FOR THE PROPER PORT TO BE USED FOR INSTALLATION. SEE THE APPROPRIATE PORT DIMENSIONAL DRAWING FOR EACH PORT TYPE.
 2. REFER TO THE FULL MANUAL FOR CONTROL PORTS AND PORTS FOR FULL MANUAL CONTROL.
 3. REFER TO THE FULL MANUAL FOR CONTROL PORTS AND PORTS FOR FULL MANUAL CONTROL.
 4. REFER TO THE FULL MANUAL FOR CONTROL PORTS AND PORTS FOR FULL MANUAL CONTROL.
 5. REFER TO THE FULL MANUAL FOR CONTROL PORTS AND PORTS FOR FULL MANUAL CONTROL.



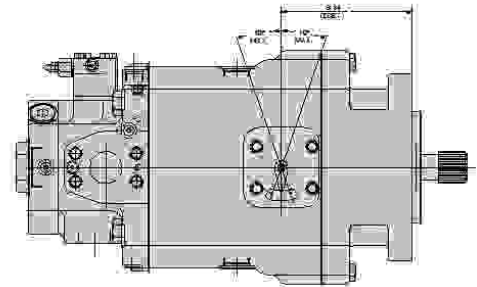
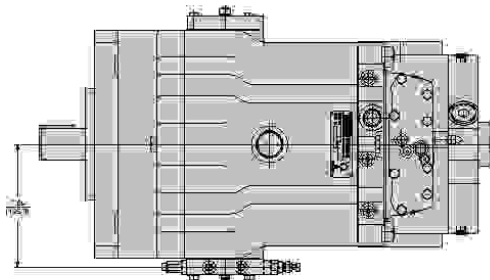
| A-A CONTROL MFG POSITION | | | | | |
|--------------------------|-----------|------------------------|---------------------------------|--------------|--|
| CONTROL PORT | PORT SIZE | CONTROL PRESSURE (PSI) | MANUAL OVERRIDE SHAFT DIA. (IN) | PORT 1/4\"/> | |
| 1/2\"/> | | | | | |

FOR PUMP WITH BACK CONTROL WITH INTERNAL GASTRIE
 DIMENSIONAL DRAWING FOR FULL MFG POSITION
 23-0915 1 of 2

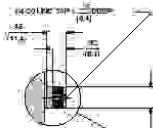
INSTALLATION DRAWING

NOTES

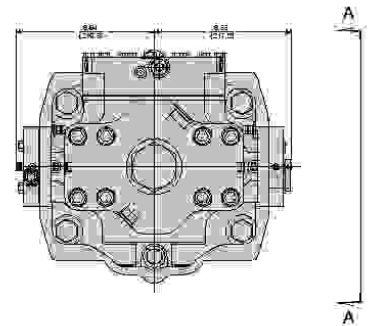
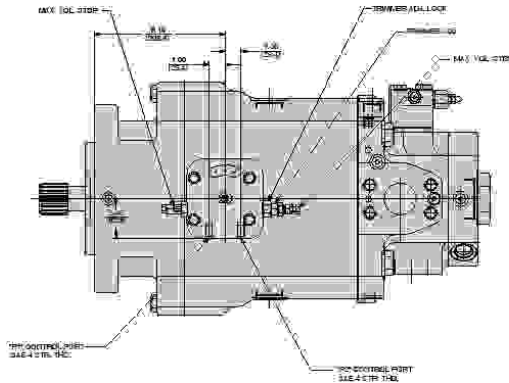
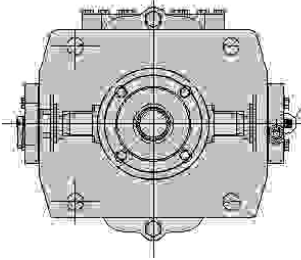
- 1. FOR DIMENSIONS & PART IDENTIFICATION SEE DRAWING
- 2. SEE THE APPROVED TYPE & SIZE PUMP OR MOTOR
- 3. CHECK AND INSTALL AND CONNECT TO THE PUMP OR MOTOR
- 4. MAKE SURE TO READ THE INSTRUCTIONS CAREFULLY
- 5. MAKE SURE TO READ THE INSTRUCTIONS CAREFULLY
- 6. MAKE SURE TO READ THE INSTRUCTIONS CAREFULLY



VIEW A-A



MANUAL OVERRIDE SHAFT DETAIL
 TO VERIFY IS CORRECTLY BE
 MADE TO CONTROL MOTOR
 OPERATION.



A

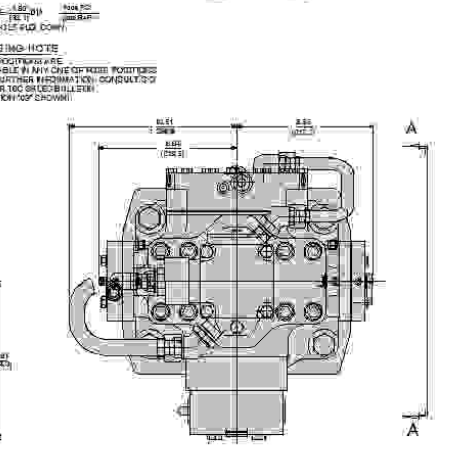
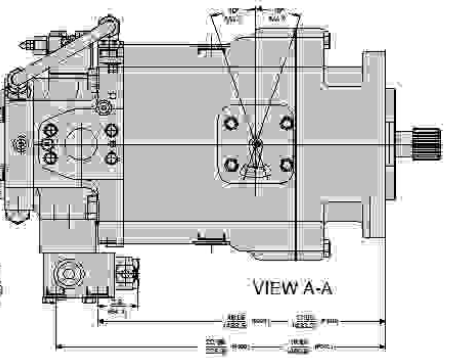
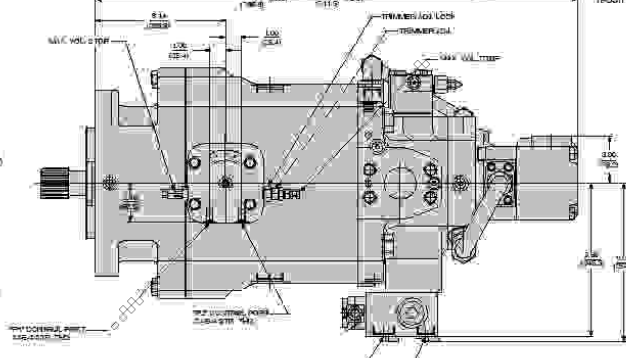
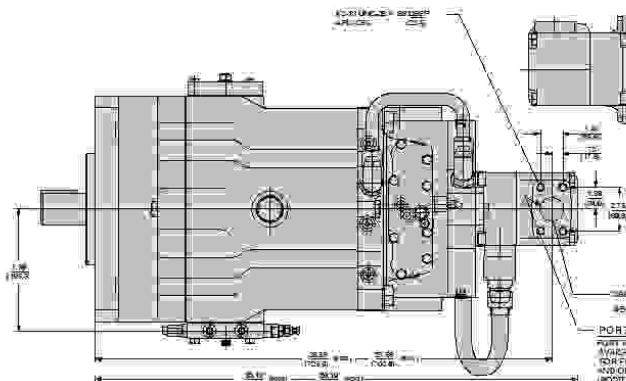
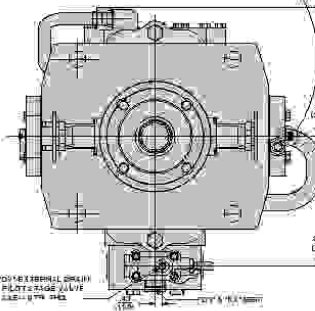
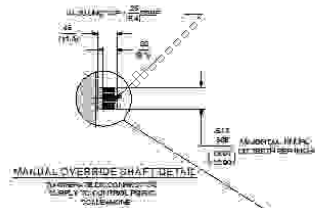
| B CONTROL MTG POSITION | | | | | | |
|------------------------|--------------|-----------|--|--------------------------------|--------|---------|
| HYDRAULIC OPTION | PUMP PACKAGE | PUMP PORT | CONTROL PRESSURE TO SUPPLY THE CONTROL VALVE | MANUAL OVERRIDE SHAFT ROTATION | PORT | |
| BNC | Pump PMS | IN | IN | IN | INLET | OUTLET |
| | | CCW | OUT | CCW | INLET | TRIPLET |
| | | CCW | IN | CCW | OUTLET | INLET |
| | | CCW | OUT | CCW | OUTLET | INLET |

PLANTOR PUMP WITH BNC CONTROL
 WITH INTERNAL CARTRIDGE
 25-8816 2 of 2

INSTALLATION DRAWING

NOTE

1. FOR DIMENSIONS FOR HYDRAULIC HOSE OUTSHOWS USE THE APPROPRIATE SAE FLARE INSTALLATION.
2. FOR BEST INSTALLATION REFER TO HYDRAULIC HOSE AND INSTALLATION USING CONTROLS 2546132.
3. REFER TO PUMP MODEL ID: 60W & L60W TO BE USED FROM HALF FWD.
4. REFER TO PUMP MODEL ID: 60W & L60W TO BE USED FROM HALF FWD.



CONTROL MTS POSITION

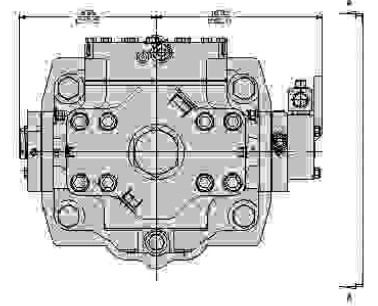
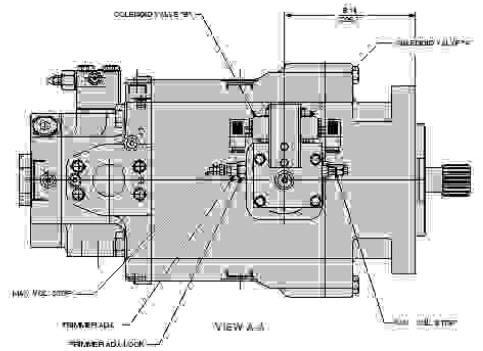
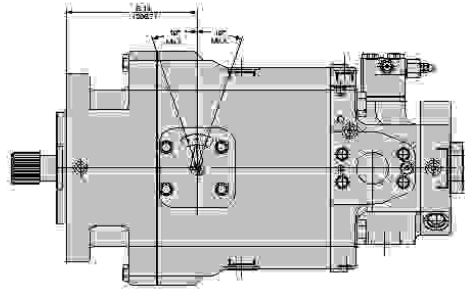
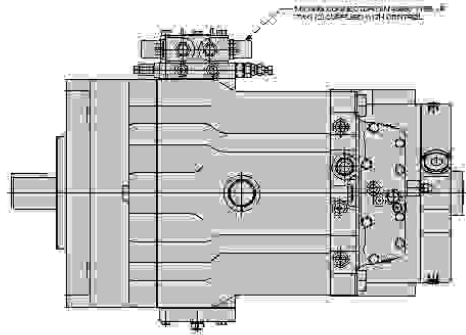
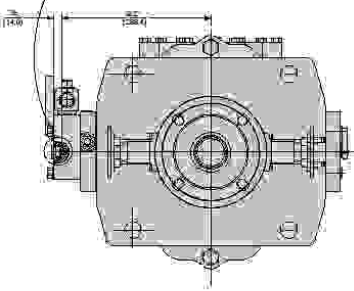
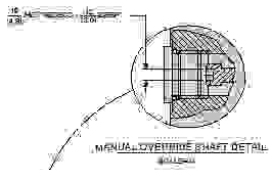
| Control Valve | Pump Rotation | Control Position | Manual Override (Rotation) | Port | Port |
|---------------|---------------|------------------|----------------------------|---------|-------|
| 74C | FOR FWD | 10 | 10 | INLET | INLET |
| | | 20 | 20 | INLET | INLET |
| | | 30 | 30 | OUTLET | INLET |
| | | 40 | 40 | REVERSE | INLET |

FOR MORE INFORMATION CONTACT US AT
 WWW.KHADAMATHYDRAULIC.COM
 OR CALL US AT 023-55882711

INSTALLATION DRAWING

NOTES

- FOR DIMENSIONS & PORT IDENTIFICATIONS (NOT SHOWN) SEE THE APPROPRIATE BUSH PUMP INSTALLATION.
- FOR BASIC INSTALLATION (LESS DOWNWARD PRESSURE) SEE THE APPROPRIATE BUSH PUMP INSTALLATION.
- REFERENCE TO PUMP ROTATION, MANUAL LOCK, IS AS VIEWED FROM DRIVE END.
- COMPASSIONATE PREPARED UNIT.



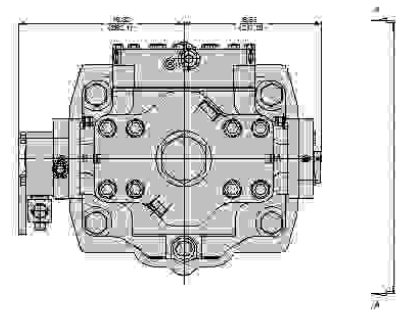
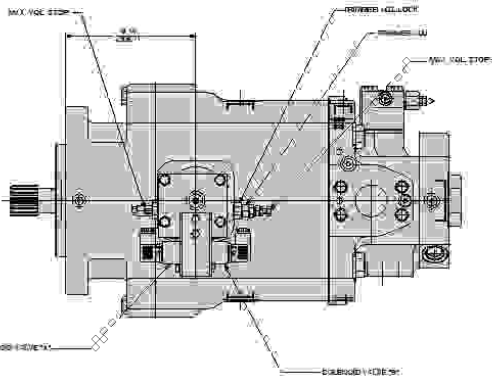
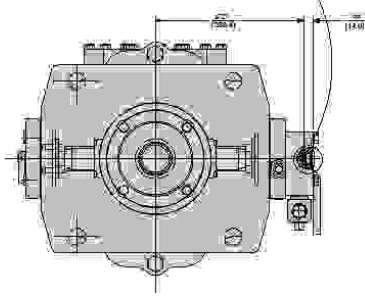
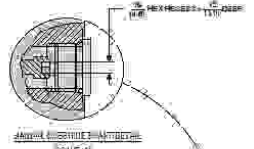
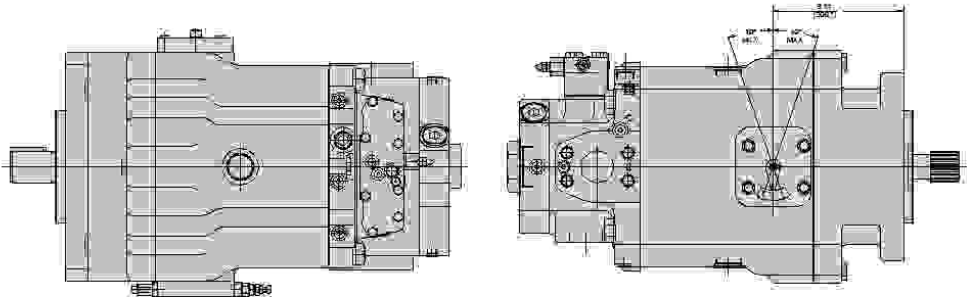
A-A CONTROL MTG POSITION

| CONTROL OPTION | PUMP POSITION | MANUAL OVERRIDE | MANUAL OVERRIDE (OTHER POSITION) | PUMP | PORT |
|----------------|---------------|-----------------|----------------------------------|--------|--------|
| N | On | On | On | OUTLET | INLET |
| | Off | On | Off | INLET | OUTLET |
| | On | Off | On | INLET | OUTLET |
| | Off | Off | Off | INLET | OUTLET |

FOR PUMP WITH "B" CONTROL WITH INTERNAL CARTRIDGE
 DIMENSIONS NOT AT THIS SCALE & BEST MTB
 23-9821 1 of 2

INSTALLATION DRAWING

NOTES
 1. FOR DIMENSIONS & PORT IDENTIFICATION/POSITION/SEE THE HYDRAULIC BASIC MOUNT INSTALLATION FOR BASIC INSTALLATION (SEE CONTROL) 23-8920 FOR BASIC INSTALLATION (SEE CONTROL) 23-8913
 2. HYDRAULIC DIMENSIONS CONTROL: RCV ALL DIMENSIONS FROM CENTER DIA.
 3. ALL DIMENSIONS IN MILLIMETER (MM)



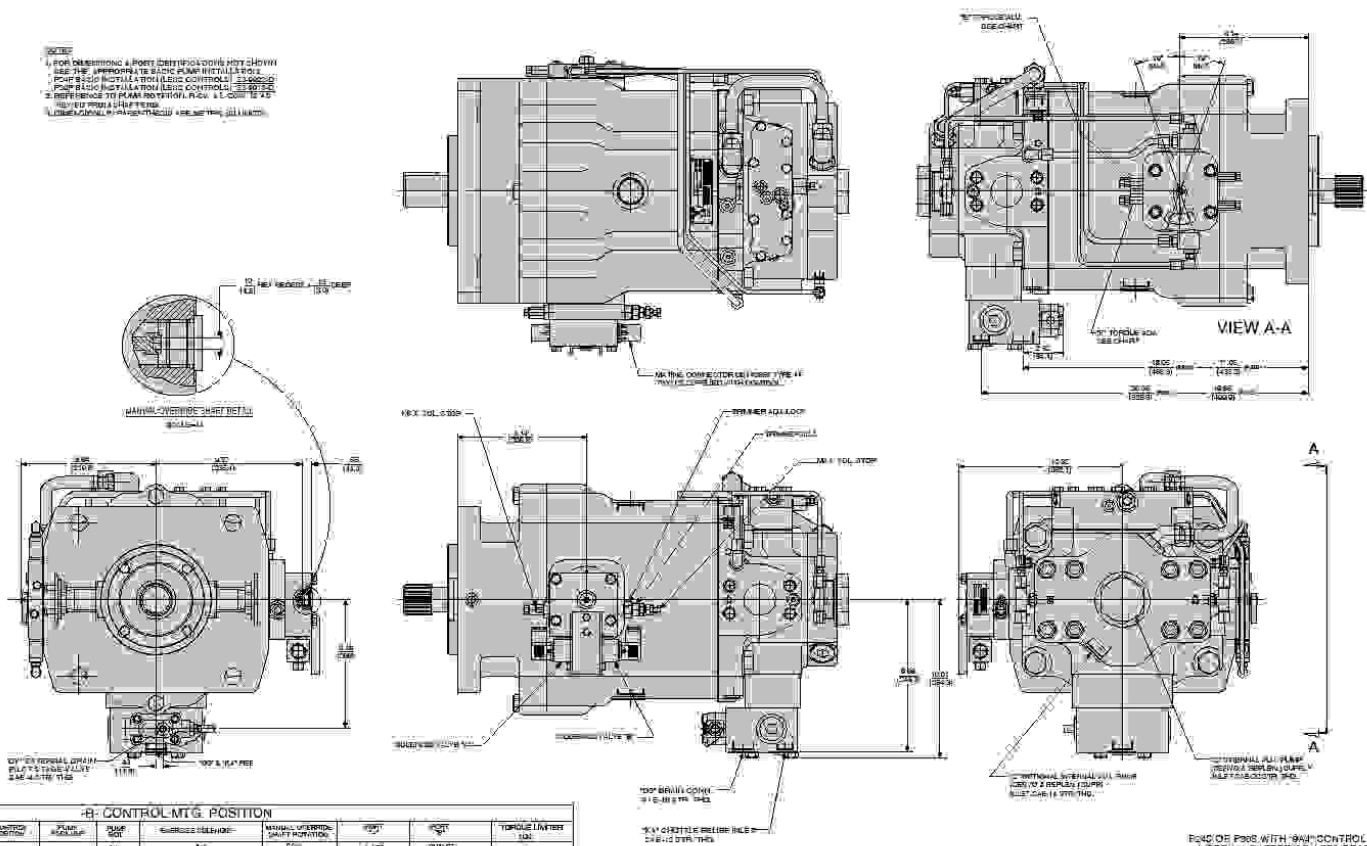
-B- CONTROL MTS POSITION

| CONTROL POSITION | VALVE POSITION | PORT | REFERENCE CONNECTION | INTERNAL CARTRIDGE (MOUNTING POSITION) | PORT | NOTE |
|------------------|----------------|------|----------------------|--|-------|-------|
| MTC | MTC | Oil | Oil | Oil | INLET | INLET |
| | | Oil | Oil | Oil | INLET | INLET |
| | | Oil | Oil | Oil | INLET | INLET |
| | | Oil | Oil | Oil | INLET | INLET |

PCAF OR PROPORTION VALVE CONTROL WITH INTERNAL CARTRIDGE
 SWYCCW ROTM KMSAB-F-8 BUILT MTS
 23-8920 - 2 of 2

INSTALLATION DRAWING

NOTE:
 1. FOR DIMENSIONING & PORT IDENTIFICATION REFER TO FIG. 1 AND FIG. 2. REFER TO SLICER PUMP INSTALLATION FOR PORT IDENTIFICATION (SLICER CONTROLS) & FIG. 3 FOR PORT IDENTIFICATION (SLICER CONTROLS).
 2. REFER TO FIG. 1 FOR PORT IDENTIFICATION. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.



| B- CONTROL MTG POSITION | | | | | | | |
|-------------------------|----------------|----------------|----------------|----------------------------------|--------|--------|--------------|
| CONTROL POSITION | SLICER CONTROL | SLICER CONTROL | SLICER RELEASE | MANUAL OVERRIDE SHUTTLE POSITION | INLET | OUTLET | TORQUE LIMIT |
| 90° | ON | ON | ON | ON | INLET | OUTLET | ON |
| 0° | OFF | OFF | OFF | OFF | OUTLET | INLET | OFF |

EQD OF PDS WITH 90° CONTROL W/ INTERNAL CARTRIDGE LESS REAR DRIVE, C/W "R" MTG. 34E-F 4 BOLT MTD.

25-9935

Model number 1100

Order number 1100

| Item | QTY | UNIT | DESCRIPTION | QTY | UNIT | DESCRIPTION | QTY | UNIT | DESCRIPTION |
|------|-----|------|-------------|-----|------|-------------|-----|------|-------------|
| 1 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 2 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 3 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 4 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 5 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 6 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 7 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 8 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 9 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 10 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 11 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 12 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 13 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 14 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 15 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 16 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 17 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 18 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 19 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 20 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 21 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 22 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 23 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 24 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 25 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 26 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 27 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 28 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 29 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 30 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 31 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 32 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 33 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
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| 35 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 36 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 37 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 38 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 39 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 40 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 41 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 42 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 43 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 44 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 45 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 46 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 47 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 48 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 49 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 50 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 51 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 52 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 53 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 54 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
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| 99 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |
| 100 | 1 | PC | PC | 1 | PC | PC | 1 | PC | PC |



PUMP CONTROL COMBINATIONS

| | | | | | | | | |
|-----|---------|---------|-----|---------|---------|---------|---------|---------|
| 102 | 2M2 *00 | 2N2 *00 | 402 | 5A2 *00 | 7D6 *00 | 8A2 *00 | 8C2 *00 | 9A2 *00 |
| 104 | 2M2 *01 | 2N2 *01 | 404 | 5A2 *01 | 7D6 *01 | 8A2 *01 | 8C2 *01 | 9A2 *01 |
| 106 | 2M2 *02 | 2N2 *02 | 406 | | | 8A2 *02 | 8C2 *02 | |
| 107 | 2M2 *03 | 2N2 *03 | 407 | 5A4 *00 | 7D7 *00 | 8A2 *03 | 8C2 *03 | 9A4 *00 |
| 109 | 2M2 *04 | 2N2 *04 | 408 | 5A4 *01 | 7D7 *01 | 8A2 *04 | | 9A4 *01 |
| | 2M2 *05 | 2N2 *05 | | | | | 8C4 *00 | |
| 2A2 | 2M2 *06 | 2N2 *06 | 4A2 | 5A6 *00 | 7D8 *00 | 8A4 *00 | 8C4 *01 | 9A6 *00 |
| 2A4 | 2M2 *07 | 2N2 *07 | 4A4 | 5A6 *01 | 7D8 *01 | 8A4 *01 | 8C4 *02 | 9A6 *01 |
| 2A6 | | | 4A6 | | | 8A4 *02 | 8C4 *03 | |
| 2A7 | 2M4 *00 | 2N4 *00 | 4A7 | 5A7 *00 | 7F6 *01 | 8A4 *03 | | 9A7 *00 |
| 2A8 | 2M4 *01 | 2N4 *01 | 4A8 | 5A7 *01 | 7F7 *01 | 8A4 *04 | 8C6 *00 | 9A7 *01 |
| | 2M4 *02 | 2N4 *02 | | | 7F8 *01 | | 8C6 *01 | |
| 2H2 | 2M4 *03 | 2N4 *03 | 4B2 | 5A8 *00 | | 8A6 *00 | 8C6 *02 | 9A8 *00 |
| 2H4 | 2M4 *04 | 2N4 *04 | 4B4 | 5A8 *01 | 7J6 *00 | 8A6 *01 | 8C6 *03 | 9A8 *01 |
| 2H6 | 2M4 *05 | 2N4 *05 | 4B6 | | 7J6 *01 | 8A6 *02 | | |
| 2H7 | 2M4 *06 | 2N4 *06 | 4B7 | 5C2 *00 | | 8A6 *03 | 8C7 *00 | 9C2 *00 |
| 2H8 | 2M4 *07 | 2N4 *07 | 4B8 | 5C2 *01 | 7J7 *00 | 8A6 *04 | 8C7 *01 | 9C2 *01 |
| | | | | | 7J7 *01 | | 8C7 *02 | |
| | 2M6 *00 | 2N6 *00 | 4C2 | 5C4 *00 | | 8A7 *00 | 8C7 *03 | 9C4 *00 |
| | 2M6 *01 | 2N6 *01 | 4C4 | 5C4 *01 | 7J8 *00 | 8A7 *01 | | 9C4 *01 |
| | 2M6 *02 | 2N6 *02 | 4C6 | | 7J8 *01 | 8A7 *02 | 8C8 *00 | |
| | 2M6 *03 | 2N6 *03 | 4C7 | 5C6 *00 | | 8A7 *03 | 8C8 *01 | 9C6 *00 |
| | 2M6 *04 | 2N6 *04 | 4C8 | 5C6 *01 | 7K6 *01 | 8A7 *04 | 8C8 *02 | 9C6 *01 |
| | 2M6 *05 | 2N6 *05 | | | 7K7 *01 | | 8C8 *03 | |
| | 2M6 *06 | 2N6 *06 | | 5C7 *00 | 7K8 *01 | 8A8 *00 | | 9C7 *00 |
| | 2M6 *07 | 2N6 *07 | | 5C7 *01 | | 8A8 *01 | | 9C7 *01 |
| | | | | | | 8A8 *02 | | |
| | 2M7 *00 | 2N7 *00 | | 5C8 *00 | | 8A8 *03 | | 9C8 *00 |
| | 2M7 *01 | 2N7 *01 | | 5C8 *01 | | 8A8 *04 | | 9C8 *01 |
| | 2M7 *02 | 2N7 *02 | | | | | | |
| | 2M7 *03 | 2N7 *03 | | | | | | |
| | 2M7 *04 | 2N7 *04 | | | | | | |
| | 2M7 *05 | 2N7 *05 | | | | | | |
| | 2M7 *06 | 2N7 *06 | | | | | | |
| | 2M7 *07 | 2N7 *07 | | | | | | |
| | 2M8 *00 | 2N8 *00 | | | | | | |
| | 2M8 *01 | 2N8 *01 | | | | | | |
| | 2M8 *02 | 2N8 *02 | | | | | | |
| | 2M8 *03 | 2N8 *03 | | | | | | |
| | 2M8 *04 | 2N8 *04 | | | | | | |
| | 2M8 *05 | 2N8 *05 | | | | | | |
| | 2M8 *06 | 2N8 *06 | | | | | | |
| | 2M8 *07 | 2N8 *07 | | | | | | |

• Unless otherwise specified on purchase order the following **factory setting** will be used:
 Maximum Stop/Full Displacement
 Minimum Stop Zero Displacement
 Pressure Compensator Override 5000 psi
 Torque Limiter (**4) P6 @ 1800 rpm = 60 hp
 P7 @ 1800 rpm = 72.5 hp
 P8 @ 1800 rpm = 80 hp
 P11 @ 1800 rpm = 110 hp
 P14 @ 1800 rpm = 140 hp
 P24 @ 1800 rpm = 240 hp
 P30 @ 1800 rpm = 300 hp

flow

flow

flow

pressure

weight

force

volume

area

length

temperature

viscosity

$$m^3/rev \times 16.387 = cm^3/rev$$

$$gpm \times 3.78 = l/min$$

$$hp \times 0.7457 = kW$$

$$lbf-ft \times 1.3558 = Nm$$

$$psd/m^2 (psi) \times 0.06895 = bar$$

$$lbf/in^2 (psi) \times 6.895 = kPa$$

$$lb \times 0.4536 = kg$$

$$lb \times 4.448 = N$$

$$m^3 \times 35.3147 = cm^3$$

$$m^2 \times 6.452 = cm^2$$

$$in \times 25.4 = mm$$

$$degrees F - 32 = ^\circ C$$

$$1.8$$

$$cSt \times 1.0 = mm^2/sec$$

$$SSU \times 0.67 = cSt \times 4.25 = 1.4$$

$$cm^3/rev \times 0.06103 = m^3/rev$$

$$l/min \times 0.2642 = gpm$$

$$kW \times 1.341 = hp$$

$$Nm \times 0.7376 = lbf-ft$$

$$bar \times 14.50 = psd/in^2 (psi)$$

$$(Pa \div 0.1450 = lbf/in^2) \div (psi)$$

$$kg \times 2.205 = lb$$

$$N \times 0.2248 = lbf$$

$$cm^3 \times 0.061032 = m^3$$

$$cm^2 \times 0.1550 = in^2$$

$$mm \times 0.03937 = in$$

$$1.8 \times ^\circ C + 32 = ^\circ F$$

$$mm^2/sec \times 1.0 = cSt$$

$$200 SSU = 99 cSt$$

FLUID POWER FORMULAS:

Pump displacement l/min

Pump input power hp

Pump output flow $Q = gpm$

Flow rate (gpm) gpm

Fluid motor torque $lbf-in$

Fluid motor power hp

(metric)

Pump input torque Nm

Pump input power kW

Pump output flow l/min

Fluid motor speed rpm

Fluid motor torque Nm

Fluid motor power kW

$\frac{\text{pressure (psi)} \times \text{displacement (in}^3/\text{rev)}}{2\pi \times \text{mech. eff.}}$

$\frac{\text{rpm} \times (\text{in}^3/\text{rev}) \times (\text{psi})}{36634 \times \text{overall eff.}}$

$\frac{\text{rpm} \times (\text{in}^3/\text{rev}) \times \text{volumetric eff.}}{231}$

$\frac{20 \times \text{flow rate (U.S. gpm)} \times \text{volumetric eff.}}{\text{displacement (in}^3/\text{rev)}}$

$\frac{\text{pressure (psi)} \times \text{displacement (in}^3/\text{rev)} \times \text{mech. eff.}}{2\pi}$

$\frac{\text{gpm} \times (\text{in}^3/\text{rev}) \times (\text{psi}) \times \text{overall eff.}}{36634}$

$\frac{\text{mech. eff. (in)} \times \text{displacement (in}^3/\text{rev)}}{20\pi \times \text{mech. eff.}}$

$\frac{\text{rpm} \times (\text{in}^3/\text{rev}) \times (\text{bar})}{60000 \times \text{overall eff.}}$

$\frac{\text{rpm} \times (\text{in}^3/\text{rev}) \times \text{volumetric eff.}}{1000}$

$\frac{1000 \times \text{flow rate (l/min)} \times \text{volumetric eff.}}{\text{displacement (in}^3/\text{rev)}}$

$\frac{\text{mech. eff. (in)} \times \text{displacement (in}^3/\text{rev)} \times \text{mech. eff.}}{20\pi}$

$\frac{\text{rpm} \times (\text{in}^3/\text{rev}) \times (\text{bar}) \times \text{overall eff.}}{60000}$

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