CST Controlled Start Transmission Mechanical Systems Instruction Manual

These instructions must be read thoroughly before installing or operating this product.

WARNING: Because of possible danger to persons or property from accidents which may result from the improper use of products it is essential that correct procedures be followed.

- **Products specified by Baldor Electric MUST be used in accordance with the supplied engineering information.**
- **Proper installation, maintenance and operational procedures must be followed.**
- **Instructions in instruction manuals must be followed.**
- **It is the responsibility of the customer to provide the necessary emergency stops and warning signals. E-Stop buttons provided by Baldor must be hard wired directly into the emergency stop circuitry. Check the operation of these safety devices before starting the conveyor and when making any changes to the program.**
- **Follow safety codes as required for signaling conveyor starts. There is no direct connection between the CST control panel and the siren provided by Baldor.**
- **The RED mushroom Emergency Stop Button on the CST connection box is not wired to any of the CST control devices. This button has been installed for customer use as required and it is the responsibility of the customer to wire it to the motor control center to receive signals for emergency stops.**
- **Inspections should be made frequently to assure safe operation under the prevailing conditions.**
- **Proper guards and other safety devices or procedures as required in local or national safety codes, are to be provided by the user and are neither provided by nor are the responsibility of Baldor Electric Company.**
- **This unit and its associated equipment must be installed, adjusted and maintained by qualified personnel who are familiar with the construction and operation of all equipment in the system and the potential hazards involved.**
- **When risks to persons or property may be involved, a holding device must be an integral part of the driven equipment beyond the speed reducer output shaft.**

WARNING: Because of the possible danger to person(s) or property from accidents which may result from the improper use of products, it is important that correct procedures be followed: Products must be used in accordance with the engineering information specified in the catalog. Proper installation, maintenance and operation procedures must be observed. The instructions in the instruction manuals must be followed. Inspections should be made as necessary to assure safe operation under prevailing conditions. Proper guards and other suitable safety devices or procedures as may be desirable or as may be specified in safety codes should be provided, and are neither provided by Baldor Electric Company nor are the responsibility of Baldor Electric Company. This unit and its associated equipment must be installed, adjusted and maintained by qualified personnel who are familiar with the construction and operation of all equipment in the system and the potential hazards involved. When risk to persons or property may be involved, a holding device must be an integral part of the driven equipment beyond the speed reducer output shaft.

OVERVIEW

A Controlled Start Transmission (CST) system is a multi-stage gear reducer combined with a wet brake acting as a clutch unit, and a hydraulic control system. It is designed for smooth-starting high inertia loads. The output torque from a CST unit is controlled via a hydraulic control system. By varying the hydraulic pressure applied to the clutch, the output torque can be varied.

INSTALLATION

INITIAL RECEIVING INSPECTION

Carefully inspect the shipping containers for obvious outside damage. If any form of damage is present, notify the carrier and take photos for future use. Great care was taken to insure that the cargo was very well protected.

UNPACKING INSTRUCTIONS

Remove the packing list from the side of the unit. Remove the screws or nails which secure the top surface of the crate. On some systems, a raised internal platform is used to keep parts separated. Each box (or item) is marked with an item number which corresponds to one on the packing list. If the box contains more than one part, a checked bill of materials will be included in the box. Remove the box(es) from the interior of the shipping crate and check the contents against the packing list. Leave the items in their individual boxes until time for use.

Loosen and remove reducer-attaching nuts and washers. See the certified drawing for reducer weight. Using properly rated slings or chains and shackles, lift the reducer unit up and clear of the crate. Electrical components should be left in the packing boxes until needed during the installation process.

CAUTION: To move or lift a CST gearbox alone, use all four (4) lifting holes in the corners of the upper housing. DO NOT use these holes to lift the entire drive motor-gearbox assembly. Use slings under a skid- type mounting base to lift the drive assembly. It is not recommended to lift the base with the drive motor and CST installed.

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FOUNDATION

The following are general tips for the installation and alignment of a CST on the drive base:

- The foundation must be of sufficient size and rigidity to prevent movement when the CST is installed and operated. Alignment between the pulley, the CST and the drive motor must be maintained. The foundation surface must be even and level to within 1.5 mm to prevent distortion of the base plate when hold down bolts are tightened. A well laid concrete slab is the most effective way of ensuring a sound foundation.
- The foundation must have adequate strength and rigidity to withstand operating torque of the reducer output shaft. Note that motor starting torque can be up to 3 to 4 times higher than the normal operating torque.
- The top of the foundation slab should be left 1" to 1.5" (25 to 38 mm) lower than will finally be required to allow for grouting. When installing, the foundation should be roughened, cleaned, and dampened before placing the drive base in position.
- Foundation bolts should be secured in the concrete as shown in Figure 1. Allow adequate length for the bolts. Foundation bolts can be placed in the concrete at the time the concrete is poured.
- Packing shims are placed between the top of the foundation and the baseplate until the unit is 1" to 1.5" (25 to 38 mm) clear of the foundation. Adjust the packing or shims until a level placed on the baseplate indicates the base is level.
- After preliminary alignment between the CST input and output couplings, the space between the top of the concrete surface and the bottom of the drive base frame must be filled with grout. The grout should be thoroughly worked under the baseplate and be allowed to set completely as specified by the product instructions. After the grout has set, the holding bolts should be tightened evenly.
- Final alignment of the CST should be checked after the grout has set and the hold down bolts have been tightened.
- When mounting a CST on structural steel, a very rigid base plate is recommended. Bolt the base plate securely to steel supports with proper shimming to achieve a level mounting. If a CST is to be mounted on a concrete foundation, grout steel mounting pads into the concrete base, rather than grouting the drive system directly onto the concrete.

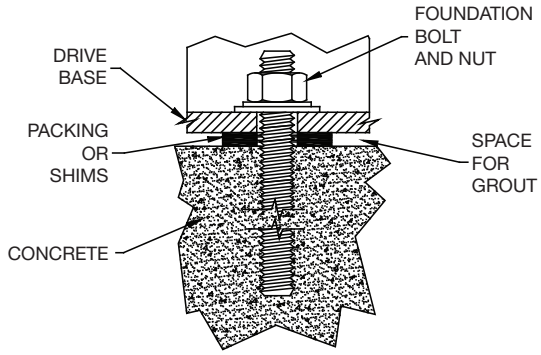

Figure 1 - Foundation

When using shims follow these rules (see typical assembly in Figure 2)

1. Use a minimum amount of shims under the CST.
2. Use shims under the drive base for height adjustment.
3. Shims must be distributed uniformly around the base to support the entire mounting surface. The supported load must be equalized to avoid any distortion or localized stress on the lower housing. Use feeler gauges to determine the correct shim thickness needed to support each pad.
4. Use large enough shims to provide adequate support. If shims are not installed properly, they may get dislodged from their location, which will cause misalignment in the system resulting in damage to the system components.

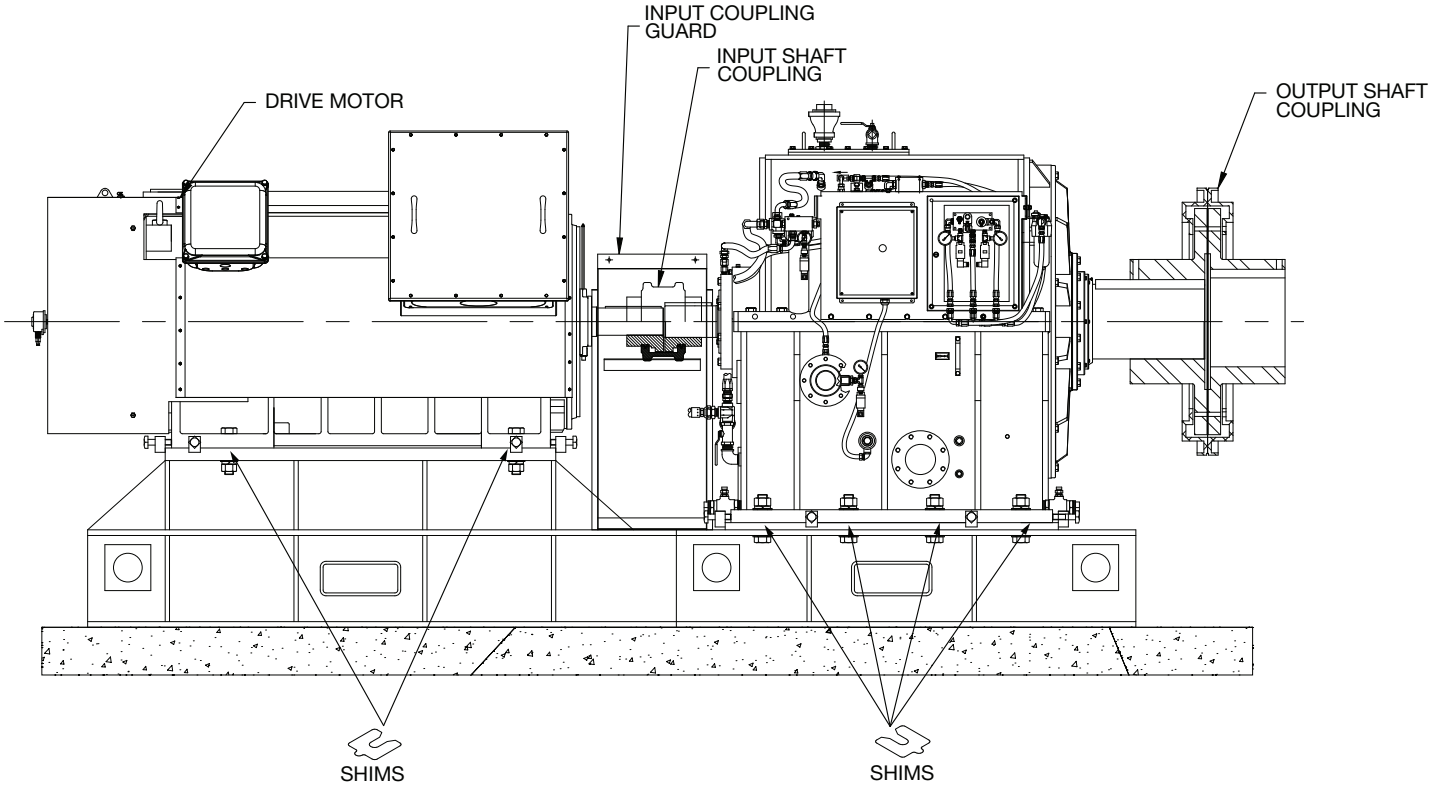

Figure 2 - Typical CST Installation

CAUTION: CST drive systems are designed only for direct coupling with a drive motor. Do not use an adjustable slide base. Do not attempt to use a chain drive on either input or output shafts.

COUPLING INSTALLATION

WARNING: Provide guards and other safety devices as specified in local or national safety codes.

NOTE: Final alignment of the CST couplings must be done after tension has been applied to the system.

Follow the installation instructions provided by the coupling manufacturer. Some general guidelines are provided that will aid in a typical coupling installation.

NOTE: Do not connect couplings until the motor shaft direction of rotation is verified.

- Check shaft, hub bore, and keys for nicks and burrs and remove as necessary.
- Use an oil bath to heat the coupling hubs to 245°F (118°C). Remove flexible elements before heating. Any kind of oil, such as gear oil, can be used as long as the flash temperature of the oil is high enough to avoid a fire hazard. Check the temperature of the coupling hub frequently with a Tempilstick to avoid overheating.
- Alternatively, mark the hub with a 275°F (135°C) temperature sensitive crayon (melts at prescribed temperatures) in several places on the hub. Remove flexible elements before heating. Use suitable method to heat the hub. When using an oxy-acetylene torch, use an excess acetylene mixture. Direct the flame toward the hub bore and keep it in motion while heating. Avoid over heating an area.

WARNING: Do not use an open flame in a combustible atmosphere or near combustible materials.

- Mount the hub on the shaft as quickly as possible to avoid heat loss. Carefully line up the keyway and slide hub onto shaft until the coupling is at the right location relative to the shaft end. If it is necessary to drive the hub into position, tap lightly with a soft brass or lead hammer. DO NOT USE excessive pounding which can cause damage to the bearings or gears.
- Allow coupling hub and shaft assembly to cool.

COUPLING ALIGNMENT

It is recommended to use laser alignment tools to achieve proper alignment. Dial indicators and feeler gauges can also be used for alignment (see Figures 3 and 4). Maximum alignment tolerance should be the lesser of the CST or coupling allowable. Start at the low speed end and work to the input side when leveling and aligning. Maximum soft foot should be .002 inch for the CST. Soft foot correction should be done before final alignment.

CAUTION: The life of the CST reducer bearings is adversely affected by coupling misalignment. The values shown are absolute maximums for the reducer. If tighter limits are specified by coupling or motor manufacturers, those tighter limits should be used. If looser limits are specified, they must not be used.

NOTE: Final alignment of the CST couplings must be done after tension has been applied to the system.

1. Align the CST output shaft with the driven equipment shaft. It is preferred to shim under the drive base for height adjustment.

   If shims are used to level or align the unit or baseplate, they must be distributed uniformly around the base to support the entire mounting surface. The supported load must be equalized to avoid any distortion or localized stress on the housing. Use feeler gauges to determine the correct shim thickness needed to support each pad.

   Use shims large enough to provide adequate support. If shims are not installed properly, they may get dislodged from their location which will cause misalignment in the system resulting in damage to the system.

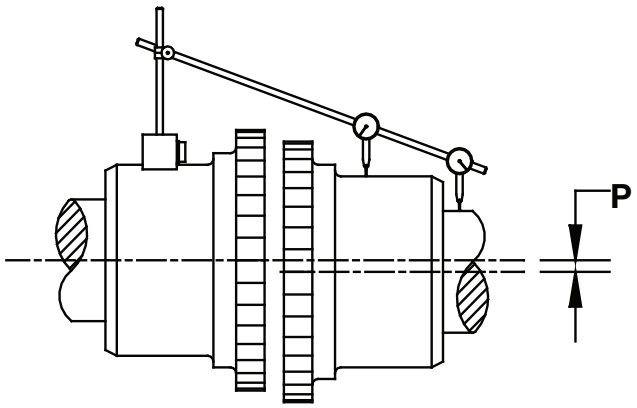

Figure 3 - Offset Alignment

Output shaft coupling maximum offset misalignment:

P (Parallel Offset)	<	0.005”	(0.13 mm)
TIR (Total Indicator Reading) = 2 x P	<	0.010”	(0.25 mm)

Angular alignment is achieved by measuring the gap between the ends of the two coupling hubs in both the horizontal and vertical planes. The difference between any two measurements 180° apart must not exceed 0.010” (0.25 mm).

Output shaft coupling maximum angular misalignment:

X - Y < 0.010” (0.25 mm)

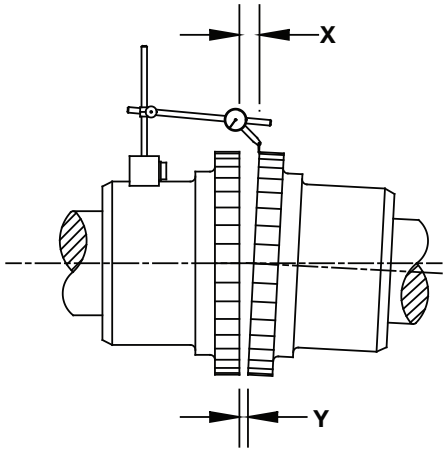

Figure 4 - Angular Alignment

2. Bolt down the reducer and tighten mounting fasteners to the torque values appropriate for the bolt sizes per Table 1.
3. Align the motor coupling hub with the reducer input shaft hub.

   Input shaft coupling maximum parallel misalignment:

P (Parallel Offset)	<	0.003”	(0.076 mm)
TIR (Total Indicator Reading) = 2 x P	<	0.005”	(0.13 mm)

   Input shaft coupling maximum angular misalignment:

X - Y	<	0.005”	(0.13 mm)

4. Tighten the motor hold down bolts to the torque values appropriate for the bolt sizes per Table 1. Re-check alignment.
5. Complete electrical connections and verify motor and CST direction of rotation is correct before connecting couplings.
6. Lubricate the couplings, if required, following the manufacturer's recommendations.
7. Install high speed and low speed coupling guards in conformity with applicable safety standards for the location.

Table 1 - Mounting Fastener Tightening Torques (course thread series): lb-ft

Inch Fasteners		Metric Fasteners	
Nominal Diameter (in)	Grade SAE 5	Nominal Diameter (mm)	Class 8.8
0.2500	6.5	5	3.5
0.3125	13	6	5.5
0.3750	23	8	14
0.4375	37	10	27
0.5000	57	12	47
0.5625	82	16	120
.06250	110	20	240
0.7500	200	24	420
.08750	320	30	840
1.000	480	36	1450
1.1250	600	42	2350
1.2500	840	48	3500
1.3750	1100	56	5650
1.5000	1450	64	8550
1.6250	2850	72	12400
1.7500	3300		
2.0000	4900		
2.2500	7200		
2.5000	9850		
2.7500	12100		
3.0000	15900		
3.2500	20500		
3.5000	26000		

THERMAL CONSIDERATIONS IN ALIGNMENT

Because of thermal growth of the CST and the motor, it is recommended that allowance be made during the cold alignment to account for this growth. An allowance of 0.010” can be used as a starting point. Set the CST shafts lower than the motor and driven equipment shafts by this amount. Hot align the CST and motor after they are at operating temperatures.

NOTE: Final alignment of the CST couplings must be done after tension has been applied to the system.

COOLING AND LUBRICATION SYSTEM

CAUTION: Use only Baldor approved oil. It is essential that ONLY Mobilfluid 424, or another Baldor approved equivalent, be used in CST drives. The use of lubricants other than those approved by Baldor will void the warranty and possibly damage the drive units.

The housing should always be filled with Mobilfluid 424 to the level indicated on the sight gauge. The use of other oils is not recommended without checking with customer support for suitability.

An integral hydraulic pump is installed on the CST for clutch actuation. Some CST use a tandem pump. If a tandem pump is used, the output from the pump’s first section is used to lubricate the input and intermediate shaft bearings. The output from the second section of the pump is used to pressurize the control system for the operation of the clutch.

A separate motor driven pump draws oil from the sump, forces part of it through a heat exchanger and returns it to the sump via the stack of grooved clutch discs. This pump is turned on by CST controls during acceleration of the belt and when the temperature of the oil exceeds a pre-determined level.

A temperature sensor shuts down the CST if the oil temperature rises above the maximum temperature limit, usually set at 190°F (88°C). A clutch cooling oil pressure or flow sensor provides the same safety shutdown if the clutch cooling oil flow drops too low. A bearing lubricating oil failure sensor is also provided.

COOLING SYSTEM INSTALLATION

COOLING SYSTEM

A typical cooling system is shown in Figure 5. Refer to the certified drawing for actual configuration and connection sizes. Maximum pressure on the discharge side of the cooling pump is 80 PSI (5.5 Bar). Use either welded pipe, threaded pipe, grooved pipe with Victaulic fittings, or MSHA approved rubber hose with appropriate pressure rating between the discharge flange of the pump, the heat exchanger inlet (bottom) and outlet (top) ports, and the CST. If rigid piping is used between the pump discharge, the heat exchanger, and the CST, then a flexible expansion joint, such as shown in Figure 5, should be installed at an appropriate location on each line to accommodate for thermal expansion and contraction of the pipes. Pipe supports should allow for thermal growth and contraction. If grooved pipe with Victaulic fittings are used, then expansion joints are not required. Short pieces of rubber hose can be used in lieu of expansion joints. If pipe supports are used, the supports should be installed such that they allow for the expansion joints to function properly. To facilitate replacement of the cooling pump, it is recommended to install valves at the suction and discharge ports of the cooling pump. Ball, gate, and butterfly valves are acceptable.

If pipes are used to make the connections, pickled pipes should be used. Prior to welding the pipes at the job site, the pipes must be thoroughly cleaned out with a rotary brush. After the welds are completed, disconnect each pipe section and clean out the weld scale from inside the pipes as much as possible using rotary wire brushes, etc. Clean out the pipe sections further by dipping them in a solvent tank.

After all the pipe joints are completed (welded, threaded, Victaulic, etc.) check the piping system for leaks using 5 PSI (0.3 Bar) maximum air pressure and a soap and water solution. Even though the piping system has been designed to handle pressures

of up to 100 PSI, do not pressurize the system more than the 5 PSI (0.3 Bar) specified limit when checking for leaks. During testing (without the cooling pump running) the internal pressure of the CST will be the same as the test pressure and over pressurizing may cause the CST seals to dislodge.

NOTE: When welded piping is used, the cooling system must be thoroughly flushed.

The CST cooling pump can be used for this purpose. The oil should be circulated in the system for approximately eight hours and then drained from the CST sump, heat exchanger, and the interconnect pipes. Replace the CST oil filter and clean out the inlet basket strainer. Fill the CST with new oil. For oil draining and filling procedures refer to the Lubrication Information in the Maintenance section of this manual. Use only oils that are specified in the Lubrication Information in the Maintenance section of this manual. If a filtration cart is available, then the circulated oil may thoroughly filtered and reused in the CST.

Some cooling systems are equipped with a by-pass line between the inlet and outlet ports of the heat exchanger. Depending on the specific application this bypass valve may be opened during cooler temperatures, if full flow through the heat exchanger is not required to maintain proper temperature.

To remove the strainer basket for cleaning, close the valves on the side of the strainer.

The heat exchanger can be installed either directly on a concrete pad or on a steel base. The top of the heat exchanger should be lower than CST shaft centers to avoid fluctuations in the CST oil level as the cooling system is shut down. Heat exchangers should be installed as close to the CST as possible to avoid excessive cooling flow pressure losses. A drain valve should be installed at the lowest point in the line between the pump discharge port and the heat exchanger inlet port to allow draining the oil out of the heat exchanger and pipes.

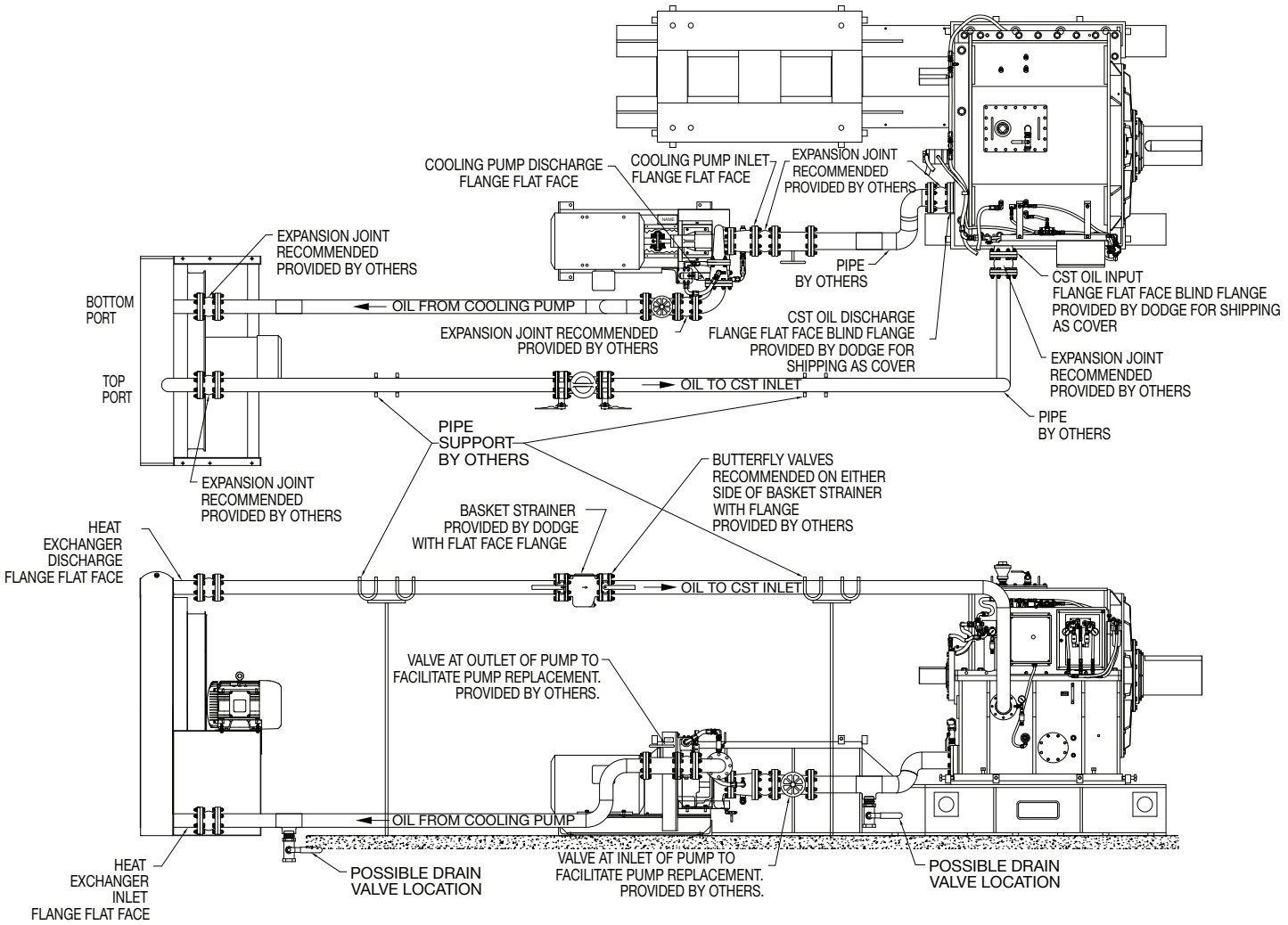

Figure 5 - Typical Cooling System

COOLING PUMP SKID SET UP

The cooling pump skid should be installed as close to the discharge flange of the CST as possible to avoid excessive pressure drop in the suction line of the pump. Use sufficiently large pipe or hose to avoid pump cavitation. For most applications, the skid may be installed at the same level as the main drive base or lower. If the drive is installed at elevations greater than 7,500 ft. above sea level, special consideration must be given to pump installation to avoid pump cavitation. In these cases, the skid must be installed at a lower elevation than the main drive base.

Pipe expansion joints must be installed at the inlet and outlet ports of the cooling pump. Alternately, a piece of hose may be installed at or near the pump ports to alleviate pipe stresses on the pump. If flanges do not match between the pipes and pump ports, do not use force to line up the pipe flanges to the pump flanges. Any stress imposed on the cooling pump from pipes, either from improper (mismatched) installation, or from thermal expansion and contraction of pipes, may cause the cooling pump seal to leak.

CAUTION: Failure to install pipe expansion joints, or hoses at or near pump ports could cause the cooling pump seals to leak due to pipe stresses and it would void the warranty on pump seals.

Make sure the cooling pump skid is leveled and shimmed properly before tightening the bolts. The skid should be grouted in the areas under the angle iron where the skid makes contact with the floor. See Figure 6.

The alignment between the cooling motor and the pump must be checked after the base is installed and the bolts are tightened. Follow the coupling installation instructions.

Do not jog the motor for verification of direction of rotation until the CST is filled with oil. Some cooling skids may be shipped from the factory with the rubber element of the coupling removed in order to prevent jogging the pump dry and damaging the pump seal. If the rubber element of the Dodge Paraflex® coupling has been removed, follow the instructions for the coupling to reinstall the rubber element. The bolt torque values and the tightening pattern of the coupling bolts are important. Failure to follow coupling instructions can lead to the failure of the rubber element. The cooling pump skid is equipped with a high flow rate filter for high efficiency oil filtration. For normal operation keep the valves on the either side of the filter open. A pressure gauge and a pressure transducer are installed downstream from the filter. When the pressure drops below 15 PSI, replace the filter element. To replace the filter element, close the valves on either side of the filter. Open the valves again after the filter element has been replaced.

To check pump discharge pressure for diagnostic purposes, temporarily close the valve downstream from the filter. That is the valve that is closest to the suction port of the pump. The pump discharge pressure can then be read on the filter pressure gauge.

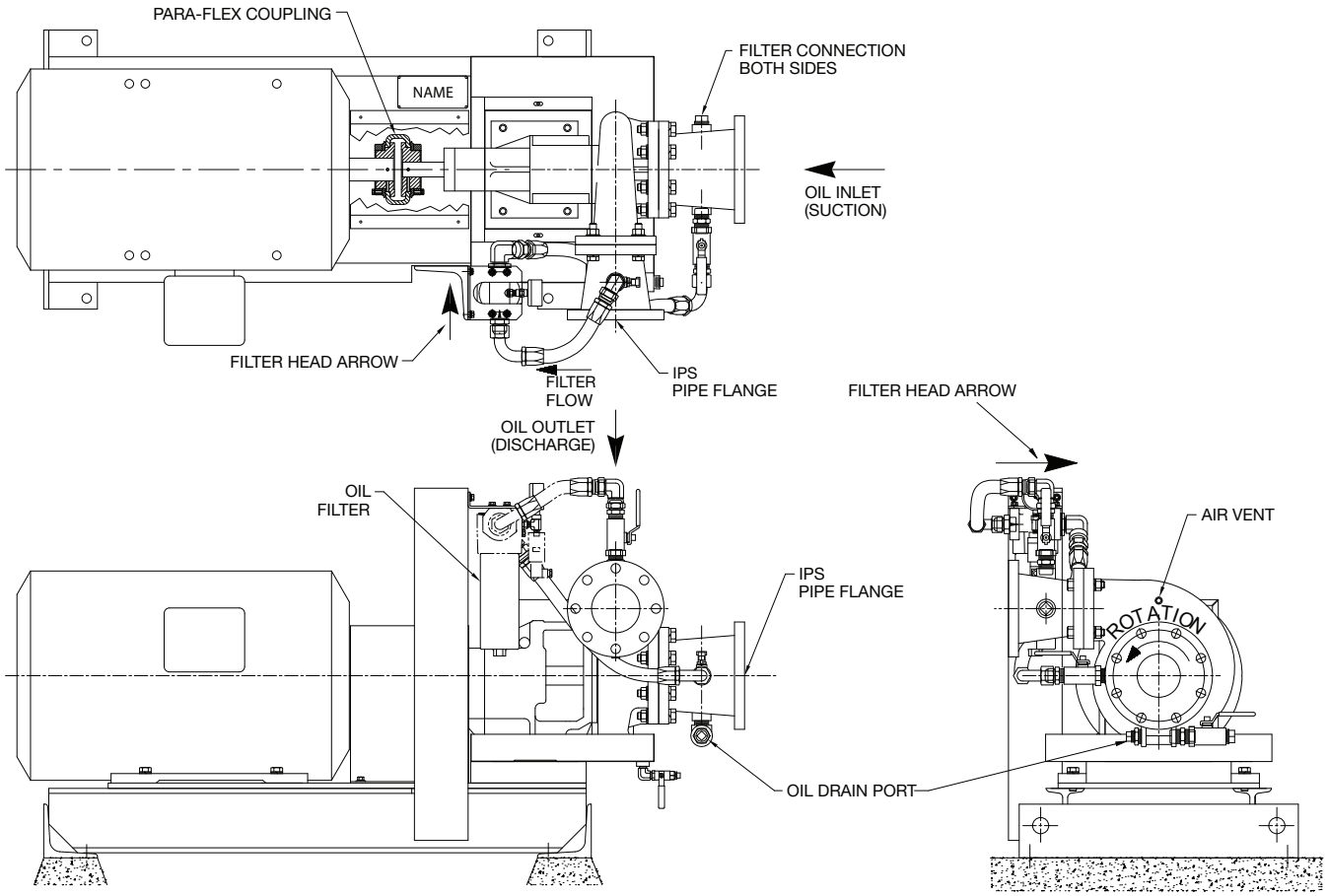

Figure 6 - Cooling Pump Skid

START-UP

GENERAL

All Dodge CST units are test-run at the factory. During initial start-up, the following procedures will ensure safe operation of a CST.

1. Check the couplings connecting the drive motor to the CST for proper alignment. Check that couplings are filled with the correct grade grease, as recommended by the coupling manufacturer.
2. Check all mounting bolts, nuts and screws to be sure they are tight.
3. Check that oil is up to the correct level in the sight gauge (see Figures 7 and 8) with the cooling pump running. Check direction of rotation of all components, including the cooling pump motor, and the main drive motor. The cooling pump and motor should turn clockwise when viewed from the top. Cooling pump rotation can be checked by removing the dust cover (see Figure 6) and looking through a small opening between the motor and the pump. Apply electrical power to the cooling pump for 1 second or less while another person observes the direction of pump shaft rotation.
4. Ensure that the breather, access covers and coupling guards are in place and secured. Please note that breathers are shipped in a bag which is attached to the breather connection port. Remove the breather from the bag and screw it into the breather port.

   WARNING: Do not operate unit with caps, covers or guards missing.

5. Operate the cooling pump to circulate lubricating/cooling oil through the system. Purge air from the pump housing volute by loosening the plug at top portion of the pump volute. Check the oil level again to be sure oil is at the correct level with the pump running.
6. If the CST has an external backstop, check that the directions of rotation of the backstop and output drive shaft are the same.
7. See the CST control manual for the rest of the start-up procedure.

   NOTE: Lubricant level checks should be done with the cooling pump and reducer running.

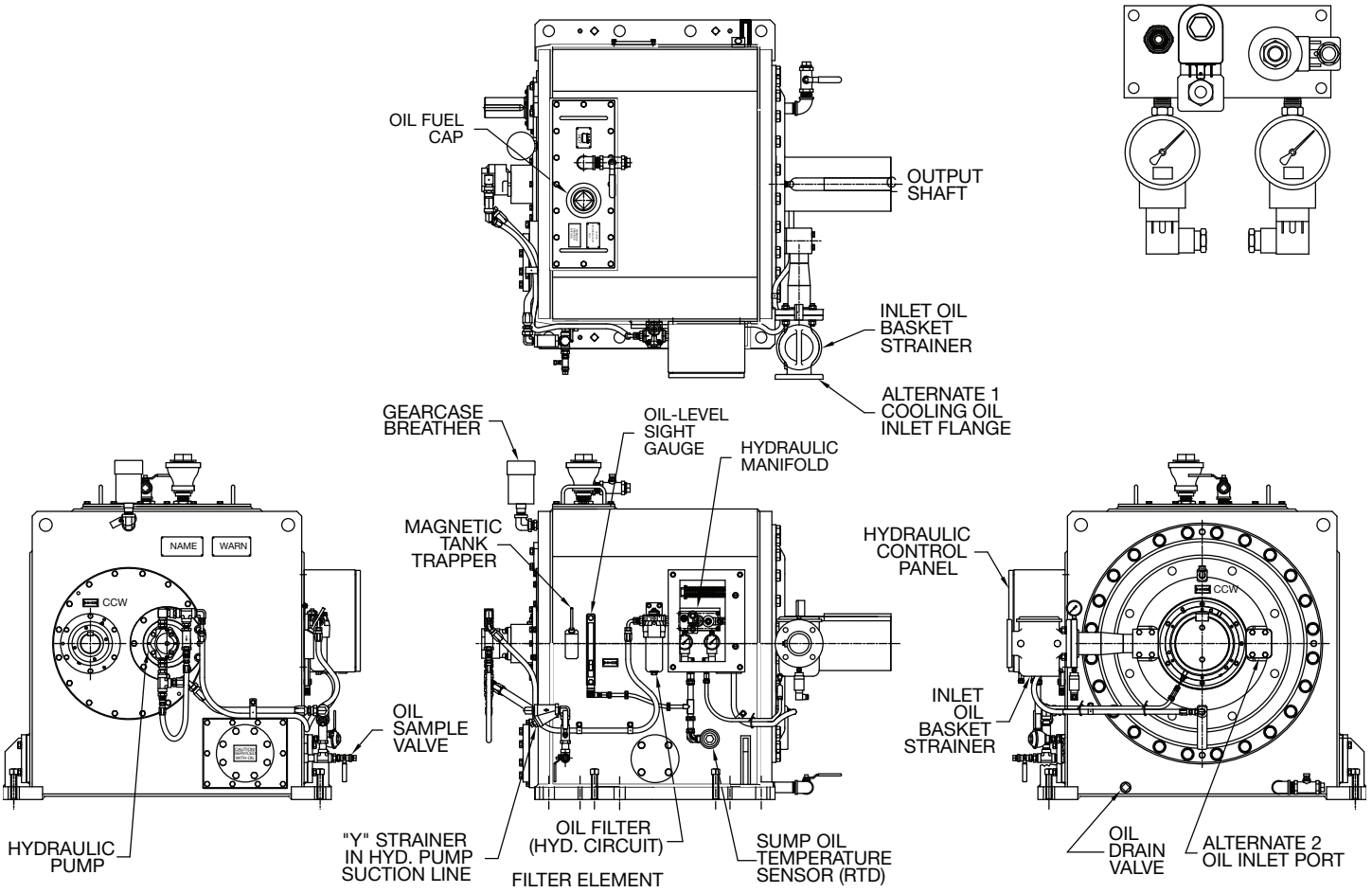

Figure 7 - Typical CST "G" Series Model

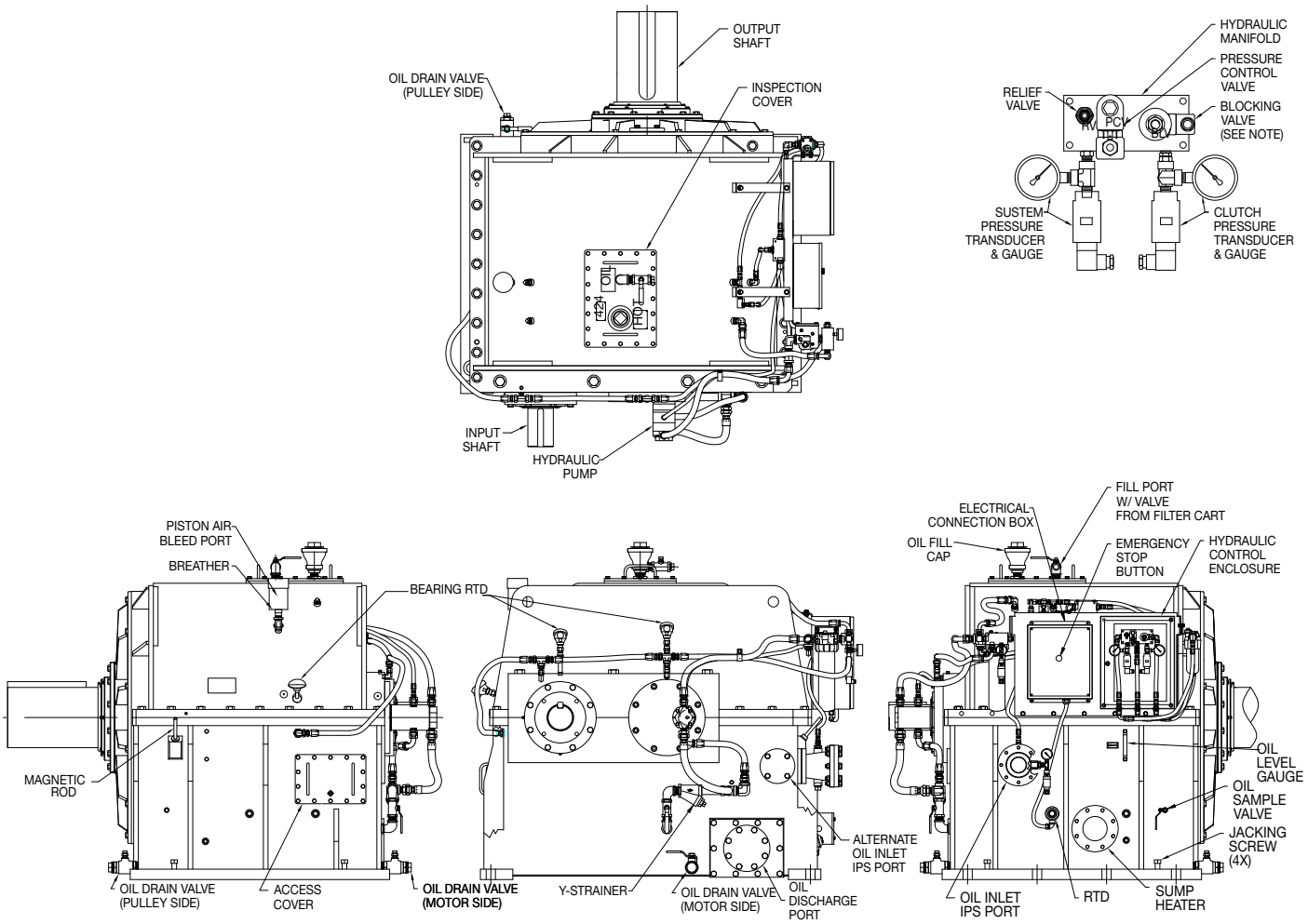

Figure 8 - Typical CST "K" Series Model

MAINTENANCE

LUBRICATION

CAUTION: Use only Mobilfluid 424 oil in the CST. The use of lubricants other than those approved by Baldor will void the warranty and possibly damage the drive units.

OIL CAPACITY

Fill to the level indicated on the sight gauge with Mobilfluid 424. Refer to the certified print for approximate oil capacity. Additional oil will be needed to fill the pipes, pump chamber, etc.

DRAINING THE OIL

Unscrew the pipe plug from the drain valve as shown in Figures 7 and 8. Open the drain valve and completely drain the oil into a suitable container.

OIL FILL AND LEVEL

Unscrew the oil fill funnel located on the top inspection cover (Figure 7 and 8). Insert the oil fill nozzle or hose in the oil fill funnel. Take the necessary cautionary step to prevent debris from getting into the gearbox. Fill the CST with oil until the oil level reaches the arrow sign located by the oil level sight gauge. Screw the oil fill cap back on and start the CST cooling pump. Check the oil level with the cooling pump running. Add oil as necessary.

CAUTION: The final check of the oil level should be done when the main drive motor and the CST cooling pump are both running.

If a pump is being used to fill the CST, connect the pump hose to the port provided on the top inspection cover and open the valve to fill. Once the pump hose has been disconnected, close the valve.

NOTE: Normal oil level is the midpoint of the oil level sight glass. However, as a cautionary step under the following conditions over fill the CST to prevent damage to bearings from disrupted oil flow.

Over fill oil by 50 gallons over and above the top of the sight glass when:

1. The CST is new and is being installed and run for the first time.
2. The CST has been just repaired and is being returned to service.
3. The CST has been sitting idle and not turning for an extended period of time.
4. The hydraulic pump has been replaced.
5. If the hydraulic connections have been altered.

NOTE: Once it is confirmed that the bearing feed system is working and the bearing feed pressure gauge shows pressure, then the oil level can be lowered to the middle of the sight glass. Overfilling does not damage the CST but it does prevent damage from bearings running dry. Overfilling can lead to minor leak from the shaft seals.

USING FILTRATION CARTS

Filtration carts are commercially available for purchase. Such carts include a pump, one or two filters, and hoses. It is strongly recommended that CST users purchase such a filtration cart as they greatly facilitate the process of draining and filling the CST oil. If such a cart is used, remove the pipe plug from the drain valve assembly (Figures 7 and 8) and connect the suction hose of the pump to the threaded port. Open the valve and pump out the used oil into an empty container. You can also open the inspection cover and route the suction hose to the bottom of the CST gearcase (oil sump) to suction off the oil residue from the bottom of the case.

Some filtration cart filters have the capability to remove moisture, such as water, from the oil. A monthly maintenance program to circulate the CST oil through the filtration cart system and to remove all the moisture and wear particles from the oil will greatly improve the life of the CST gears, bearings, and clutch plates.

To return new or filtered oil back to the CST gearcase, connect the discharge hose of the filtration cart to the threaded connection of the drain valve (the same connection which was used for draining the oil) and pump the oil from the container into the gearcase.

OIL CHANGE INTERVAL

In the absence of an oil sampling program, the oil should be changed every six months for normal operating conditions. For dusty environments, the oil should be changed more frequently. An oil sampling program may allow an extended oil change interval. Oil samples should be taken once every month and analyzed by a reputable lab. Use the oil sampling valve (Figures 7 and 8). Take oil samples when the CST is operating. If that is not possible, take oil samples with the cooling pump running. When taking oil samples, open the valve and drain static oil from the port before using for lab analysis. Change the oil when the contaminants or moisture exceed the levels shown below, or when viscosity drops below the levels shown below, or when the additives or alkalinity are not within the range given in Table 2.

Table 2 - Contaminant Levels

Contaminant		Maximum Level	
Al	Aluminum	20	ppm
B	Boron	50	ppm
Ba	Barium	20	ppm
Ca	Calcium	900 - 3000	ppm (An additive)
Cr	Chromium	20	ppm
Cu	Copper	20	ppm
Fe	Iron	200	ppm
Mg	Magnesium	20	ppm
Mn	Manganese	20	ppm
Mo	Molybdenum	20	ppm
Na	Sodium	20	ppm (In some oils as an additive - increase allowable to 150 ppm)
Ni	Nickel	20	ppm
P	Phosphorus	900 - 2000	ppm (An additive)
Pb	Lead	20	ppm
Sb	Antimony	20	ppm
Si	Silicon	20	ppm
Sn	Tin	50	ppm
Zn	Zinc	900 - 2000	ppm (An additive)
Moisture		1000	ppm
T.B.N.		7.5 - 3.0	Total Base (Alkalinity)Number

Minimum Viscosity:		
40	cSt	at 40°C
5.8	cSt	at 100°C

NOTE: If your environment is especially high in moisture, dust and dirt, check the oil condition frequently. Take samples and check for condensation and sediment. Check the oil any time unusual ambient conditions might cause excessive condensation inside the CST.

PERIODIC MAINTENANCE

In addition to the periodic maintenance schedule listed below, additional inspection and maintenance is required during the first few weeks and months of CST operation.

THE INITIAL FIRST WEEKS

After the first two or three weeks of operation perform the following maintenance steps:

1. Check all external housing and hold-down bolts. Tighten as necessary.
2. Check alignment between the drive motor, coupling and CST. At the same time, check alignment between the CST and driven equipment (pulley shaft).
3. Closely monitor filters for break-in contamination during the first 3 weeks of operation. Frequent changing of filters is sometimes required during this period.

AFTER THE FIRST THREE MONTHS

After the first three months of operation perform the following maintenance steps:

1. Drain the oil, remove the inspection cover, magnetic rod, and magnetic drain plug (Figures 7 and 8). Inspect the iron particles attached to the magnetic rod and plug. Check inside the gear case for signs of dirt and/or metal particles. Contact Dodge Product Support for guidance.
2. Replace the filter element in the lubrication system. Replace the filter in the hydraulic manifold assembly (shown in Figures 7 and 8). Clean and reinstall the basket of the cooling system strainer, the magnetic rod, and the magnetic plug.
3. Refill the CST with new Mobilfluid 424 oil to the level indicated on the sight glass.
4. Check hydraulic components for proper operation.
5. Check all electrical terminations for loose and/or frayed wires. Repair connections as required. Re-tighten all screws.
6. Check operation of all temperature, pressure and tachometer sensors. Replace as required.
7. Clean interiors of electrical cabinets of all dust, dirt, and grease.

CAUTION: If environmental conditions become severe with excessive amounts of dirt, dust or moisture, contact Dodge Product Support to determine whether other devices may be needed to protect your CST.

DAILY

1. Visual inspections should be a daily routine. Check for oil leaks, vibration or unusual sounds.

WEEKLY

1. Check the oil level. Add oil as needed.
2. Visually inspect for leaks and remedy any problems in the gear case, hydraulic enclosure and lines, cooling system and fittings.
3. Pump grease into the input and output shaft seal grease cavity until grease comes out from the grease relief fitting. Use only high temperature grease such as Mobil HTS High Temperature grease or equivalent high temperature grease.
4. Note any unusual noise or sound. If present, diagnose and remedy the problem(s). Contact your local Baldor service representative for assistance.

NOTE: Lubricant level checks should be done with the cooling pump and reducer running.

MONTHLY

1. Procure sample of cooling oil and analyze for contamination. After first two samples, increasing contamination between successive samples should be minimal. Sudden increases in contamination are an indication of potential problems or failures and should be closely investigated to determine the root cause.
2. If a filtration cart is available, circulate and filter the CST oil to remove all moisture and wear particles from the oil. Remove and inspect the magnetic rod and the magnetic plug (Figures 7 and 8) for wear debris. Clean and reinstall the magnetic rod and plug. Clean and reinstall the strainer basket in the cooling system (Figure 5).
3. Check all electrical and hydraulic control enclosures for condensate collection. Drain if needed by opening hole seals. Replace when dry. Check for malfunction of optional enclosure heater.
4. Pump grease into the grease cavity of the input and output shaft seals as outlined under the weekly maintenance procedure described previously.

BIANNUALLY (SIX MONTHS)

1. Drain the oil, remove the inspection cover and the magnetic oil drain plug. Check the magnetic rod and plug for iron wear debris. Check inside the gear case for signs of dirt and/or metal particles.
2. Replace the filter element in the lubrication system. Replace the filter element in the hydraulic manifold assembly. Clean and reinstall the basket of the cooling system strainer, the magnetic rod, and the magnetic plug (Figures 5, 7 and 8).
3. Refill the CST with new Mobilfluid 424 oil to the level indicated on the sight glass.
4. Check hydraulic components for proper operation.
5. Check all electrical terminations for loose and/or frayed wires. Repair connections as required. Re-tighten all screws.
6. Check operation of all temperature, pressure and tachometer sensors. Replace as required.
7. Clean interiors of electrical cabinets of all dust, dirt, and grease.

LONG-TERM SHUTDOWN

Disconnect the output shaft from the conveyor pulley or other equipment. It is advisable to operate the CST for 15 minutes once a week during shutdowns. If regular warm-ups are not possible, fill the CST completely with Mobilfluid 424 and coat exposed shafts with a thick layer of grease. Additional weather¬proofing may be required for some installations.

CAUTION: If the unit is completely filled with oil, before resuming operations, drain the fluid from the CST to normal level.

LONG TERM STORAGE INSTRUCTIONS

Recommended storage requirements for CST drives are listed below. Follow these recommendations for drives that will not be placed in service for at least six months from date of shipment.

1. Place CST drives in a clean, dry, protected warehouse where control over temperature, dust, humidity, shock and vibration are maintained.
2. The storage area is to be free from any shock or vibration of 2 mils maximum at 60 hertz, to prevent bearings from brinelling. The storage area temperatures should not be below 50°F or over 120°F and relative humidity should be a maximum of 60%.

3. The CST drive should be protected by a covering, but not sealed to allow air circulation.
4. Fill the CST completely to the top with Mobilfluid 424 oil. The oil will protect all internal parts from corrosion and reduce the volume of air in the CST. Before filling the CST with oil the air breather must be removed and stored for later use. Plug the breather port with a 1" NPT pipe plug. A 1" pipe plug is provided with each CST. This will minimize the amount of moisture that can accumulate due to expansion and contraction of air from temperature changes.
5. Coat exposed shafts with a thick layer of grease. Additional weather-proofing may be required for some installations. If there are any other exposed steel surfaces elsewhere on the CST, they should be coated with grease or other suitable rust inhibitors as well.
6. For the protection of bearings from brinelling, turn the CST input shaft once a month. If a coupling is installed on the input shaft, the shaft can be turned by hand. Otherwise, use a chain wrench to turn the shaft. To protect the shaft from damage, wrap a soft cloth rag on the shaft and clamp the chain over the rag.
7. The input shaft should be turned by a sufficient number of times to allow the output shaft to turn by at least one turn plus 1/8 of a turn. After rotation, the output shaft should come to rest in a different angular orientation than before rotation, approximately 45 degrees away from the previous position. The number of turns of the input shaft should be equal to the gearbox ratio plus 1/8 of the ratio. For example if the nameplate on the gearcase shows the gear ratio as 24, then turn the input shaft by 24 plus 1/8 of 24.

   No input shaft turns = ratio + (ratio / 8)

   Example: 24 + (24 / 8) = 24 + 3 = 27 turns

8. If either the input or output shafts are braced to support the weight of their respective couplings, or flywheels, remove the brace before turning the shafts. After rotating the shafts, reinstall the braces. Make sure the brace adequately supports the coupling, or the flywheel, to take the weight off the bearings.

MECHANICAL MAINTENANCE

REPLACING SEALS

Before attempting to replace the seals make sure the cause of oil leakage is not a clogged air breather, or that the gearbox is overfilled with oil. Seals can be removed without affecting bearing adjustment by following these steps.

To remove the input seal:

1. Remove the coupling hub using a puller. Do not hammer.
2. Remove the key.
3. Remove the seal retainer bolts. Insert two of the bolts in threaded jacking screw holes to remove retainer.
4. Drill two small holes in the seal 180 degrees apart and insert sheet metal screws into the holes.
5. Remove the seals using a pry bar behind the screw heads being careful not to damage the shaft surface. Clean the seal area of any metal chips.
6. Inspect the seal surface for damage. If the seal surface is damaged, a wear sleeve can be used.
7. To install or replace a wear sleeve, remove the larger bolts from the bearing cap. Lightly tap on the bearing cap with a mallet to loosen it. Remove the bearing cap, the shims (if equipped), and the o-ring. Be careful not to damage the shims. The bearing endplay is set by the thickness of the shims or by ground bearing retainers.

   NOTE: Each bearing retainer is machined specifically for each CST to achieve proper input shaft axial float. If seals of more than one CST unit are being repaired, make sure the bearing retainers between CST units are not interchanged.

8. Some CST units have wear sleeves installed on the shaft at the factory. Before removing the wear sleeves note the exact position of each sleeve on the shaft. Measure the position of each sleeve with respect to the step on the shaft so that the new sleeves can be reinstalled in the same positions. Remove the wear sleeves by applying some heat to the sleeve. Remove the sleeve when the sleeve is sufficiently expanded due to the heat.

To install the input seal:

1. Clean and inspect the shaft extension and seal area. Remove burrs or rough spots on the shaft extension being careful not to damage the sealing surface.
2. If required, install new wear sleeves on the shaft. Follow the wear sleeve manufacturer's instructions for installation. The installation tool is a simple piece of pipe or tubing with the end cut off squarely and deburred. The tool should be long enough so that when the wear sleeve is pulled to its correct position on the shaft, the end of the tool extends beyond of the CST shaft end. After installation, the flanges on the wear sleeves should be broken off and removed.
3. Wrap electrical tape over the keyway to protect the seal from being cut when installed. Coat the shaft with grease.
4. Apply a small amount of "Aviation Permatex Non-Hardening Compound" or an equivalent compound on the outer diameter of the double lip seal. Install the seal in the bearing retainer by lightly pressing or tapping the seal into position using a cylindrical tool with a diameter close to the seal outer diameter. Note that the lip of the seal is installed toward the inside of the gearbox. The seal should be positioned slightly recessed from the counterbored face. If the bearing retainer has been removed, install the seals before reinstalling the retainer using steps 5-8, otherwise proceed to Step 9.
5. Replace the rubber o-ring in the bearing retainer. Use "Parker O Lube" grease or equivalent to lubricate the o-ring.
6. Apply a small amount of high temperature grease on the rubber part of the seal.
7. Position the shims on the bearing cap. Then carefully slide the bearing retainer and seal assembly on the shaft, taking care that the seal is not damaged as it passes over the key area on the shaft. A strip of tape, such as electrical tape, can be placed over the keyway area of the shaft to prevent the sharp edges of the keyway from damaging the seal. Apply a small amount of thread lubricant on the bolts and install them in the bearing retainer. Tighten the bolts to the torque values shown in Table 1.
8. Measure the end play of the shaft by placing a dial indicator on the shaft end. Move the shaft back and forth and note the shaft end play on the dial indicator. The shaft end play should be within the limits specified below. If the end play is out of specification, make the necessary adjustment by the shims. See Table 3 for shaft endplay settings.

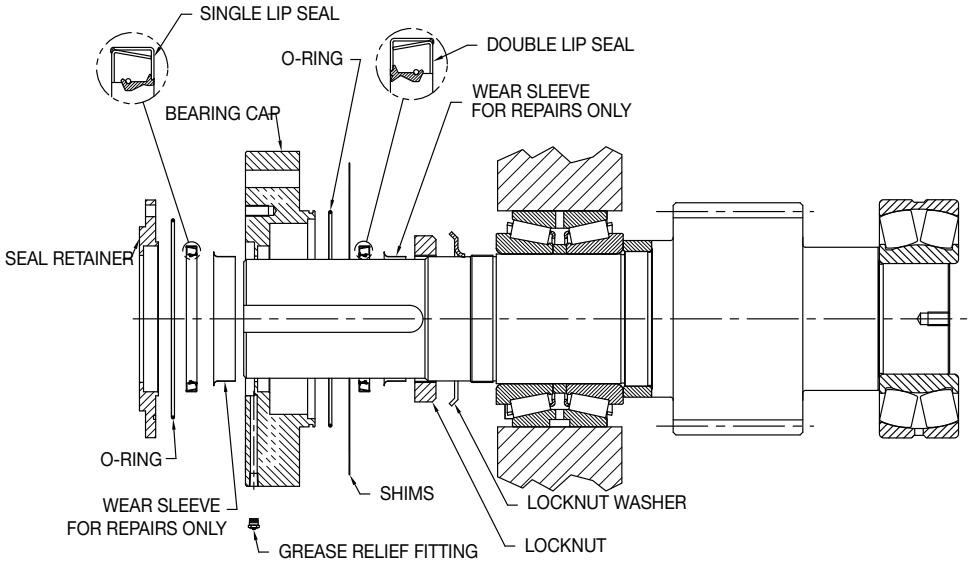

Figure 9 - Typical Input Seal Configuration for All Models Except G750

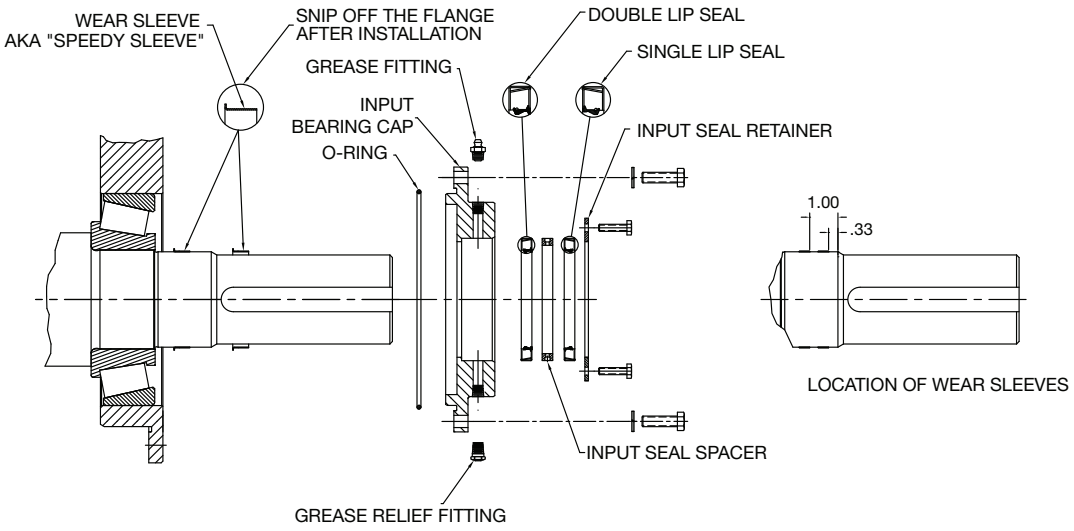

Figure 10 - Typical Input Seal Configuration for Model G750K

Table 3 - Shaft Endplay settings

CST MODEL	INCH	mm
420K	0.005 - 0.015	0.13 - 0.38
630K	0.008 - 0.010	0.20 - 0.25
G750K	0.002 - 0.004	0.06 - 0.10
G1000K	0.007 - 0.009	0.18 - 0.23
G1500K	0.009 - 0.011	0.23 - 0.28
2500K	0.004 - 0.006	0.10 - 0.15

9. Apply a small amount of “Aviation Permatex Non-Hardening Compound” or an equivalent compound on the outer diameter of the other lip seal. Install the seal in the seal retainer by lightly pressing the seal into position. Note that the lip of the seal is installed toward the outside of the gearbox.
10. Replace the rubber o-ring in the seal retainer. Use “Parker O Lube” grease or equivalent to lubricate the o-ring.
11. Apply a small amount of high temperature grease on the rubber part of the seal. Carefully slide the bearing retainer and seal assembly on the shaft taking care that the seal is not damaged as it passes over the key area on the shaft. Place a small amount of thread lubricant on the bolt threads and tighten the bolts to the torque values shown in Table 1.
12. Install the coupling.
13. Fill the grease cavity with high temperature grease such as Mobil HTS or equivalent grease until grease comes out of the relief fitting.

REPLACING OUTPUT SHAFT SEALS

CAUTION: Prior to removing the output seal, it is necessary to make two special tools and install them as described below in order to keep the heavy internal components of the CST from accidentally dropping out of the reducer.

WARNING: Prior to removing the output shaft seal, disengage the input shaft coupling and make sure the input shaft cannot be accidentally rotated.

To remove the output seals:

1. Remove the output shaft coupling using a hub puller. Do not hammer.
2. Remove the key.
3. Loosen the jam nut and remove the tach probe (speed sensor) assembly.
4. Disengage the input shaft coupling and make sure the input shaft cannot be accidentally rotated.
5. Remove the bolts that attach the seal cover. Remove the seal cover.
6. Remove the bolts that attach the tach wheel cover. Screw two of the bolts in the jacking screw threaded holes.
7. Press out the seal from the tach wheel cover
8. Slightly heat the tach wheel and slide the wheel off the shaft.
9. At 180 degrees from each other, drill two small holes in the inner seal. Insert sheet metal screws into the holes.
10. Remove the seal using a pry bar behind the screw heads being careful not to damage the shaft surface.
11. Clean the seal area of any metal chips.
12. Inspect the condition of the shaft sealing surface.

To reinstall the seals:

1. Clean and inspect the seal areas on the shaft. Remove any burrs, being careful not to touch the sealing surface with abrasives.
2. Cover the keyway with electrical tape to prevent damage to the seals.
3. Apply a small amount of high temperature grease on the rubber part of the larger diameter seal and apply a small amount of “Aviation Permatex Non-Hardening Compound” on the outer diameter of the seal. Lightly press or tap the seal into the bearing cap until it is flush with the counterbored face. The sealing lip should be facing the gearbox.
4. Heat the tach wheel slightly and slide it until it stops against the step on the shaft. The chamfered edge on the inside diameter of the tach wheel should be toward the gearbox.
5. Apply a small amount of “Aviation Permatex Non-Hardening Compound” on the outer diameter of the smaller seal and lightly press the seal in the tach wheel cover in the position shown in Figures 11, 12 and 13. The sealing lip should be facing away from the gearbox.
6. Apply a small amount of high temperature grease on the rubber part of the seal. Slide the tach wheel cover and seal assembly on the shaft. A strip of tape, such as electrical tape, can be placed over the keyway to prevent the sharp edges of the keyway from damaging the seal. Lubricate the threads and install the bolts to fasten the tach wheel cover to the bearing cap.
7. Install the seal cover using the smallest bolts. Use thread lubricant on the bolts.
8. Tighten all the bolts to the torque values shown in Table 1.
9. Install the tach probe assembly and tighten the set screw. Adjust the tach probe if necessary.
10. Fill the grease cavity with high temperature grease such as Mobil HTS or equivalent grease. Pump grease into the cavity until grease comes out from around the shaft.

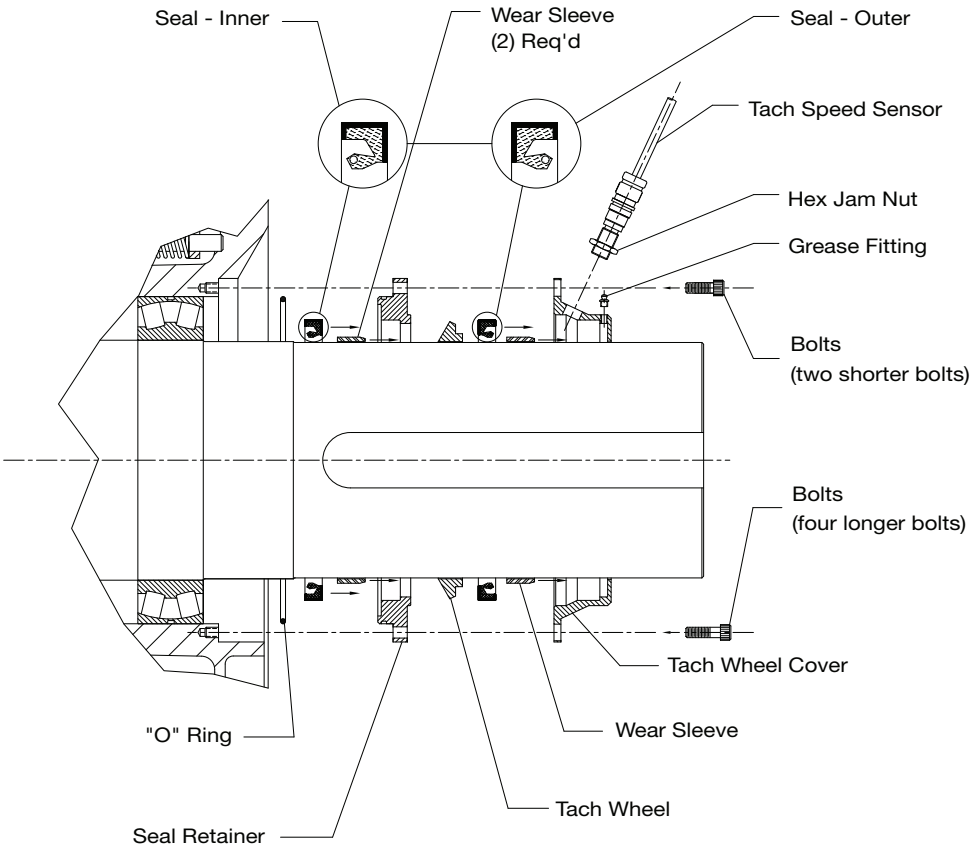

Figure 11 - Typical Output Seal Configuration for Models 420K and 630K

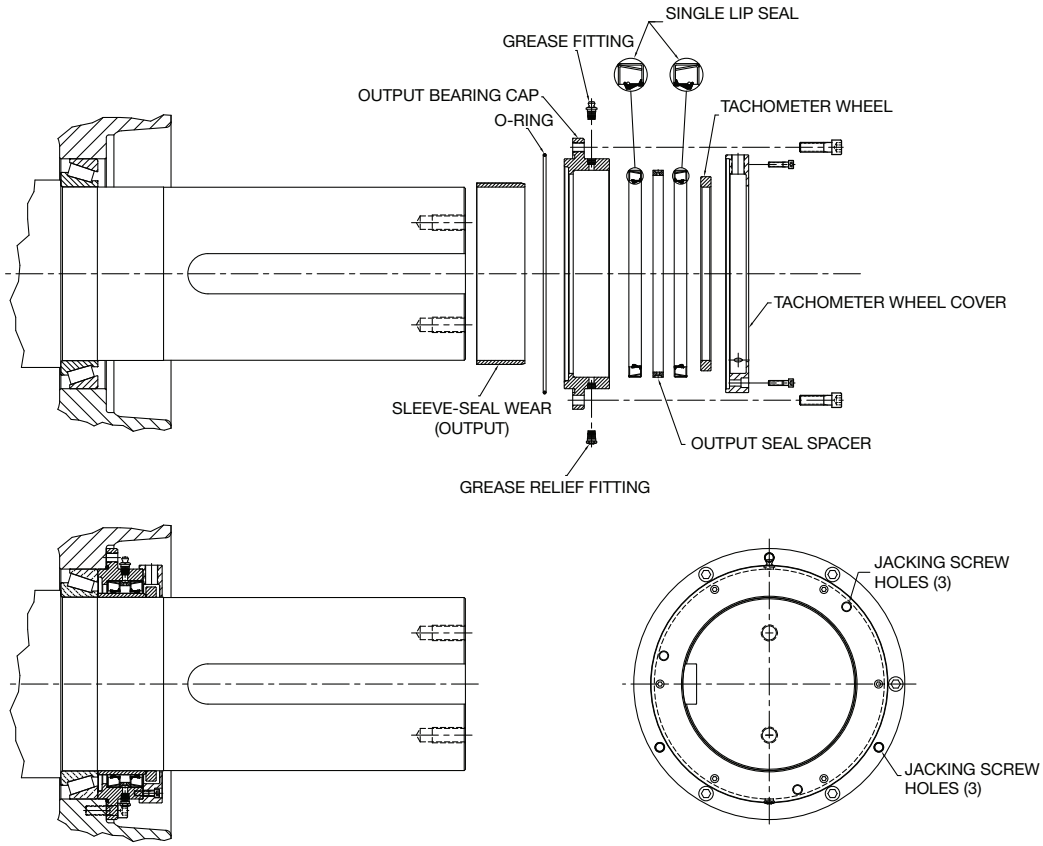

Figure 12 - Typical Output Seal Configuration for Model G750K

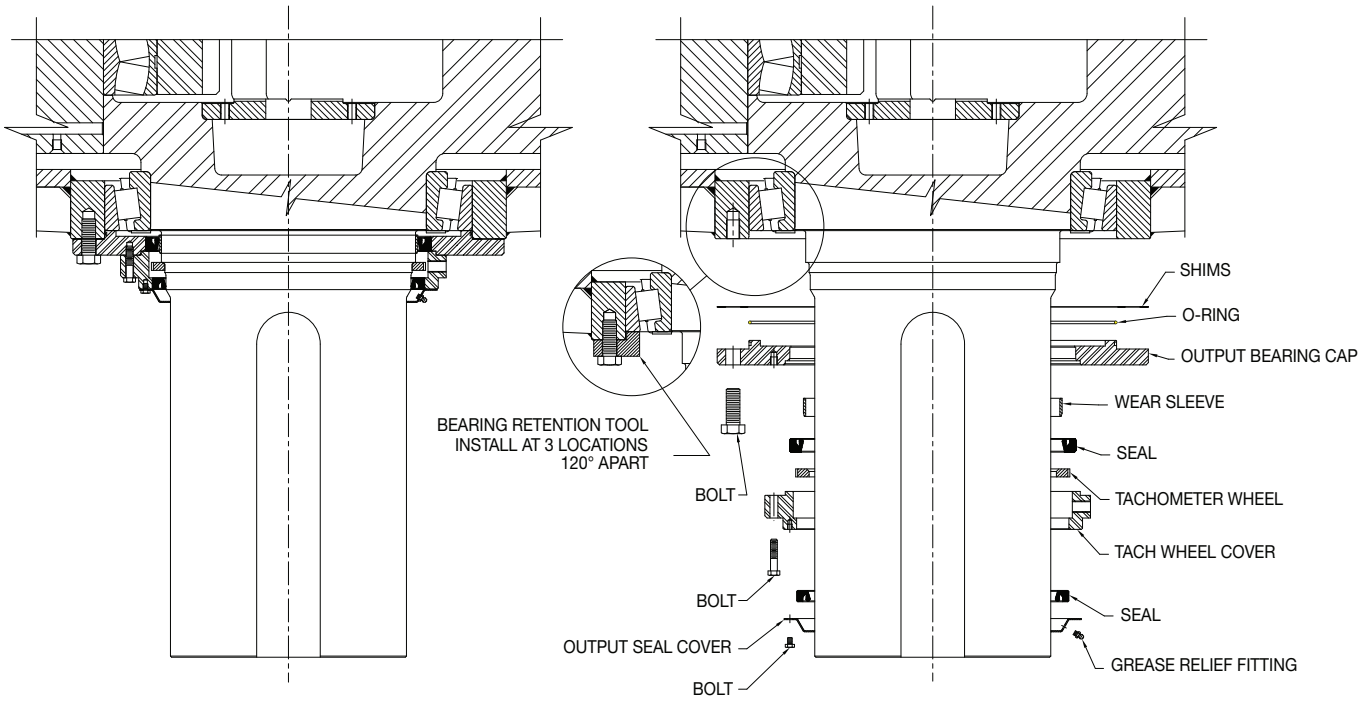

Figure 13 - Typical Output Seal Configuration for Model 1000K and Larger

REPLACING THE HYDRAULIC PUMP

For installation and removal of the hydraulic pump refer to Figures 14 and 15.

To remove the pump:

1. Relieve pressure from the hydraulic system before attempting removal
2. Disconnect the hydraulic lines from the pump.
3. Unscrew the bolts holding the pump to the bearing cap (pump adapter).
4. Pull out the pump.
5. Remove the setscrew which secures the pinion to the pump shaft.
6. Remove the pinion and key.

To assemble the pump:

1. Inspect the condition of the pinion. If the pinion is pitted or worn it must be replaced.
2. From the bearing cap opening, inspect the condition of the pump drive gear (bearing retainer). If the gear is pitted or worn it must be replaced.
3. Install the key on the pump shaft and install the pinion. The pinion must be flush with the end of the shaft. Install the roll pin.
4. Apply silicon sealant to the pilot area of the pump where the pump seats in the pump adapter. Slide the pump in until the gears engage properly. Push the pump firmly in place until the pump register is properly seated in the bearing cap hole.
5. Apply silicon sealant to the first three threads of the pump mounting bolts. Screw the two bolts in to secure the pump in place. The bolt torque value is shown in Table 1. Do not over torque the bolts.
6. Reconnect hydraulic lines.

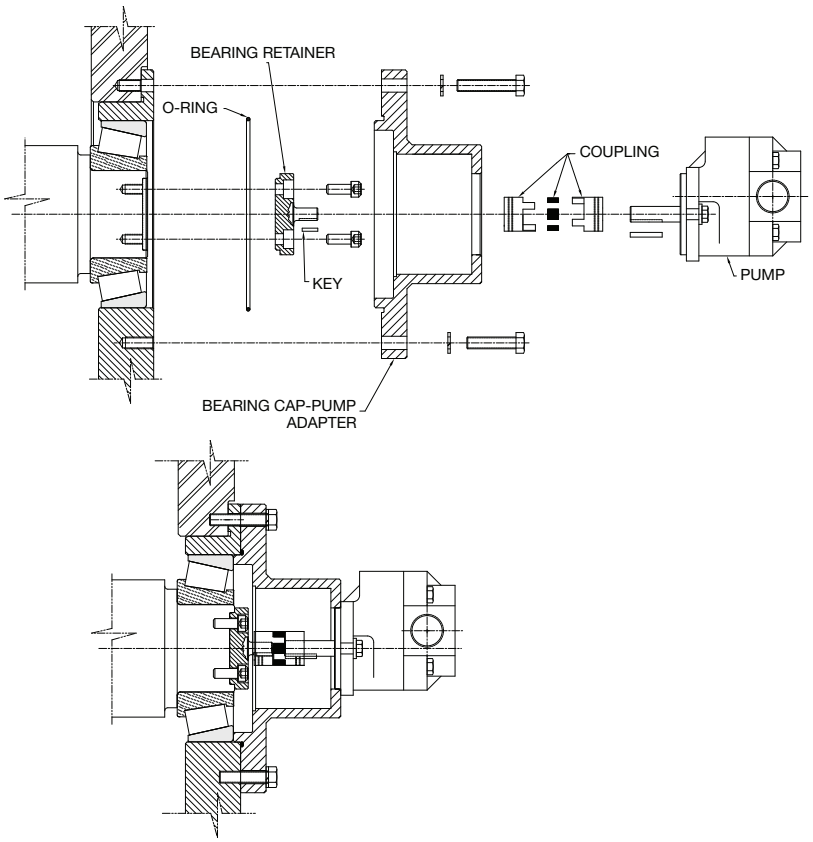

Figure 14 - Hydraulic Pump - Direct Drive (Single Stage Pump Shown)

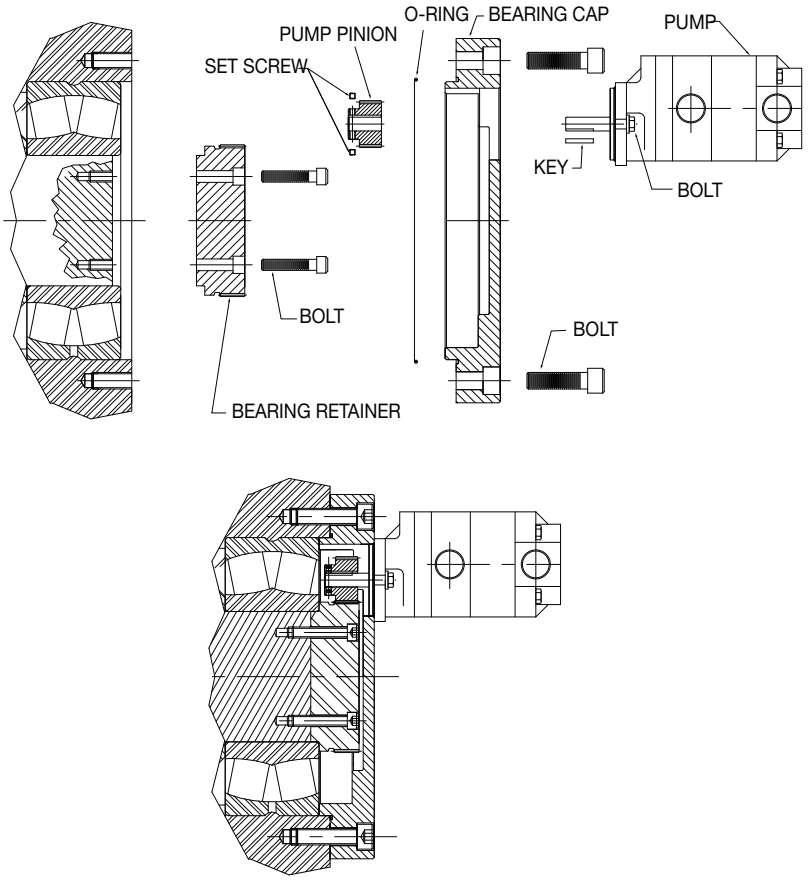

Figure 15 - Tandem Hydraulic Pump with Pinion

REPLACING COOLING PUMP SEAL

Please refer to the instruction manual, titled “PACO - PARTS LIST AND DISASSEMBLY INSTRUCTIONS” for complete repair of the cooling pump. The information provided here is a supplement to the Paco Pump manual.

Do not touch the mechanical seal element with fingers. Use plastic tools to push the fixed seal element into its counter bore. Use three drops clean CST oil on the face of the seal elements before installing the seal. Use a few drops of oil on the inside of the rubber part of the seal before pushing it on the shaft sleeve. If you are removing the shaft sleeve, use a sealant between the shaft and the sleeve.

Do not jog the pump motor for rotation until the system has been filled with oil.

TROUBLESHOOTING CHART

TROUBLE	WHAT TO INSPECT	ACTION
OVERHEATING	Oil cooler	Check coolant and oil flow. If the top of the heat exchanger is at a level above the gearbox normal oil level, air can get trapped in the heat exchanger. Loosen piping at the top of the heat exchanger and vent the air out. Oil temperature into CST should be about 120 to 190° F (49 to 88°C). Check pipes and cooler/heat exchanger for deposits of sediment.
	Oil level	Check sight-gauge for correct oil level.
	Bearings	Check bearing end play and radial clearance. All shafts must turn freely when disconnected from load.
	Breather	Breather must be open. Replace if plugged.
	Type of oil	Oil must be Mobilfluid 424. If not, DRAIN COMPLETELY. Clean and refill CST with proper oil.
NO OIL PRESSURE	Cooling pump	Air might get trapped in the pump casing volute. After completing oil changes loosen the plug at the top of the pump casing volute and purge the air.
SHAFT FAILURE	Type of coupling	Rigid couplings between rigidly supported shafts can cause shaft failure. Replace with flexible coupling that provides required lateral float.
	Coupling alignment	Realign equipment as necessary.
	Overhung load	K Series CST units are designed only for direct coupling.
	Excessive high energy loads	Equip CST with couplings designed to absorb shock or repetitive shock loads
BEARING FAILURE	Overloads	Check nameplate rating and compare with rating chart at front of manual.
	Overhung loads	See Shaft Failure
	Bearing adjustment	See Overheating
	Bearing lubrication	Check operation of the lube oil pump. Output pressure at full speed should not be less than 30 psi (2 Bars). Clean or replace filter on pump and suction strainer. Replace worn, cracked or badly heat-discolored bearings.
	Rust formation	Seal unit to prevent entrance of moisture and to reduce condensation inside unit. Drain condensation often. Run the unit to full warm frequently during long shutdowns or fill the CST COMPLETELY with Mobilfluid 424.
	Storage conditions	Long periods of storage in moist atmospheres will cause destructive rusting of bearings and gears. If this occurs, disassemble the unit, inspect and clean or replace parts.

TROUBLE	WHAT TO INSPECT	ACTION
OIL LEAKAGE	Oil level	Drain excess oil from housing.
	Breather	If breather is clogged remove and replace.
	Oil seals	Check oil seals and replace if worn.
	Plugs, gauges and fittings	Apply thread sealant and tighten.
	Housing and caps	Tighten bolts or cap screws. If leak persists, remove housing cover and caps. **NOTE: Drain oil to level below housing cover to avoid spillage. Clean mating surfaces.** Install new o-rings and reassemble. Tighten fasteners securely. Refill housing to proper level.
GEAR WEAR	Gear tooth wear and failure	Contact Dodge Product Support
	Backlash	Nominal range is .014” to .022”. Contact Dodge Product Support.
	Misalignment	Check contact pattern on gear face. 75% of the total face, is correct.
	Overloads	See Bearing Failure
	Oil level	See Overheating
	Type of oil	See Overheating
	Coupling lateral float	See Shaft Failure
	Rust formation	See Bearing Failure
NOISE	Unusual or increasing noise	See Gear Wear and Bearings Failure

CAUTION: Warranty service or repair should be performed only by Baldor authorized service shops.

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P.O. Box 2400, Fort Smith, AR 72902-2400 U.S.A., Ph: (1) 479.646.4711, Fax (1) 479.648.5792, International Fax (1) 479.648.5895

Dodge Product Support

6040 Ponders Court, Greenville, SC 29615-4617 U.S.A., Ph: (1) 864.297.4800, Fax: (1) 864.281.2433

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MN1684 (Replaces E3665)

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