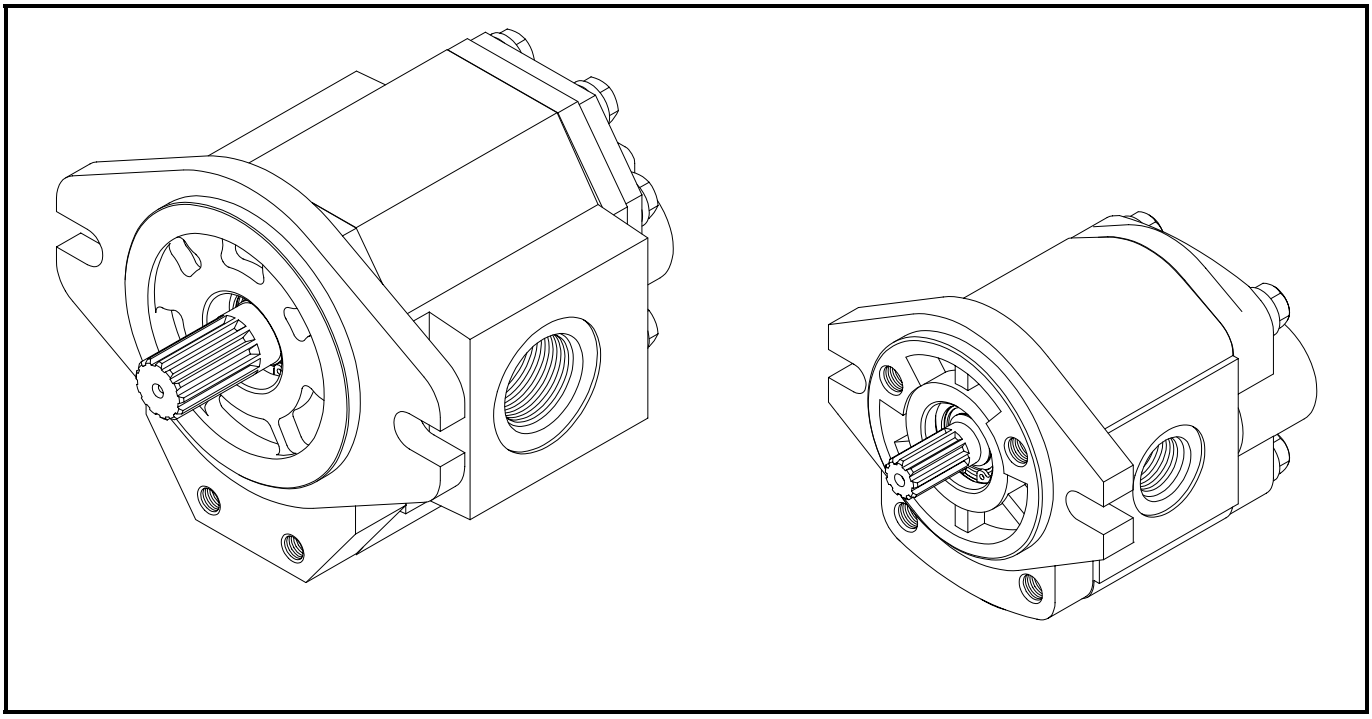
SERVICE MANUAL

SP20B AND SP25A HYDRAULIC PUMPS



Prince HYDRAULICS

SAFETY PRECAUTIONS

1.) All hydraulic pumps must be properly assembled and installed in the hydraulic system to prevent personal injury and /or property damage. Further, the improper servicing of a pump may result in personal injury and/or property damage. Read and understand all catalog and service information before starting. As with all mechanical work, the proper tools, knowledge and safety equipment are required. Always wear safety glasses.

2.) Make sure all pressure has been relieved in the hydraulic lines before removing, installing or servicing a hydraulic pump.

WARNING: Hydraulic fluid escaping under pressure can have sufficient force to penetrate skin, causing serious personal injury. Do not use your hand to check for hydraulic leaks.

3.) Before installing or servicing a hydraulic component, make sure all weight has been removed from the cylinders or motors before disconnecting hydraulic lines.

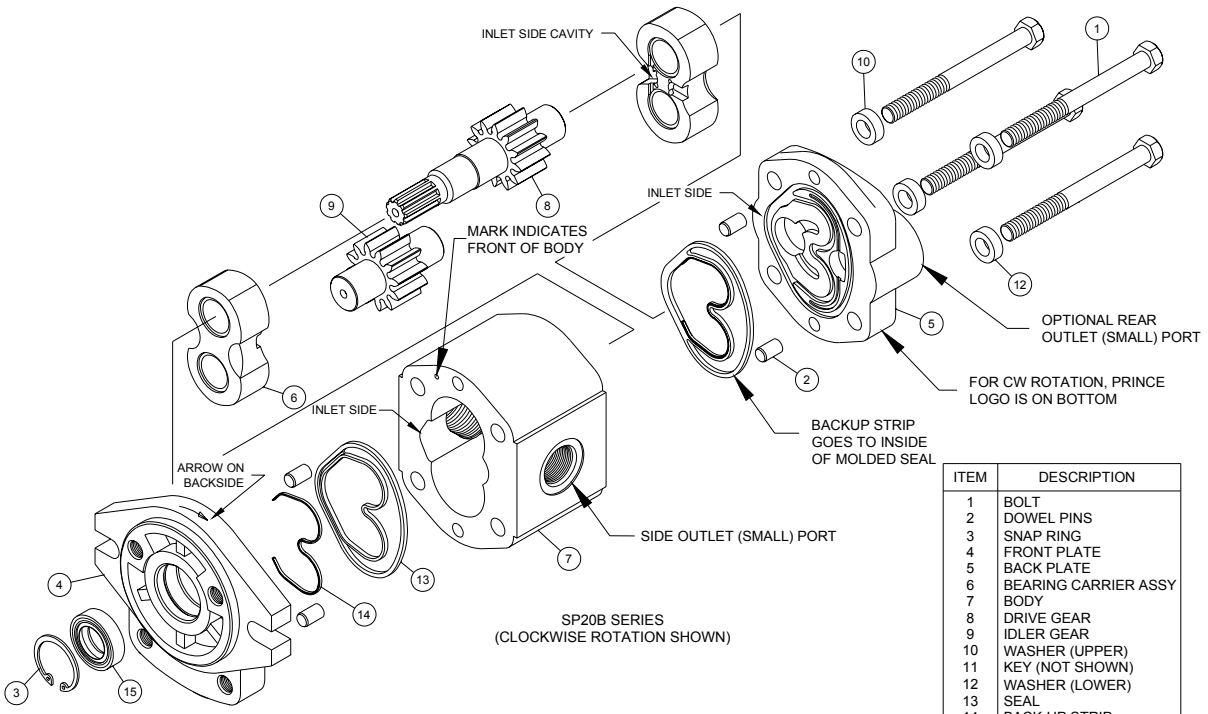
WARNING: Disconnecting the hydraulic lines while the cylinder or motor is under load may result in the unexpected rapid movement of a machine, resulting in serious personal injury.

4.) Do not exceed the operating specifications, including those for pressure, speed and temperature. All hydraulic systems require a means to limit the maximum pressure. This requires either a pressure relief valve in the system or a pump that has pressure compensation.

WARNING: Pressure levels above the specifications may cause sudden and unexpected failure of a component in the hydraulic system. The failure may result in serious personal injury. Always use a gauge when adjusting a relief valve.

TABLE OF CONTENTS

PRINCE SP SERIES HYDRAULIC GEAR PUMP



ITEM	DESCRIPTION
1	BOLT
2	DOWEL PINS
3	SNAP RING
4	FRONT PLATE
5	BACK PLATE
6	BEARING CARRIER ASSY
7	BODY
8	DRIVE GEAR
9	IDLER GEAR
10	WASHER (UPPER)
11	KEY (NOT SHOWN)
12	WASHER (LOWER)
13	SEAL
14	BACK-UP STRIP
15	SHAFT SEAL STD.

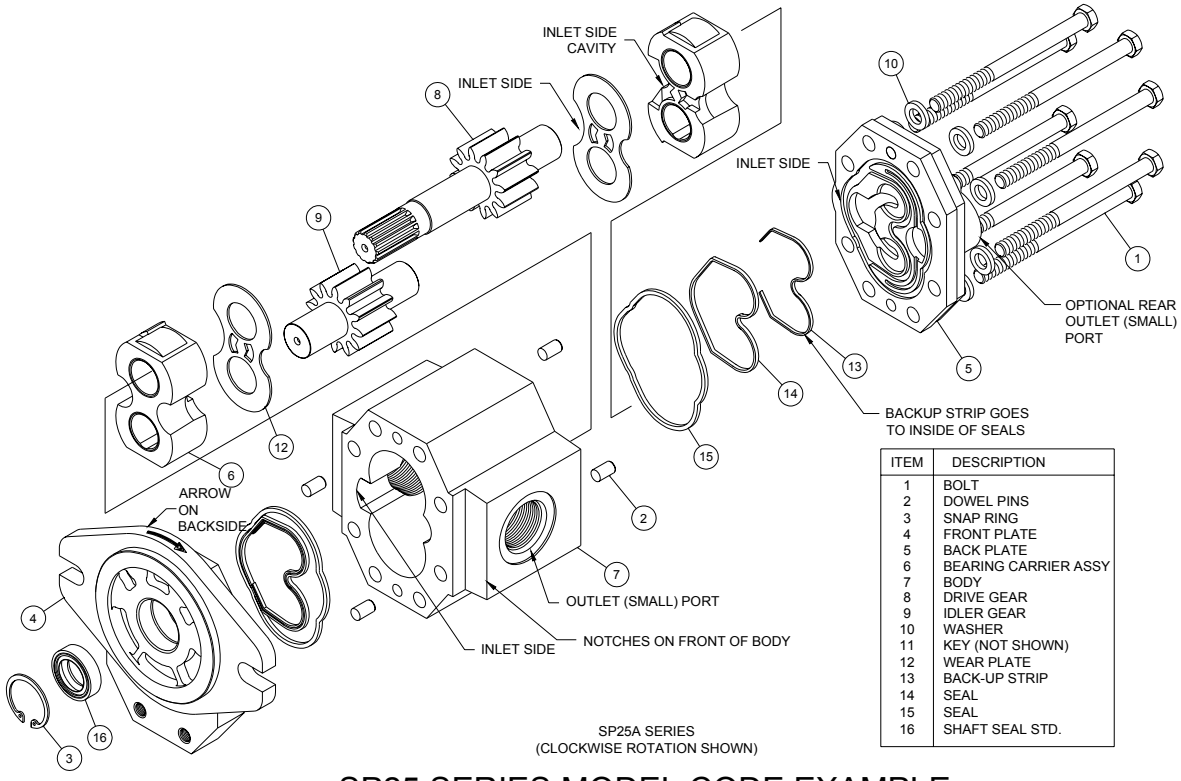
SP20B SERIES MODEL CODE EXAMPLE

SP20B XX X X H X-X X

- BASIC SERIES NO.
- DISPLACEMENT CC/REV
  - 06
  - 08
  - 09
  - 11
  - 14
  - 16
  - 20
  - 23
  - 27
  - 30
  - 33
- PORT LOCATION OPTION
  - A-SIDE INLET AND OUTLET W/PLASTIC PORT PLUGS
  - C-BOTH SIDE & REAR INLET AND OUTLET W/STEEL PORT PLUGS
  - D-REAR INLET AND OUTLET W/PLASTIC PORT PLUGS
  - E-BOTH SIDE & REAR INLET AND OUTLET W/PLASTIC PORT PLUGS
- PORT TYPE
  - 9-STANDARD SAE PER CHART
  - 8-METRIC O-RING PORTS
  - 7-BSPP PORTS
  - 6-SAE SPLIT FLANGE PORTS
  - 5-METRIC SPLIT FLANGE PORTS
- DRIVE SHAFT
  - 9-SAE 9T 16/32 SPLINE
  - 2-SAE 5/8 STRAIGHT KEYED
  - 3-11 TOOTH 16/32 SPLINE
  - 4-3/4 STRAIGHT KEYED
  - 5-SAE 10T 16/32 SPLINE
- MOUNTING
  - H-SAE "A" 2 BOLT
- ROTATION*
  - L-COUNTER-CLOCKWISE
  - R-CLOCKWISE
  - *FACING THE DRIVE SHAFT END OF THE PUMP
- SHAFT SEAL TYPE
  - OMIT FOR STANDARD BUNA-N
  - H-MEDIUM PRESSURE BUNA-N

A. GENERAL INFORMATION (Note: SP20B pumps DO NOT have Wear Plates)

1. When assembling and disassembling pumps, the work area should be clean and dry. There should be adequate space to lay out the parts in the manner in which they were disassembled or



ITEM	DESCRIPTION
1	BOLT
2	DOWEL PINS
3	SNAP RING
4	FRONT PLATE
5	BACK PLATE
6	BEARING CARRIER ASSY
7	BODY
8	DRIVE GEAR
9	IDLER GEAR
10	WASHER
11	KEY (NOT SHOWN)
12	WEAR PLATE
13	BACK-UP STRIP
14	SEAL
15	SEAL
16	SHAFT SEAL STD.

SP25 SERIES MODEL CODE EXAMPLE

SP25A XX X 9 H X-X X

- BASIC SERIES NO.
- DISPLACEMENT CC/REV: 19, 22, 27, 32, 38, 44, 52, 63
- PORT LOCATION OPTION
  - A-SIDE INLET AND OUTLET
  - B-SIDE INLET, SIDE AND REAR OUTLET
  - C-BOTH SIDE & REAR INLET AND OUTLET W/STEEL PORT PLUGS
  - D-REAR INLET AND OUTLET
  - E-BOTH SIDE & REAR INLET AND OUTLET W/PLASTIC PORT PLUGS
- PORT TYPE
  - 9-STANDARD PORTS (SIDE PORTS "A" REAR PORTS "D" BOTH SIDE & REAR PORTS "C")
  - 8-STANDARD PORTS (SIDE INLET, SIDE & REAR OUTLET "B"
- DRIVE SHAFT
  - 1-SAE 13T 16/32 SPLINE
  - 2-SAE .875/.874 STRAIGHT KEYED
- MOUNTING
  - H-SAE "A" 2 BOLT
- SHAFT SEAL TYPE
  - OMIT FOR STANDARD BUNA-N
  - H-MEDIUM PRESSURE BUNA-N
- ROTATION*
  - L-COUNTER-CLOCKWISE
  - R-CLOCKWISE
  - *FACING THE DRIVE SHAFT END OF THE PUMP

in which they will be assembled. Clean tools and equipment should be used. Any dirt or grit that gets into the pump can cause significant damage to the pump and cause failure.

2. Before disassembly of any pump, the outside of the pump should be cleaned thoroughly with a good grade solvent then dried.
3. Before the assembly of any parts, they should be inspected for cleanliness and cleaned if required.
4. A vice with soft jaw inserts or a holding fixture will be necessary to retain the front flange during assembly and disassembly. If a vice is used, extreme caution must be exercised to avoid over-tightening the jaws and distorting the part.
5. A soft blow mallet (one with plastic or rubber heads) may be used to aide in disassembly. Do not use metal hammers.

B. DISASSEMBLY

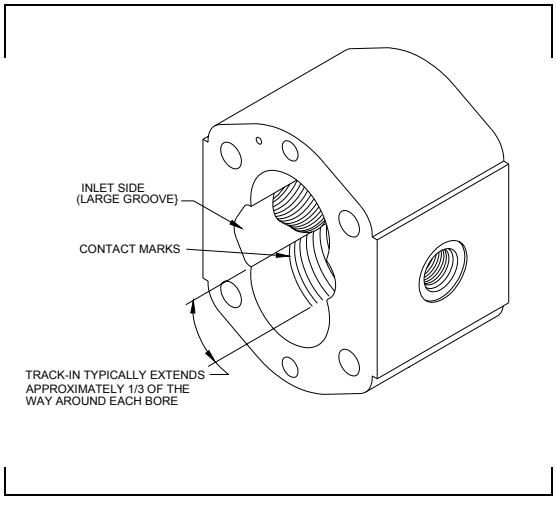
Note: Maintaining the proper orientation of parts is extremely important. In order to keep a consistent reference, lay out the parts in the same manner as shown in the exploded drawings, with the drive shaft end of the pump to the left and the drive shaft above (furthest away from you) the idler shaft.

1. Prior to disassembly, scribe a match line between the front cover and the body and between the body and the back cover.
2. If the pump has a keyed shaft, remove the key and place tape over the keyway.
3. Secure the front cover in a holding fixture or clamp lightly in a vice with the shaft pointing down. Remove the bolts and washers holding the pump together.
4. Remove the rear cover by pulling upward in an axial direction. The cover can be tapped lightly with a soft blow hammer to aide in removal.
5. Lift the body and gear/bearing assembly (including the body, drive gear, idler gear, (two wear plates SP25 only) and two bearing carriers out of the front cover. Lay the assembly down with the drive end of the drive shaft to the left and the drive shaft farther away from you than the idler shaft.
6. Slide the gear/bearing assembly out of the body and lay the assembly down, again keeping the drive end of the drive shaft to the left and the drive shaft farther away from you than the idler shaft. Some initial resistance may be felt when removing the assembly from the body.
7. Mark the ends of the drive shaft and the idler shaft on the end that the pump is driven from.
8. Note that the bearing carriers have an inlet cavity that is on the inlet side of the pump and that goes towards the gear. Also note that the SP25 wear plates have a wider notched area on the side that goes next to the inlet cavity. (See the Bearing Carrier and Wear Plate (SP25) Orientation drawings in the reassembly section) Once the correct orientation is observed, slide the bearing carriers and (wear plates SP25 only) off the gear journals and lay them down in the same orientation as they originally had on the gears.
9. The square cut seals and the white backup strip may be removed from the front and rear covers for inspection.
10. Generally, the shaft seal needs to be replaced if it is removed. If the shaft seal is to be replaced, remove the snap ring and then the shaft seal from the front cover. Care must be used to not damage or scratch the seal bore during seal removal.

C. INSPECTION AND REPAIR

After parts have been cleaned, they should be checked for changes in color, any pitting or scoring or any debris. Individual parts may be checked according to the following instructions. If any of the parts are damaged, replace them.

1. Pump Body
   The pump is designed so that when the pump is initially broke-in, the tips of the gear teeth create a “tracked-in” area in the body that is the width of the gears and extends from the inlet port area, to about one third of the way around each bore (any signs of tooth contact beyond the one third point on the bores should be faint and not have any appreciable depth). The “tracked in” areas should appear to have a fairly fine grained and relatively smooth surface finish. If the finish is rough or pitted or if there is evidence of scoring, the body is damaged and the pump may not build full pressure or flow. Also if the bearings and shaft



Journals show excessive wear, the teeth will have tracked into the body too far and, again, the pump may not build full pressure or flow. The pump body is not available as a service part.

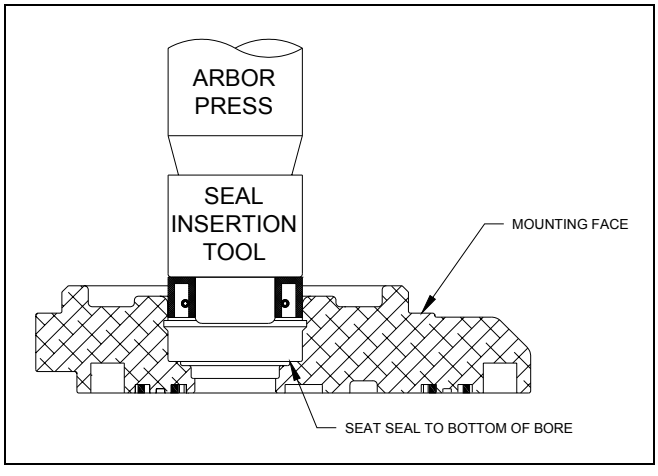
2. Drive Gear and Idler Gear
   The shaft and side surfaces of the gear should exhibit a very smooth contact pattern. If the contact pattern on the shaft or the gear sides shows signs of scoring the gear should be replaced. If the gears show any discoloration due to heat, the gears should be replaced. Signs of contact and minor scratching on the profiles of the teeth are normal. However, if there is excessive or uneven wear or if there is excessive pitting, the gears should be replaced.
3. Wear plates (SP25 only)
   The wear plates consist of a bronze layer over a steel backing. The bronze layers will normally exhibit some bright burnished areas due to contact with the sides of the gears. If there is significant scoring on the bronze surface or the if surface is rough or if any of the bronze surface has been chipped off, the plates should be replaced. If the plates are not flat, or if there is evidence of heat build up (the steel side of the plate will show blue areas) the plates should be replaced. Any evidence of heat buildup usually means the pump has been run without oil.
4. Bearing carriers
   The bearing carriers hold the teflon lined bearings. An oil drain groove has been machined through the teflon layer, through the bronze layer and into the steel layer at the top of the upper bearing and the bottom of the lower bearing. This should not be misinterpreted as wear. During normal operation some of the grayish teflon layer will be eroded toward the inlet side of the bearing. This should not be considered excessive until about 80% of the bronze layer shows through the gray layer on about 1/3 of the bearing perimeter. The wear is also excessive if there is scoring on the gear shaft or if the bearing has rotated or if there are any signs of heat buildup. If there are signs of excessive wear the bearing carriers should be replaced.
5. Mating Surfaces of the Front Cover, Rear Cover and Body
   Some discoloration of mating surfaces is normal. If there is damage that would prevent a tight fit during reassembly, the problems should be corrected or the parts replaced.
6. Square Cut Seals and Backup Strip
   The seals and backup strips should have square edges, and be pliable. If they are deformed, or are hard or show signs of being hot, they should be replaced.

REASSEMBLY/ROTATION CHANGE

If the pump is to be reassembled with the same rotation configuration, the following instructions should be used. The exploded views and parts listings can be used for reference. If the rotation direction of the pump is to be changed, the rotation change instructions (Section E) should be used.

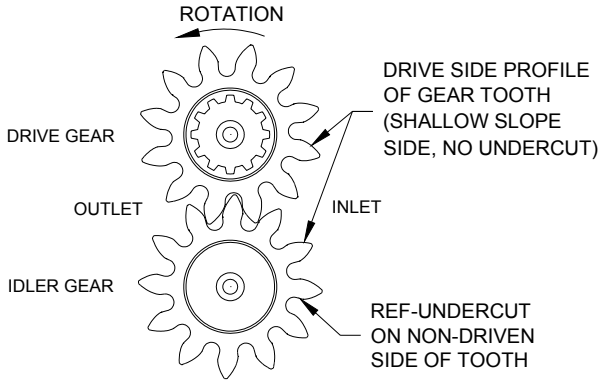
D.) REASSEMBLY (with same rotation direction)

1. If the shaft seal has been removed, insert a new shaft seal and snap ring into the front cover. Lubricate the outside of the seal with oil before installation. To insure that the seal remains square to the bore and is not damaged during installation, an arbor press and seal insertion tool should be used during installation. The side of the seal containing the spring goes to the inside of the pump.
2. Lay out the gears, bearing carriers and (wear plates SP25 only) orientated in the manner in which they came out of the pump.

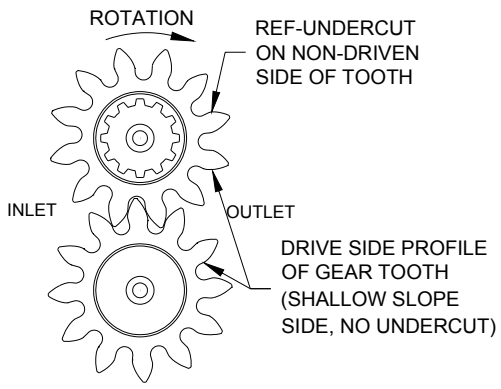


GEAR TOOTH ORIENTATION EXAMPLE

LEFT HAND ROTATION (CCW)
(FACING DRIVE SHAFT END)



RIGHT HAND ROTATION (CW)
(FACING DRIVE SHAFT END)



The pump gears have non-symmetrical teeth, with different profiles on each side. The idler gear is turned by the drive gear through contact on the drive side profile of the tooth (shallow slope side with no undercut). Like profiles are touching and the gears rotate freely when assembled in the bearing carrier. Rotating in the correct rotation, the teeth come out of mesh on the inlet side of the pump.

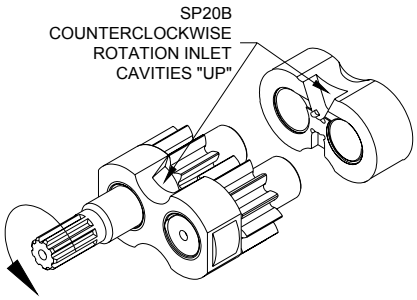
3. Assemble the gear/bearing carrier assembly. The pump gears have non-symmetrical teeth, with different profiles on each side of the tooth. The correct rotation orientation can bee seen in the illustration below.
When assembling the gears into the bearing carrier it is extremely important to maintain the correct orientation of the bearing carriers and, in the case of SP25 pumps, the wear plates. In the Bearing Carrier and (Wear Plate SP25 only) Orientation view, note the proper rotation and then use the position of the “inlet cavities” as a key reference. For SP25 pumps, also use the position of the “large radius” section as a key reference.

Orient the gears with the drive end of the drive shaft to the left and the drive shaft farther away from you than the idler shaft. Bring the gears together and slide a (wear plate SP25 only) (keeping the bronze side towards the gear) and then a bearing carrier over the journals on the rear (right) side. Use the illustrations to confirm the correct orientation of the inlet cavity and (wear plate SP25 only). At this point, the gears should rotate in the bearing carrier without the teeth binding. If the gears bind, correct by correcting the orientation of the idler gear by removing the idler gear, rotating it end for end and inserting the opposite end back into the bearing carrier or by using the correct rotation drive gear. Again check to see if the gears rotate without binding. (If the ends of the gears were marked during disassembly, and the rotation direction of the pump is not being changed, the front end/drive end of both gears should also have a mark on them.)

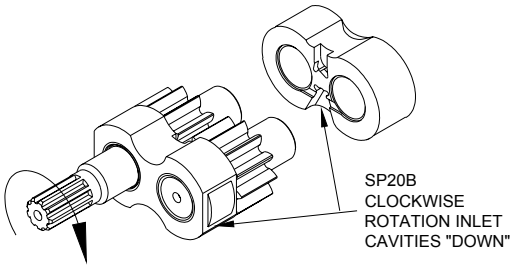
After confirming that the gears rotate without binding, slide the second (wear plate SP25 only) over the journal (bronze side towards the gear) and then the second bearing carrier over the journal. Make sure that the orientation of the inlet cavity (and the large radius for the SP25 wear plate) is correct.

Lay the bearing carrier/gear assembly down again with the drive end of the drive shaft to the left and the drive shaft farthest away from you.

BEARING CARRIER AND WEAR PLATE ORIENTATION

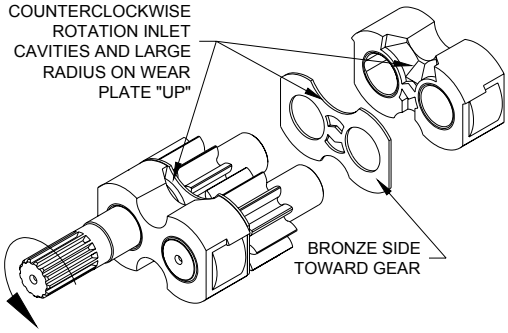


SP20B COUNTERCLOCKWISE ORIENTATAION

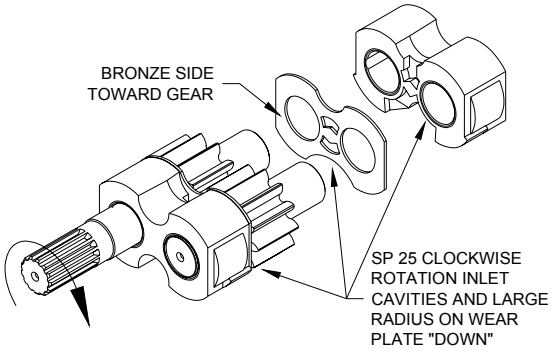


SP20B CLOCKWISE ORIENTATAION

SP20B SERIES



SP25 COUNTERCLOCKWISE ORIENTATION



SP25 CLOCKWISE ORIENTATION

SP25 SERIES

4. Lay the body on the table with the front surface to the left. The front surface is identified by a drill point mark on the surface for the SP20B bodies and by the milled notches on the side of the body for the SP25 bodies. If you are assembling a clockwise rotation pump, lay the body down with the inlet side down. The inlet side can be identified by the wider and deeper grove that runs lengthwise on the inside of the body. If you are assembling a counterclockwise rotation pump, lay the body down with the inlet side up.
5. Keeping the body and gears in the orientation described above, carefully align the bearing/gear assembly and insert it into the body. You may have to adjust the (wear plates SP25 only) slightly as they enter the body. At this point confirm that the inlet cavities of the bearing carriers are next to the inlet side of the body and that the drive end of the drive shaft and the front surface of the body are on the same end.
6. Insert the square cut seals (1 piece on the SP20B and 2 piece on the SP25) first and then the backup strips into the front and rear covers. The groove on the SP20B seal goes to the bottom of the seal groove and the white backup strip goes to the inside of the square cut seals. Insure that the seals and strips are fully seated in the seal groove for their entire length.

7. Confirm that the arrow on the front cover indicates the correct rotation and then secure the front cover in a holding fixture or clamp lightly in a vice with the shaft seal side down. Insert two dowel pins into the dowel pin holes.
8. Assemble the body/gear assembly onto the front cover and dowel pins. Confirm that the "IN" on flange ear of the front cover is also on the inlet side of the body.
9. Put two dowel pins into the dowel pin holes on the rear surface of the body.
10. Identify the inlet side of the rear cover (the side with the largest rear port boss) and position the rear cover on the body so that the inlet side of the body (wide groove side) and the inlet side of the rear cover are on the same side.
11. Insert the bolts through the washers and into the body. Lightly tighten the bolts (lubricated threads) and then torque them in a crisscross pattern to 24 FT-LB +/- 2 FT-LB.
12. If the pump has a keyed shaft, remove the tape over the keyway and insert the key.
13. Pour approximately 1/2 oz of clean hydraulic fluid into the pump.
14. With the pump assembled correctly there is normally some resistance to turning the shaft, however, with the assistance of a wrench, the shaft should turn smoothly. If there is binding, the pump should be disassembled and checked to see: if the components have been assembled in the correct orientation, if there is any foreign matter in the pump or if the seals are out of place.
15. Before being put into service, the pump needs to be tested to confirm performance. The test procedures are described in the TESTING section.

E.) ROTATION CHANGE

If the direction of rotation is to be changed, the following instructions should be followed. Use the exploded rotation change views showing the correct "before and after rotation change" views of the pump for reference. If the pump is to be reassembled with the same rotation direction or for additional information, go to the Reassembly instructions (Section D).

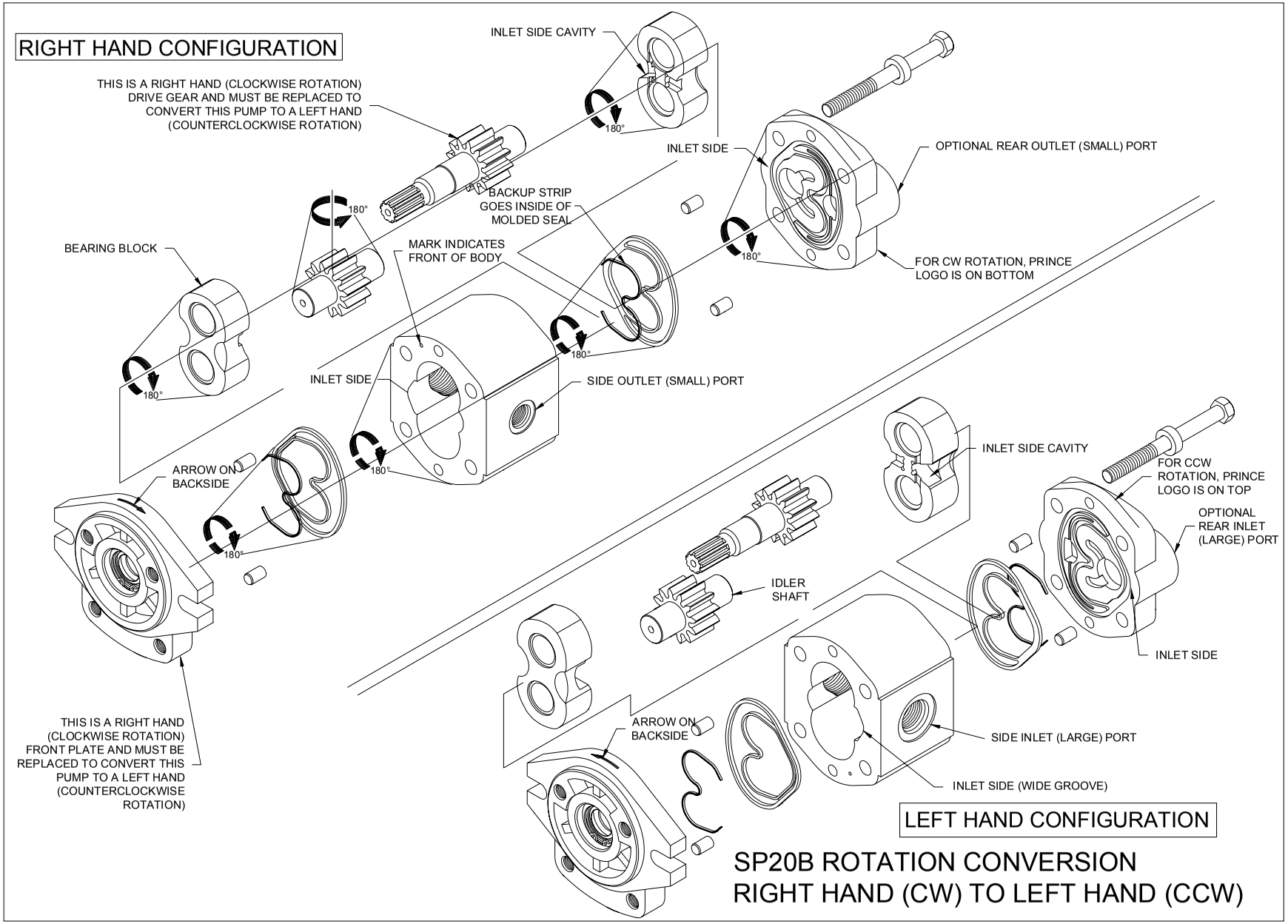
1. Lay out the gears, bearing carriers and (wear plates SP25 only) orientated in the manner in which they came out of the pump. (Drive end to the left, drive gear farther away from you than the idler gear). If the bearing carriers and (wear plate SP25 only) are still on the shafts, slide them off.
2. Replace the drive gear with the new drive gear of the opposite rotation, again keeping the drive end to the left. If the new shaft is a keyed shaft, remove the key and place tape over the keyway. The Gear Tooth Orientation Example may be used to confirm the correct rotation drive gear is being used.
3. Rotate the idler gear end for end. The front end (end that pump is driven from) of the idler shaft should have been marked during disassembly. This marked end will now go towards the rear of the pump.
4. Slide the gears back together.

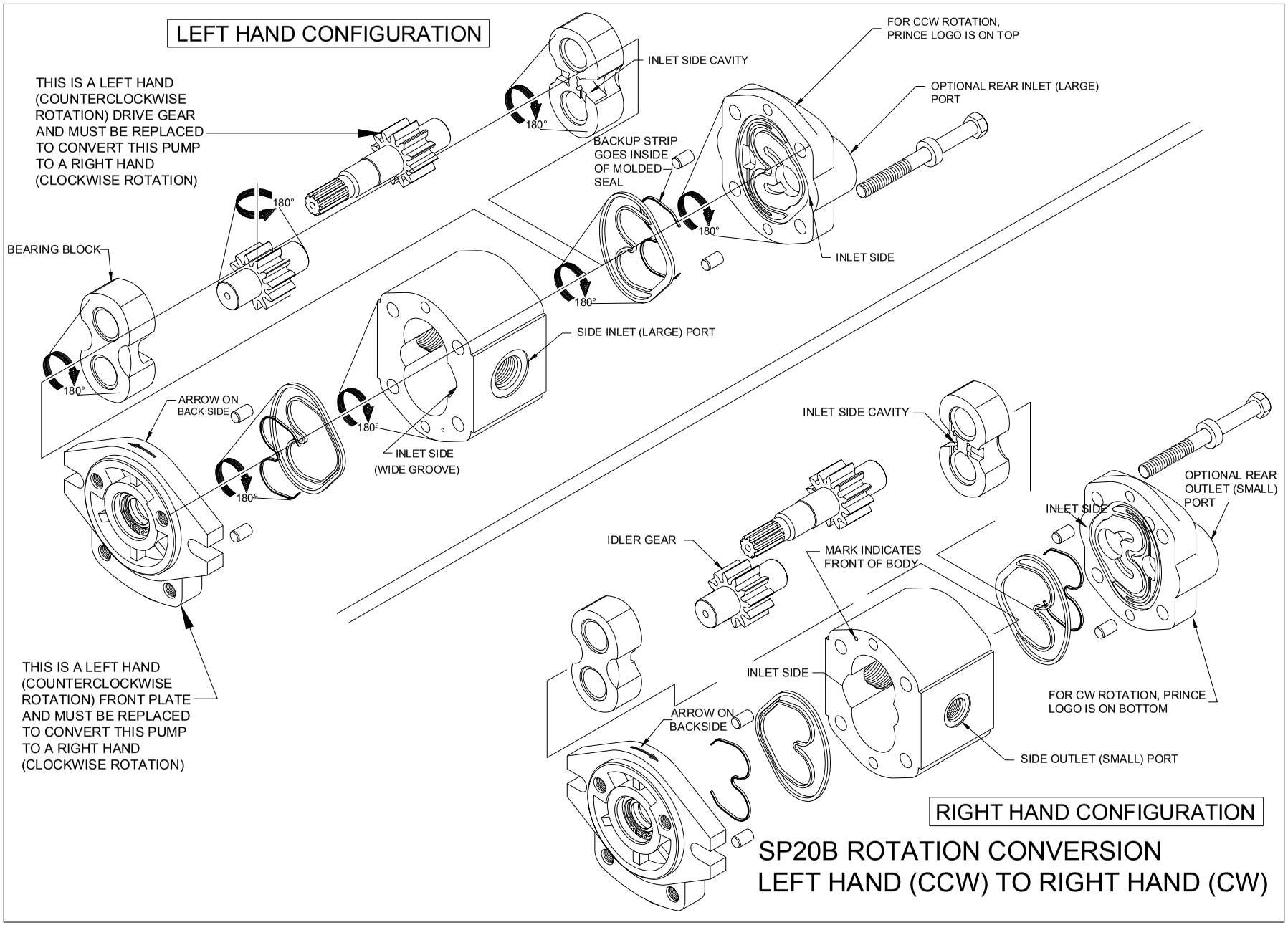
   Note: *When assembling the gears into the bearing carrier it is extremely important to maintain the correct orientation of the bearing carriers and, in the case of SP25 pumps, the wear plates. Refer to the Bearing Carrier and (Wear Plate SP25 only) Orientation drawings in the Reassembly section for details. Note the proper rotation and then use the position of the "inlet cavities" as a key reference. For SP25 pumps, also use the position of the "large radius" section as a key reference.*

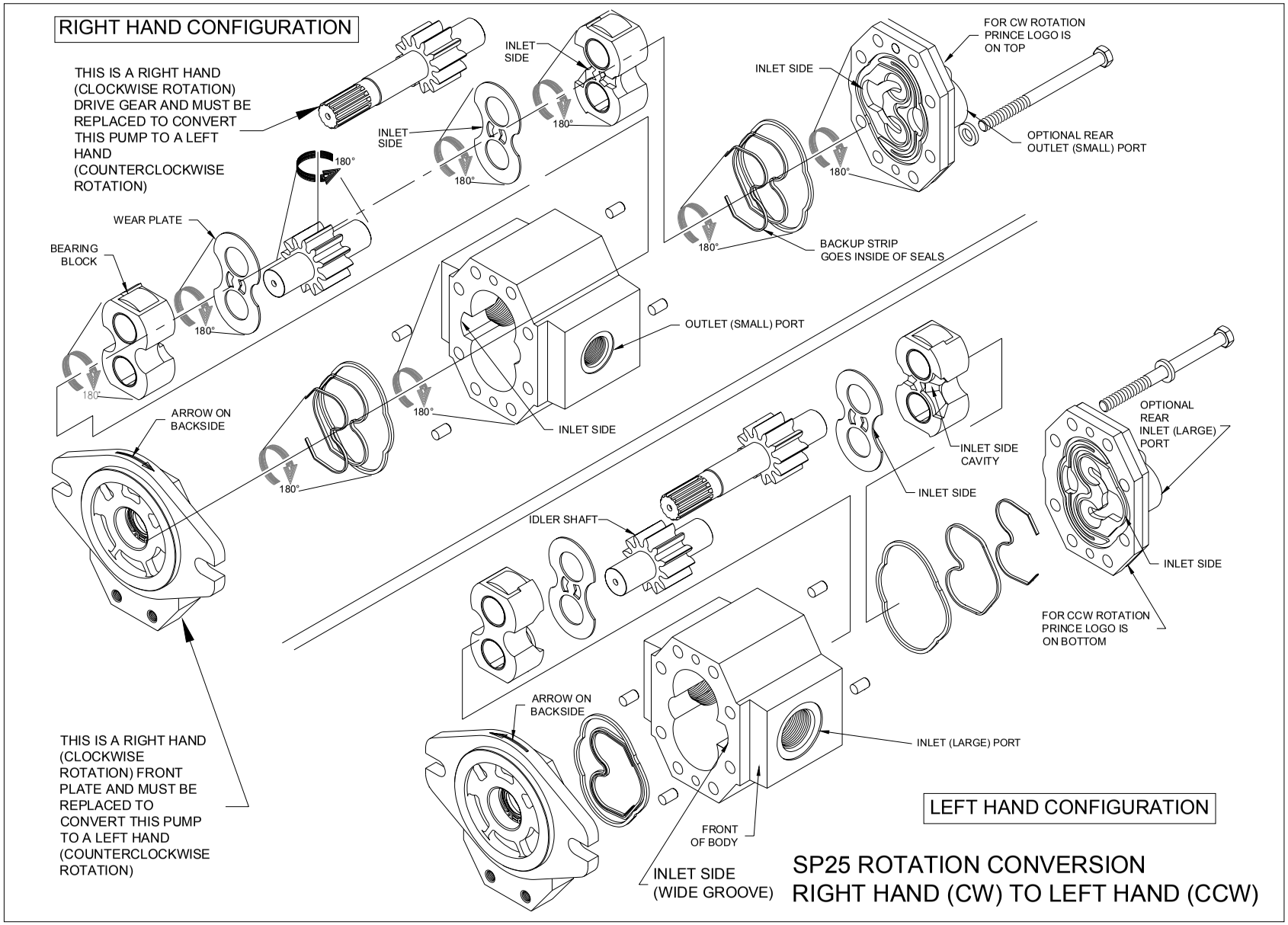
5. Rotate the rear bearing carrier and (wear plate SP25 only) so that the bearing that went over the drive shaft, will now go over the idler shaft. Insure that the inlet cavity still goes toward the gear and that the bronze side of the (wear plate SP25 only) still goes toward the gear. Slide the bearing carrier and (wear plate SP25 only) back onto the shafts. On the SP25 series, make sure that the larger notched side of the wear plate is next to the inlet cavity of the bearing carrier. Do the same for the front bearing carrier and wear plate. If the correct gears are in place and correctly orientated, the gears will rotate relatively freely within the bearing carriers.
6. Rotate the body about the pump axis (centerline), making sure that the front surface of the body remains toward the front (left side) of the pump. The front surface is identified by a drill point mark on the surface for the SP20B bodies and by the milled notches on the side of the body for the SP25 bodies. The inlet side (side with the wide, lengthwise groove on the inside) will go from

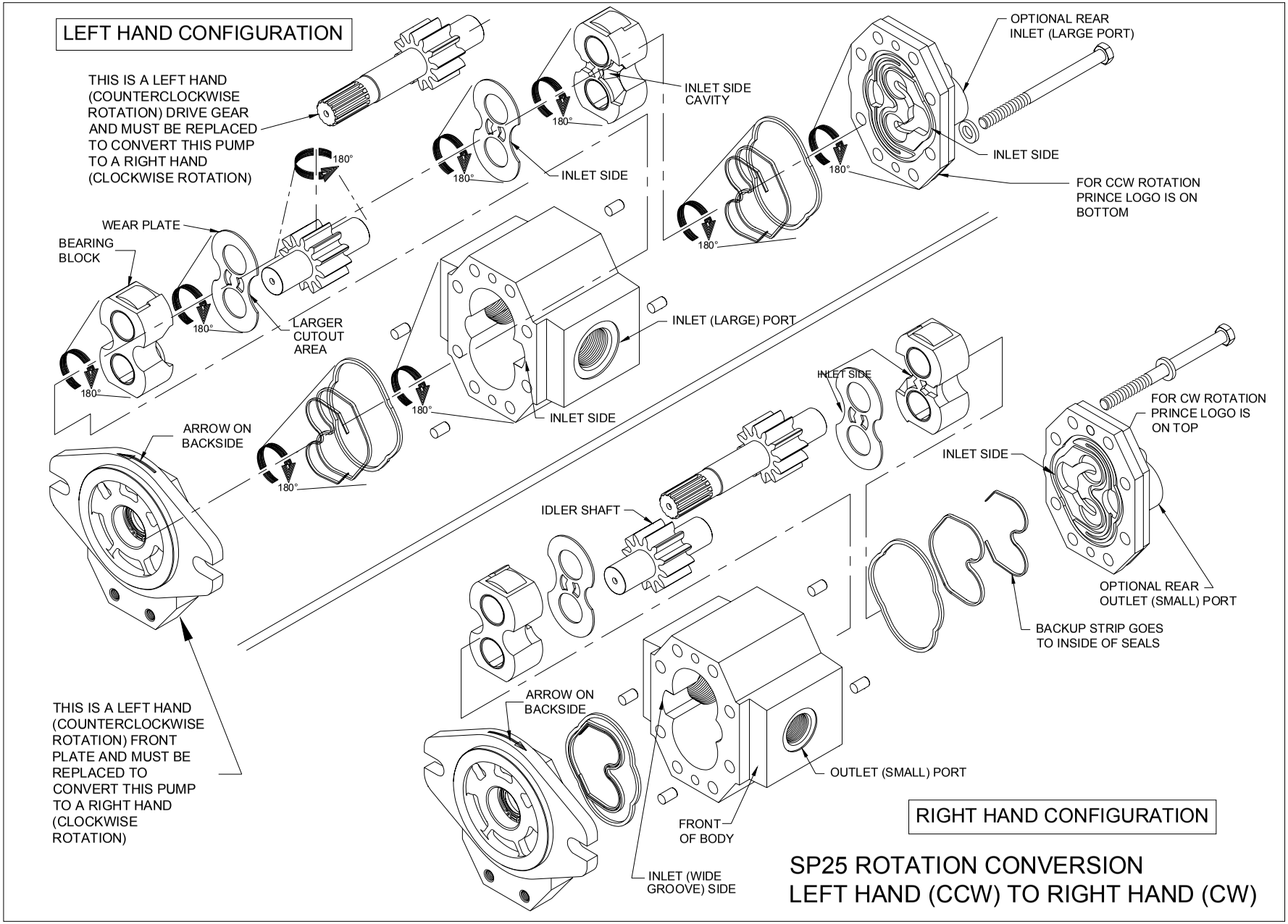
top to bottom or from bottom to top depending on rotation. If you now are assembling a clockwise rotation pump, the body will have the inlet side down. If you are now assembling a counterclockwise rotation pump, the body will have the inlet side up.

7. Keeping the body and gears in the orientation described above, carefully align the bearing/gear assembly and insert it into the body. You may have to adjust the (wear plates SP25 only) slightly as they enter the body. At this point confirm that the inlet cavities of the bearing are next to the inlet side of the body and that the drive end of the drive shaft and the front surface of the body are both on the left end.
8. Confirm that the arrow on the cover indicates the correct rotation for the new (opposite rotation) front cover. Insert the square cut seal (1 piece on the SP20B and 2 piece on the SP25) first and then the white backup strip into the new front cover. The groove on the SP20B seal goes to the bottom of the seal groove and the white backup strip goes to the inside of the square cut seals. Also install the rear cover seals if they have been removed. Make sure that the seals and strips are fully seated for their entire length. Insure that the shaft seal and snap ring are also installed in the front cover.
9. Rotate the rear cover about the axis (centerline) of the pump, the inlet side (side with the largest rear port boss) will have gone to the opposite side of the pump and should be on the same side as the wide inlet groove on the inlet side of the body. Insert dowel pins into the body and assemble the rear cover onto the body. The match line that was scribed between the rear cover and body during disassembly should again be inline.
10. Secure the front cover in a holding fixture or clamp lightly in a vice with the shaft seal side down. Insert the dowel pins into the front cover and assemble the partially assembled parts onto the front cover. Confirm that the “IN” on flange ear of the front cover is also on the inlet side of the body.
11. Insert the bolts through the washers and into the body. Lightly tighten the bolts (lubricated threads) and then torque them in a crisscross pattern to 24FT-LB +/-2 FT-LB.
12. If the pump has a keyed shaft, remove the tape over the keyway and insert the key.
13. Pour approximately 1/2 oz of clean hydraulic fluid into the pump.
14. With the pump assembled correctly there is normally some resistance to turning the shaft, however, with the assistance of a wrench, the shaft should turn smoothly. If there is binding, the pump should be disassembled and checked to see: if the components have been assembled in the correct orientation, if there is any foreign matter in the pump or if the seals are out of place.
15. Before being put into service, the pump needs to be tested to confirm performance. The test procedures are described in the TESTING section.


RIGHT HAND CONFIGURATION
INLET SIDE CAVITY
THIS IS A RIGHT HAND (CLOCKWISE ROTATION) DRIVE GEAR AND MUST BE REPLACED TO CONVERT THIS PUMP TO A LEFT HAND (COUNTERCLOCKWISE ROTATION)
INLET SIDE
OPTIONAL REAR OUTLET (SMALL) PORT
BACKUP STRIP GOES INSIDE OF MOLDED SEAL
BEARING BLOCK
MARK INDICATES FRONT OF BODY
FOR CW ROTATION, PRINCE LOGO IS ON BOTTOM
INLET SIDE
SIDE OUTLET (SMALL) PORT
ARROW ON BACKSIDE
INLET SIDE CAVITY
FOR CCW ROTATION, PRINCE LOGO IS ON TOP
OPTIONAL REAR INLET (LARGE) PORT
IDLER SHAFT
INLET SIDE
THIS IS A RIGHT HAND (CLOCKWISE ROTATION) FRONT PLATE AND MUST BE REPLACED TO CONVERT THIS PUMP TO A LEFT HAND (COUNTERCLOCKWISE ROTATION)
ARROW ON BACKSIDE
SIDE INLET (LARGE) PORT
INLET SIDE (WIDE GROOVE)
LEFT HAND CONFIGURATION
SP20B ROTATION CONVERSION
RIGHT HAND (CW) TO LEFT HAND (CCW)


LEFT HAND CONFIGURATION
THIS IS A LEFT HAND (COUNTERCLOCKWISE ROTATION) DRIVE GEAR AND MUST BE REPLACED TO CONVERT THIS PUMP TO A RIGHT HAND (CLOCKWISE ROTATION)
INLET SIDE CAVITY
FOR CCW ROTATION, PRINCE LOGO IS ON TOP
OPTIONAL REAR INLET (LARGE) PORT
BACKUP STRIP GOES INSIDE OF MOLDED SEAL
INLET SIDE
BEARING BLOCK
SIDE INLET (LARGE) PORT
ARROW ON BACK SIDE
INLET SIDE (WIDE GROOVE)
180°
THIS IS A LEFT HAND (COUNTERCLOCKWISE ROTATION) FRONT PLATE AND MUST BE REPLACED TO CONVERT THIS PUMP TO A RIGHT HAND (CLOCKWISE ROTATION)
INLET SIDE CAVITY
OPTIONAL REAR OUTLET (SMALL) PORT
INLET SIDE
IDLER GEAR
MARK INDICATES FRONT OF BODY
INLET SIDE
FOR CW ROTATION, PRINCE LOGO IS ON BOTTOM
ARROW ON BACKSIDE
SIDE OUTLET (SMALL) PORT
RIGHT HAND CONFIGURATION
SP20B ROTATION CONVERSION
LEFT HAND (CCW) TO RIGHT HAND (CW)


RIGHT HAND CONFIGURATION
THIS IS A RIGHT HAND (CLOCKWISE ROTATION) DRIVE GEAR AND MUST BE REPLACED TO CONVERT THIS PUMP TO A LEFT HAND (COUNTERCLOCKWISE ROTATION)
INLET SIDE
INLET SIDE
180°
180°
180°
180°
180°
180°
180°
180°
180°
FOR CW ROTATION PRINCE LOGO IS ON TOP
INLET SIDE
OPTIONAL REAR OUTLET (SMALL) PORT
BACKUP STRIP GOES INSIDE OF SEALS
WEAR PLATE
BEARING BLOCK
OUTLET (SMALL) PORT
INLET SIDE
ARROW ON BACKSIDE
INLET SIDE CAVITY
INLET SIDE
OPTIONAL REAR INLET (LARGE) PORT
IDLER SHAFT
INLET SIDE
FOR CCW ROTATION PRINCE LOGO IS ON BOTTOM
ARROW ON BACKSIDE
INLET (LARGE) PORT
THIS IS A RIGHT HAND (CLOCKWISE ROTATION) FRONT PLATE AND MUST BE REPLACED TO CONVERT THIS PUMP TO A LEFT HAND (COUNTERCLOCKWISE ROTATION)
FRONT OF BODY
INLET SIDE (WIDE GROOVE)
LEFT HAND CONFIGURATION
SP25 ROTATION CONVERSION
RIGHT HAND (CW) TO LEFT HAND (CCW)


LEFT HAND CONFIGURATION
THIS IS A LEFT HAND (COUNTERCLOCKWISE ROTATION) DRIVE GEAR AND MUST BE REPLACED TO CONVERT THIS PUMP TO A RIGHT HAND (CLOCKWISE ROTATION)
INLET SIDE CAVITY
INLET SIDE
OPTIONAL REAR INLET (LARGE PORT)
INLET SIDE
FOR CCW ROTATION PRINCE LOGO IS ON BOTTOM
WEAR PLATE
BEARING BLOCK
LARGER CUTOUT AREA
INLET (LARGE) PORT
INLET SIDE
ARROW ON BACKSIDE
INLET SIDE
FOR CW ROTATION PRINCE LOGO IS ON TOP
IDLER SHAFT
INLET SIDE
OPTIONAL REAR OUTLET (SMALL) PORT
BACKUP STRIP GOES TO INSIDE OF SEALS
THIS IS A LEFT HAND (COUNTERCLOCKWISE ROTATION) FRONT PLATE AND MUST BE REPLACED TO CONVERT THIS PUMP TO A RIGHT HAND (CLOCKWISE ROTATION)
ARROW ON BACKSIDE
OUTLET (SMALL) PORT
FRONT OF BODY
INLET (WIDE GROOVE) SIDE
RIGHT HAND CONFIGURATION
SP25 ROTATION CONVERSION
LEFT HAND (CCW) TO RIGHT HAND (CW)

F.) TESTING

In order to confirm performance and insure quality, all pumps that have been disassembled and then reassembled with either the same or different components need to be tested on a suitable pump test stand. (Contact Prince Manufacturing for test stand requirements.) To pass the test, the flow from the pump must exceed a minimum value at a given rpm and pressure. Perform the test as follows.

1. Wipe off any excess oil on the pump and shaft seal so that any leakage that might occur during the test will be visible.
2. Mount the pump to the test stand insuring that the correct drive shaft coupler is being used.
3. Connect the inlet and outlet lines to the correct ports on the pump. Before the inlet fitting is fully tightened, the inlet shutoff should be opened. When oil begins to leak from the loose inlet fitting, it should be fully tightened. Confirm that any valves in either the inlet line or outlet line are open.
4. Set the pump test stand to rotate in the proper direction.
5. Accelerate the test stand to 1180 rpm (or 1780 rpm) at zero/minimum pressure.
6. Check the flow meter to confirm that the there is oil flow. If there is no flow after a few seconds, stop the test stand. The inlet line fitting should be loosened slightly to check to see if the pump is getting oil. If it is, begin the test again. If there is still no oil flow, stop the test, remove the pump and disassemble it to check for problems. Prolonged running with out oil will damage pump.
7. After noting that there is flow, run the pump for approximately 30 seconds at minimum pressure.
8. Cycle the pressure from minimum to approximately 1000 psi three times, holding it on pressure for about two seconds during each cycle.
9. Cycle the pressure from minimum to approximately 2000 psi three times, holding it on pressure for about two seconds during each cycle.
10. Cycle the pressure from minimum to approximately 2500 psi three times, holding it on pressure for about two seconds during each cycle.
11. Bring the pressure back up to 2500 psi and run the pump at that pressure for one minute. Note the flow produced by the pump and confirm that the pump flow meets or exceeds the minimum flow for the specific pump size, as is indicated below. The flow at either 1180 or 1780 rpm may be used as a reference. (Note: As an allowance for disassembly and reassembly, the minimum flows have been reduced slightly from factory standards.) If the pump flow does not exceed the minimum, go through steps 7 through 11 an additional time. If the flow still does not exceed the minimum, remove the pump from the stand and disassemble to check for problems.
12. If the flow exceeds the minimum, inspect the exterior of the pump for leaks, remove the inlet and outlet lines and plug the ports with shipping plugs. Remove the pump from the test stand and check the shaft seal for any signs of leakage. Any signs of leakage should be corrected.
13. After test the tester's identification needs to be stamped above the pump ID stamp. If the configuration of the pump has been changed, the former model number on the ID stamp needs to be stamped (X'd) out.

MINIMUM TEST FLOW DATA FOR SP20B SERIES PUMPS

PUMP SIZE	DISPLACEMENT (IN^3/REV)	MINIMUM FLOW @ 1180 RPM (GPM)	MINIMUM FLOW @ 1780 RPM (GPM)
SP20B06	.400	1.37	2.00
SP20B08	.499	1.74	2.62
SP20B09	.589	2.26	3.40
SP20B11	.677	2.58	3.89
SP20B14	.860	3.41	5.15
SP20B16	.976	4.05	6.11
SP20B20	1.220	5.10	7.70
SP20B23	1.403	5.90	8.90
SP20B27	1.654	6.98	10.54
SP20B30	1.881	7.73	11.66
SP20B33	2.014	8.50	12.83

MINIMUM TEST FLOW DATA FOR SP25 SERIES PUMPS

PUMP SIZE	DISPLACEMENT (IN^3/REV)	MINIMUM FLOW @ 1180 RPM (GPM)	MINIMUM FLOW @ 1780 RPM (GPM)
SP25A19	1.141	4.46	6.73
SP25A22	1.349	5.38	8.12
SP25A27	1.660	6.89	10.39
SP25A32	2.008	8.57	12.94
SP25A38	2.318	9.78	14.76
SP25A44	2.697	11.43	17.25
SP25A52	3.179	13.06	19.71
SP25A63	3.869	15.49	23.36

The reference base for the test data is SAE 10 wt oil at 110° F

G.) TROUBLE SHOOTING

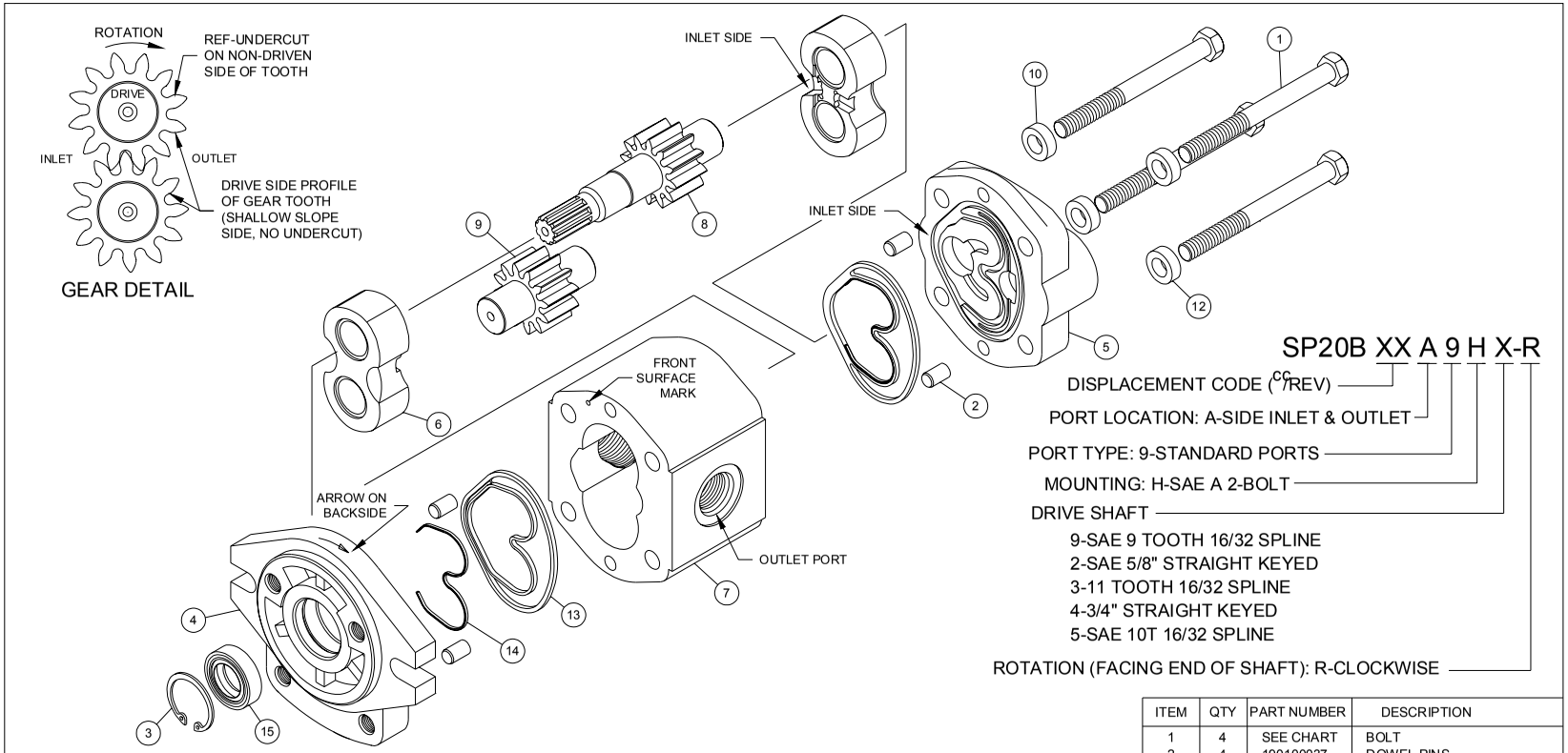
The following table may be used as a brief trouble shooting guide for the pumps.

Condition	Probable Cause	Possible Corrective Actions
Low or no oil flow from the pump	Low oil level in reservoir	Add oil to correct level.
	Restriction in the inlet line	Correct or clean out restriction.
	Pump fails to prime	Insure there is no pressure at the outlet during initial startup. Insure oil is getting to the inlet port. Raise reservoir.
	Warped, damaged or scored wear plates (SP25 ONLY)	Replace wear plates. (SP25 ONLY)
	Rough or damaged bearing carrier exterior	Replace bearing carrier.
	Scoring grooves in the bores of the body	Replace pump.
	Pump is driven via a belt and pull is in the wrong direction or belt is over tightened	Correct the direction of belt pull or the belt tension.
	Pump drive not aligned or eccentric	Align the pump drive.
Pump will not develop full pressure	Warped, damaged or scored wear plates (SP25 ONLY)	Replace wear plates. (SP25 ONLY)
	Rough or damaged bearing carrier exterior	Replace bearing carrier.
	Scoring grooves in the body bores	Replace pump.
	General scoring on body bores, gear shaft journals or (wear plates SP25 only) or roughening of the gear track-in area in the bores of the body	Oil is contaminated. Clean system and replace filter or provide proper filter. Replace pump.
	Pump has been run at excessive pressures causing bearing and journal failure and/or excessive gear track-in depth	Replace pump.
	System relief valve misadjusted	Readjust relief valve.

Condition	Probable Cause	Possible Corrective Actions
	Air in the oil	Check inlet lines for being air tight. Check shaft seal, Check for restrictions in inlet lines. Raise reservoir.
Pump is noisy	Excessive inlet vacuum/Cavitation	Increase inlet line size or remove restrictions in inlet line. Use a lower or proper viscosity oil, Reduce rpm. If a suction strainer is used clean or use a larger one. Raise reservoir
	Air in oil	Check inlet lines for being air tight. Check shaft seal. Check for restrictions in inlet lines. Increase reservoir size. Raise reservoir.
Shaft seal leaks	Shaft seal is worn or was cut by the shaft during assembly	Replace shaft seal.
	Fluid incompatible with seal	Use compatible fluids.
	Casting porosity in front cover seal bore	Replace front cover.
	Pump is driven via a belt and pull is in the wrong direction or belt is over tightened	Correct the direction of belt pull or the belt tension. See Section I, SP20B Belt Drive Instructions.
	Pump drive not aligned or eccentric	Align the pump drive.
Pump leaks oil between sections	Pump seals have become brittle due to heat	Replace seals. Correct heat problem.
	Fluid incompatible with seals	Use compatible fluids.
	Mating surfaces have become rough or damaged	Repair any surface irregularities or roughness.
Pump overheats	Internal leakage due to contamination, wear or scoring	Replace pump. Correct contamination.
	Improper system design or cooling	Correct design or improve cooling.
	Too small a reservoir	Use larger reservoir.

H.) EXPLODED VIEWS AND PARTS LISTS

The following section contains exploded views and parts lists of the SP20B and SP25 series pumps. Separate pages are shown for each combination of side/rear ports and clockwise/counterclockwise rotations for a total of four pages for each pump series.



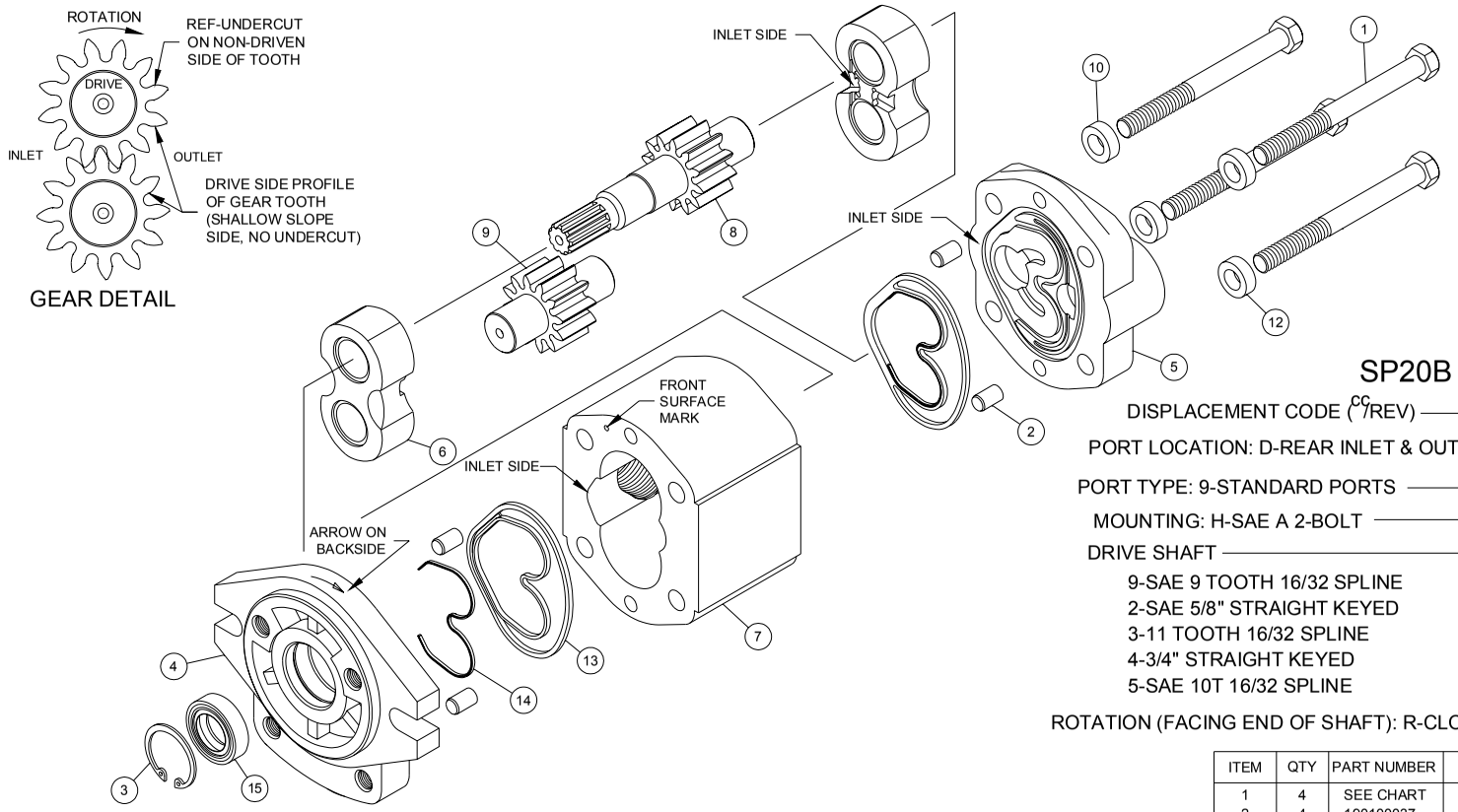
SP20B XX A 9 H X-R

- DISPLACEMENT CODE (cc/REV)
- PORT LOCATION: A-SIDE INLET & OUTLET
- PORT TYPE: 9-STANDARD PORTS
- MOUNTING: H-SAE A 2-BOLT
- DRIVE SHAFT
  - 9-SAE 9 TOOTH 16/32 SPLINE
  - 2-SAE 5/8" STRAIGHT KEYED
  - 3-11 TOOTH 16/32 SPLINE
  - 4-3/4" STRAIGHT KEYED
  - 5-SAE 10T 16/32 SPLINE
- ROTATION (FACING END OF SHAFT): R-CLOCKWISE

PUMP SIZE	BOLTS (ITEM 1)	BODY (ITEM 7)	DRIVE GEAR (ITEM 8) 9 T SPLINE DRV	5/8 KEYED DRV	11 T SPLINE DRV	3/4 KEYED DRV	10 T SPLINE DRV	IDLER GEAR	WASHERS (LOWER) (ITEM 12)
SP20B 6	170002133 (.350)	500503015	500504513	500504512	500504515	500504514	———	500506010	500507500 (.060)
SP20B 8	170002087 (3.75)	500503100	500504000	500504100	500504050	500504010	500504040	500506000	500507501 (.120)
SP20B 9	170002087 (3.75)	500503101	500504001	500504101	500504051	500504011	500504041	500506001	500507500 (.060)
SP20B 11	170002087 (3.75)	500503102	500504002	500504102	500504052	500504012	500504042	500506002	500507500 (.060)
SP20B 14	170002055 (4)	500503103	500504003	500504103	500504053	500504013	500504043	500506003	500507500 (.060)
SP20B 16	170002055 (4)	500503104	500504004	500504104	500504054	500504014	500504044	500506004	500507500 (.060)
SP20B 20	170002081 (4.5)	500503105	500504005	500504105	500504055	500504015	500504045	500506005	500507506 (.240)
SP20B 23	170002081 (4.5)	500503106	500504006	500504106	500504056	500504016	500504046	500506006	500507501 (.120)
SP20A 27	170002083 (5)	500503107	500504007	500504107	500504057	500504017	500504047	500506007	500507502 (.350)
SP20B 30	17002083 (5)	500503108	500504008	500504108	500504058	500504018	500504048	500506008	500507506 (.240)
SP20B 33	170002083 (5)	500503109	500504009	500504109	500504059	500504019	———	500506009	500507500 (.060)

ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	SEE CHART	BOLT
2	4	190100037	DOWEL PINS
3*	1	230001125	SNAP RING
4	1	500501010	FRONT PLATE
5	1	500501501	BACK PLATE
6	2	500502004	BEARING CARRIER ASSY
7	1	SEE CHART	BODY
8	1	SEE CHART	DRIVE GEAR
9	1	SEE CHART	IDLER GEAR
10	2	500507500	WASHER (UPPER) (.060 THK)
11	1	500507504	KEY FOR 5/8 KEYED SHAFT
11	1	500507523	KEY FOR 3/4 KEYED SHAFT
12	2	SEE CHART	WASHER (LOWER)
13*	2	500512000	SEAL
14*	2	500512101	BACK-UP STRIP
15*	1	500512500	SHAFT SEAL STD.
15	1	500512503	SHAFT SEAL MED. PRESSURE
	*	PMCK-SP20	SEAL KIT (*ITEMS INCLUDED)

SP20B PUMP-CLOCKWISE ROTATION-SIDE PORTS (SP20B__A9H_-R)



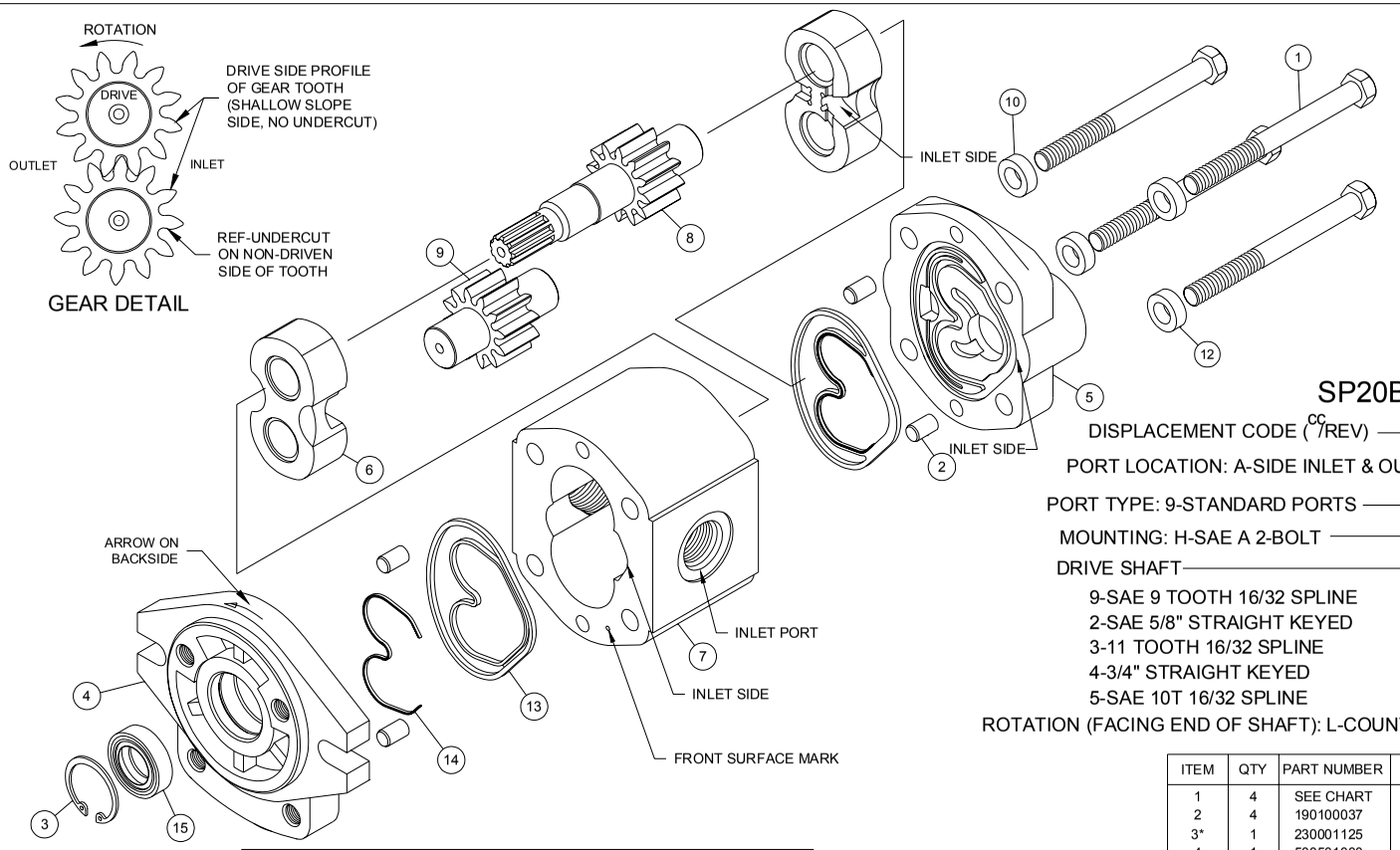
SP20B XX D 9 H X-R

- DISPLACEMENT CODE (cc/REV)
- PORT LOCATION: D-REAR INLET & OUTLET
- PORT TYPE: 9-STANDARD PORTS
- MOUNTING: H-SAE A 2-BOLT
- DRIVE SHAFT
  - 9-SAE 9 TOOTH 16/32 SPLINE
  - 2-SAE 5/8" STRAIGHT KEYED
  - 3-11 TOOTH 16/32 SPLINE
  - 4-3/4" STRAIGHT KEYED
  - 5-SAE 10T 16/32 SPLINE
- ROTATION (FACING END OF SHAFT): R-CLOCKWISE

			DRIVE GEAR (ITEM 8)						
PUMP SIZE	BOLTS (ITEM 1)	BODY (ITEM 7)	9 T SPLINE DRV	5/8 KEYED DRV	11 T SPLINE DRV	3/4 KEYED DRV	10 T SPLINE DRV	IDLER GEAR	WASHERS (LOWER) (ITEM 12)
SP20B 6	170002133 (.350)	500503018	500504513	500504512	500504515	500504514	————	500506010	500507500 (.060)
SP20B 8	170002087 (3.75)	500503000	500504000	500504100	500504050	500504010	500504040	500506000	500507501 (.120)
SP20B 9	170002087 (3.75)	500503001	500504001	500504101	500504051	500504011	500504041	500506001	500507500 (.060)
SP20B 11	170002087 (3.75)	500503002	500504002	500504102	500504052	500504012	500504042	500506002	500507500 (.060)
SP20B 14	170002055 (4)	500503003	500504003	500504103	500504053	500504013	500504043	500506003	500507500 (.060)
SP20B 16	170002055 (4)	500503004	500504004	500504104	500504054	500504014	500504044	500506004	500507500 (.060)
SP20B 20	170002081 (4.5)	500503005	500504005	500504105	500504055	500504015	500504045	500506005	500507506 (.240)
SP20B 23	170002081 (4.5)	500503006	500504006	500504106	500504056	500504016	500504046	500506006	500507501 (.120)
SP20B 27	170002083 (5)	500503007	500504007	500504107	500504057	500504017	500504047	500506007	500507502 (.350)
SP20B 30	17002083 (5)	500503008	500504008	500504108	500504058	500504018	500504048	500506008	500507506 (.240)
SP20B 33	170002083 (5)	500503009	500504009	500504109	500504059	500504019	————	500506009	500507500 (.060)

ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	SEE CHART	BOLT
2	4	190100037	DOWEL PINS
3*	1	230001125	SNAP RING
4	1	500501010	FRONT PLATE
5	1	500501500	BACK PLATE
6	2	500502004	BEARING CARRIER ASSY
7	1	SEE CHART	BODY
8	1	SEE CHART	DRIVE GEAR
9	1	SEE CHART	IDLER GEAR
10	2	500507500	WASHER (UPPER) (.060 THK)
11	1	500507504	KEY FOR 5/8 KEYED SHAFT
11	1	500507523	KEY FOR 3/4 KEYED SHAFT
12	2	SEE CHART	WASHER (LOWER)
13*	2	500512000	SEAL
14*	2	500512101	BACK-UP STRIP
15*	1	500512500	SHAFT SEAL STD.
15	1	500512503	SHAFT SEAL MED. PRESSURE
	*	PMCK-SP20	SEAL KIT (*ITEMS INCLUDED)

SP20B PUMP-CLOCKWISE ROTATION-REAR PORTS (SP20B__D9H_-R)



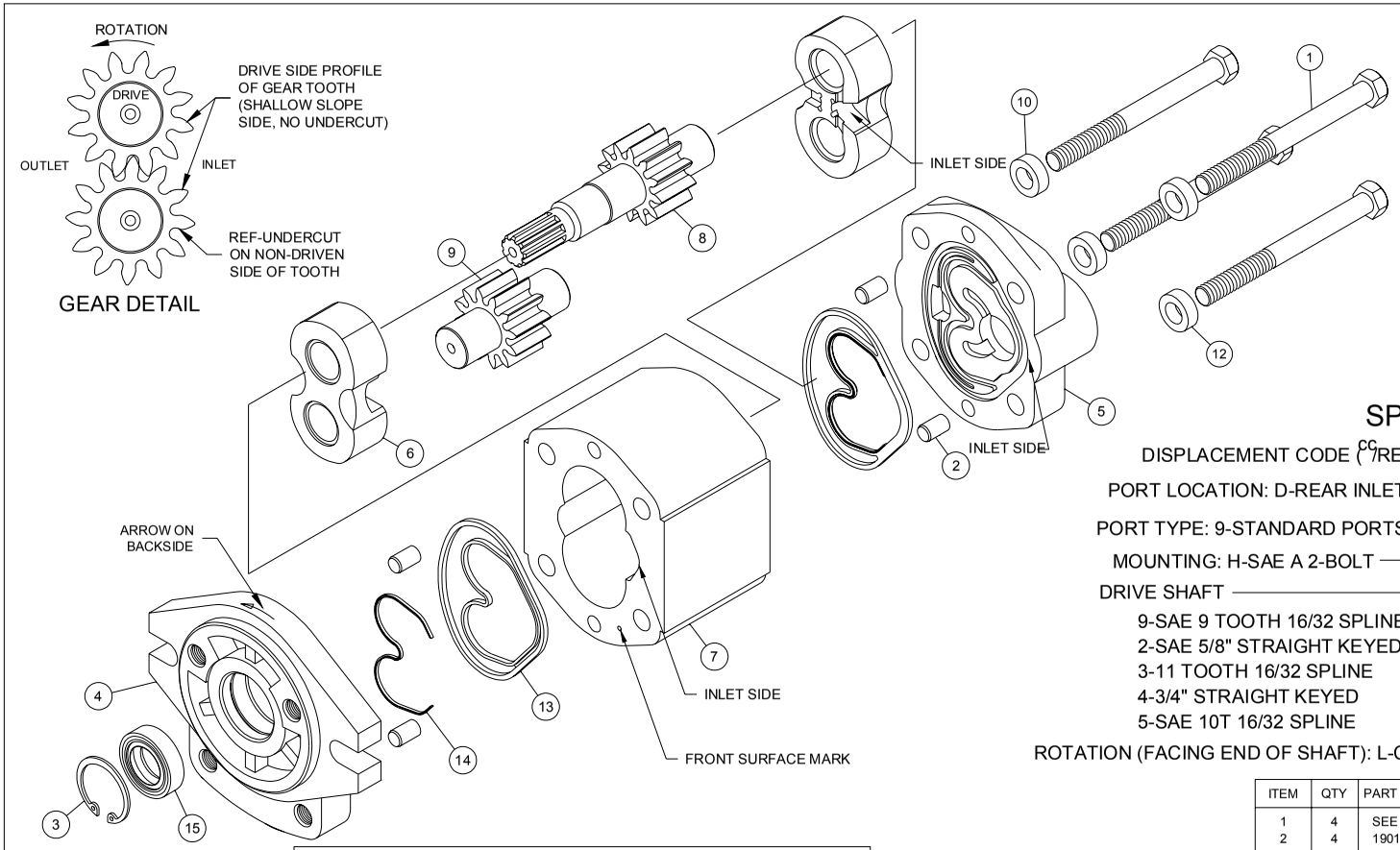
SP20B XX A 9 H X-L

- DISPLACEMENT CODE (CC/REV)
- PORT LOCATION: A-SIDE INLET & OUTLET
- PORT TYPE: 9-STANDARD PORTS
- MOUNTING: H-SAE A 2-BOLT
- DRIVE SHAFT
  - 9-SAE 9 TOOTH 16/32 SPLINE
  - 2-SAE 5/8" STRAIGHT KEYED
  - 3-11 TOOTH 16/32 SPLINE
  - 4-3/4" STRAIGHT KEYED
  - 5-SAE 10T 16/32 SPLINE
- ROTATION (FACING END OF SHAFT): L-COUNTERCLOCKWISE

			DRIVE GEAR (ITEM 8)						
PUMP SIZE	BOLTS (ITEM 1)	BODY (ITEM 7)	9 T SPLINE DRV	5/8 KEYED DRV	11 T SPLINE DRV	3/4 KEYED DRV	10 T SPLINE DRV	IDLER GEAR	WASHERS (LOWER) (ITEM 12)
SP20B 6	170002133 (.350)	500503015	500505511	500505510	500505513	500505512	————	500506010	500507500 (.060)
SP20B 8	170002087 (3.75)	500503100	500505000	500505100	500505050	500505010	500505040	500506000	500507501 (.120)
SP20B 9	170002087 (3.75)	500503101	500505001	500505101	500505051	500505011	500505041	500506001	500507500 (.060)
SP20B 11	170002087 (3.75)	500503102	500505002	500505102	500505052	500505012	500505042	500506002	500507500 (.060)
SP20B 14	170002055 (4)	500503103	500505003	500505103	500505053	500505013	500505043	500506003	500507500 (.060)
SP20B 16	170002055 (4)	500503104	500505004	500505104	500505054	500505014	500505044	500506004	500507500 (.060)
SP20B 20	170002081 (4.5)	500503105	500505005	500505105	500505055	500505015	500505045	500506005	500507506 (.240)
SP20B 23	170002081 (4.5)	500503106	500505006	500505106	500505056	500505016	500505046	500506006	500507501 (.120)
SP20B 27	170002083 (5)	500503107	500505007	500505107	500505057	500505017	500505047	500506007	500507502 (.350)
SP20B 30	17002083 (5)	500503108	500505008	500505108	500505058	500505018	500505048	500506008	500507506 (.240)
SP20B 33	170002083 (5)	500503109	500505009	500505109	500505059	500505019	————	500506009	500507500 (.060)

ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	SEE CHART	BOLT
2	4	190100037	DOWEL PINS
3*	1	230001125	SNAP RING
4	1	500501000	FRONT PLATE
5	1	500501501	BACK PLATE
6	2	500502004	BEARING CARRIER ASSY
7	1	SEE CHART	BODY
8	1	SEE CHART	DRIVE GEAR
9	1	SEE CHART	IDLER GEAR
10	2	500507500	WASHER (UPPER) (.060 THK)
11	1	500507504	KEY FOR 5/8 KEYED SHAFT
11	1	500507523	KEY FOR 3/4 KEYED SHAFT
12	2	SEE CHART	WASHER (LOWER)
13*	2	500512000	SEAL
14*	2	500512101	BACK-UP STRIP
15*	1	500512500	SHAFT SEAL STD.
15	1	500512503	SHAFT SEAL MED. PRESSURE
	*	PMCK-SP20	SEAL KIT (*ITEMS INCLUDED)

SP20B PUMP-COUNTER CLOCKWISE ROTATION-SIDE PORTS (SP20B__A9H_-L)



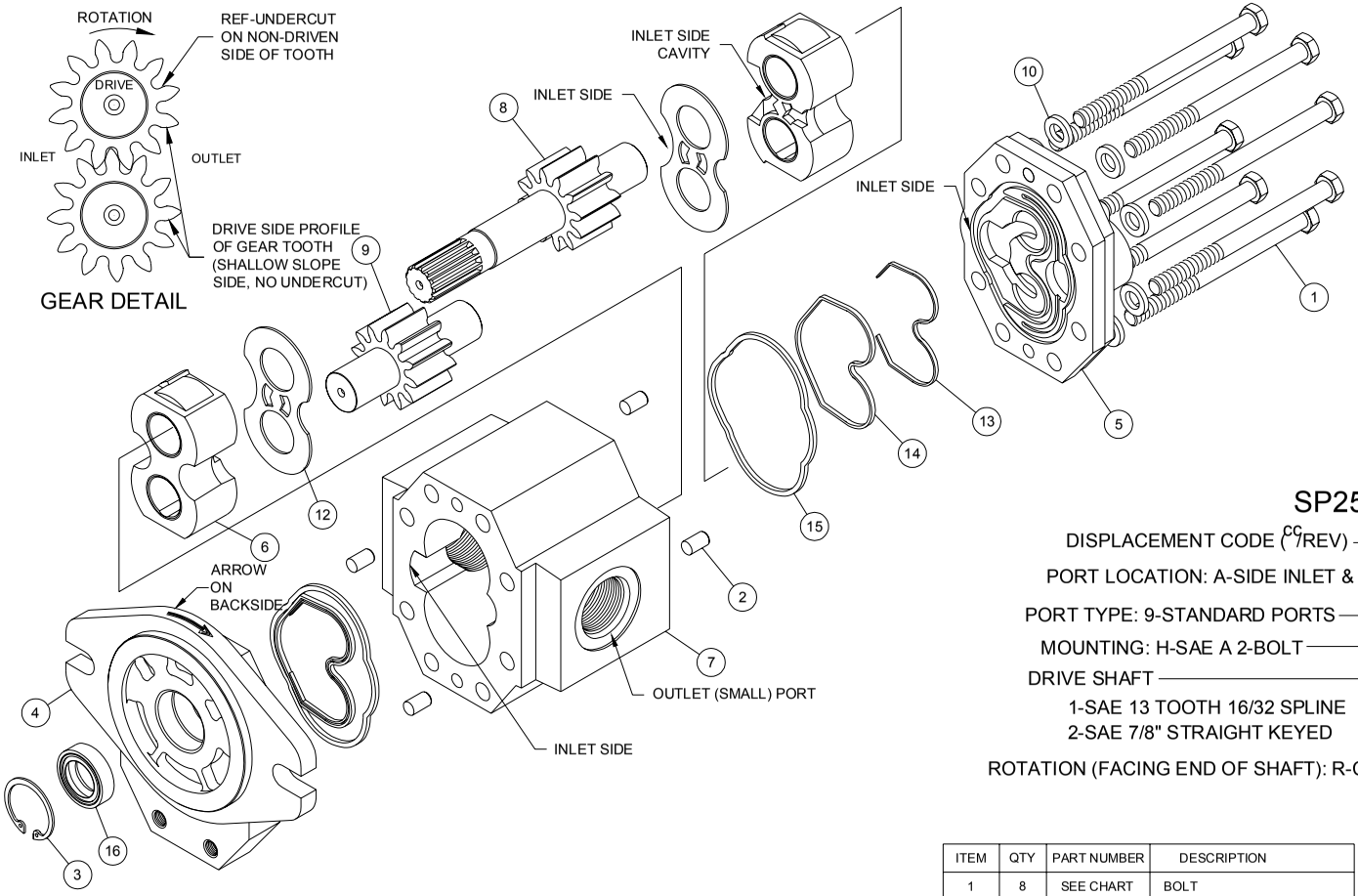
SP20B XX D 9 H X-L

- DISPLACEMENT CODE ($^{cc}/_{REV}$)
- PORT LOCATION: D-REAR INLET & OUTLET
- PORT TYPE: 9-STANDARD PORTS
- MOUNTING: H-SAE A 2-BOLT
- DRIVE SHAFT
  - 9-SAE 9 TOOTH 16/32 SPLINE
  - 2-SAE 5/8" STRAIGHT KEYED
  - 3-11 TOOTH 16/32 SPLINE
  - 4-3/4" STRAIGHT KEYED
  - 5-SAE 10T 16/32 SPLINE
- ROTATION (FACING END OF SHAFT): L-COUNTERCLOCKWISE

PUMP SIZE	BOLTS (ITEM 1)	BODY (ITEM 7)	DRIVE GEAR (ITEM 8) 9 T SPLINE DRV	5/8 KEYED DRV	11 T SPLINE DRV	3/4 KEYED DRV	10 T SPLINE DRV	IDLER GEAR	WASHERS (LOWER) (ITEM 12)
SP20B 6	170002133 (.350)	500503018	500505511	500505510	500505513	500505512	———	500506010	500507500 (.060)
SP20B 8	170002087 (3.75)	500503000	500505000	500505100	500505050	500505010	500505040	500506000	500507501 (.120)
SP20B 9	170002087 (3.75)	500503001	500505001	500505101	500505051	500505011	500505041	500506001	500507500 (.060)
SP20B 11	170002087 (3.75)	500503002	500505002	500505102	500505052	500505012	500505042	500506002	500507500 (.060)
SP20B 14	170002055 (4)	500503003	500505003	500505103	500505053	500505013	500505043	500506003	500507500 (.060)
SP20B 16	170002055 (4)	500503004	500505004	500505104	500505054	500505014	500505044	500506004	500507500 (.060)
SP20B 20	170002081 (4.5)	500503005	500505005	500505105	500505055	500505015	500505045	500506005	500507506 (.240)
SP20B 23	170002081 (4.5)	500503006	500505006	500505106	500505056	500505016	500505046	500506006	500507501 (.120)
SP20B 27	170002083 (5)	500503007	500505007	500505107	500505057	500505017	500505047	500506007	500507502 (.350)
SP20B 30	17002083 (5)	500503008	500505008	500505108	500505058	500505018	500505048	500506008	500507506 (.240)
SP20B 33	170002083 (5)	500503009	500505009	500505109	500505059	500505019	———	500506009	500507500 (.060)

ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	SEE CHART	BOLT
2	4	190100037	DOWEL PINS
3*	1	230001125	SNAP RING
4	1	500501000	FRONT PLATE
5	1	500501500	BACK PLATE
6	2	500502004	BEARING CARRIER ASSY
7	1	SEE CHART	BODY
8	1	SEE CHART	DRIVE GEAR
9	1	SEE CHART	IDLER GEAR
10	2	SEE CHART	WASHER (UPPER) (.060 THK)
11	1	500507504	KEY FOR 5/8 KEYED SHAFT
11	1	500507523	KEY FOR 3/4 KEYED SHAFT
12	2	SEE CHART	WASHER (LOWER)
13*	2	500512000	SEAL
14*	2	500512101	BACK-UP STRIP
15*	1	500512500	SHAFT SEAL STD.
15	1	500512503	SHAFT SEAL MED. PRESSURE
	*	PMCK-SP20	SEAL KIT (*ITEMS INCLUDED)

SP20B PUMP-COUNTER CLOCKWISE ROTATION-REAR PORTS (SP20B__D9H_-L)



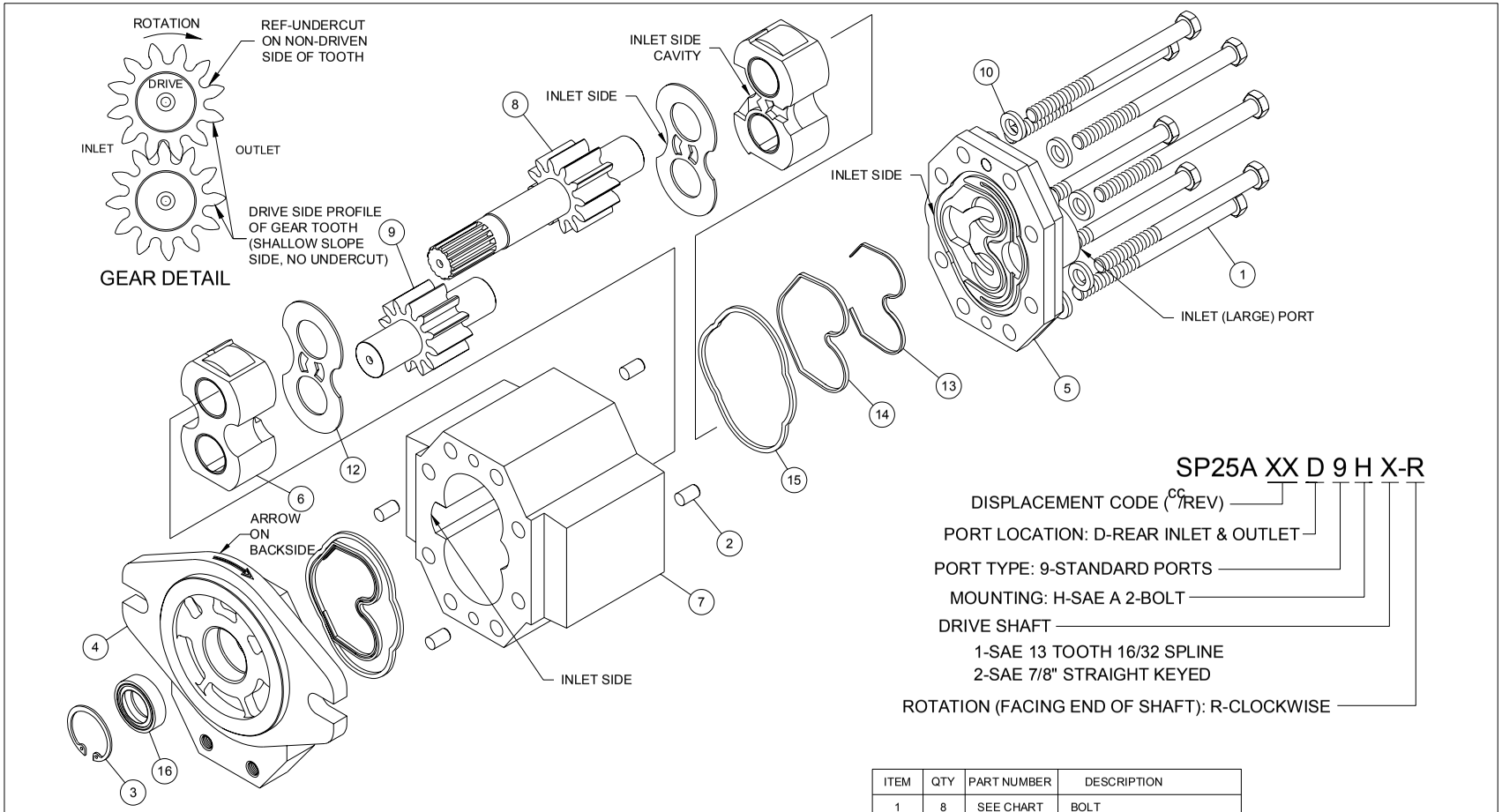
SP25A XX A 9 H X-R

- DISPLACEMENT CODE ($^{cc}/_{REV}$)
- PORT LOCATION: A-SIDE INLET & OUTLET
- PORT TYPE: 9-STANDARD PORTS
- MOUNTING: H-SAE A 2-BOLT
- DRIVE SHAFT
  - 1-SAE 13 TOOTH 16/32 SPLINE
  - 2-SAE 7/8" STRAIGHT KEYED
- ROTATION (FACING END OF SHAFT): R-CLOCKWISE

PUMP SIZE	BOLTS (ITEM 1)	BODY (ITEM 7)	DRIVE GEAR (ITEM 8) 13 T SPLINE DRV	DRIVE GEAR (ITEM 8) 7/8 KEYED DRV	IDLER GEAR	WASHERS (ITEM 10)
SP25A 19	170002081 (4.5)	500503300	500504200	500504300	500506200	500507501 (.120)
SP25A 22	170002081 (4.5)	500503301	500504201	500504301	500506201	500507500 (.060)
SP25A 27	170002083 (5)	500503302	500504202	500504302	500506202	500507502 (.350)
SP25A 32	170002083 (5)	500503303	500504203	500504303	500506203	500507501 (.120)
SP25A 38	170002067 (5.5)	500503304	500504204	500504304	500506204	500507503 (.450)
SP25A 44	170002067 (5.5)	500503305	500504205	500504305	500506205	500507506 (.240)
SP25A 52	170002068 (6)	500503306	500504206	500504306	500506206	500507503 (.450)
SP25A 63	170002068 (6)	500503307	500504207	500504307	500506207	500507500 (.060)

ITEM	QTY	PART NUMBER	DESCRIPTION
1	8	SEE CHART	BOLT
2	4	190100037	DOWEL PINS
3*	1	230001131	SNAP RING
4	1	500501030	FRONT PLATE
5	1	500501521	BACK PLATE
6	2	500502010	BEARING CASE ASSY
7	1	SEE CHART	BODY
8	1	SEE CHART	DRIVE GEAR
9	1	SEE CHART	IDLER GEAR
10	8	SEE CHART	WASHER
11	1	500507505	KEY FOR 7/8 KEYED SHAFT
12	2	500510010	WEAR PLATE
13*	2	500512100	BACK-UP STRIP
14*	2	500512051	SEAL
15*	2	500512050	SEAL
16*	1	500512501	SHAFT SEAL STD.
16	1	500512505	SHAFT SEAL MED. PRESSURE
	*	PMCK-SP25	SEAL KIT (*ITEMS INCLUDED)

SP25 PUMP-CLOCKWISE ROTATION-SIDE PORTS (SP25A__A9H_-R)



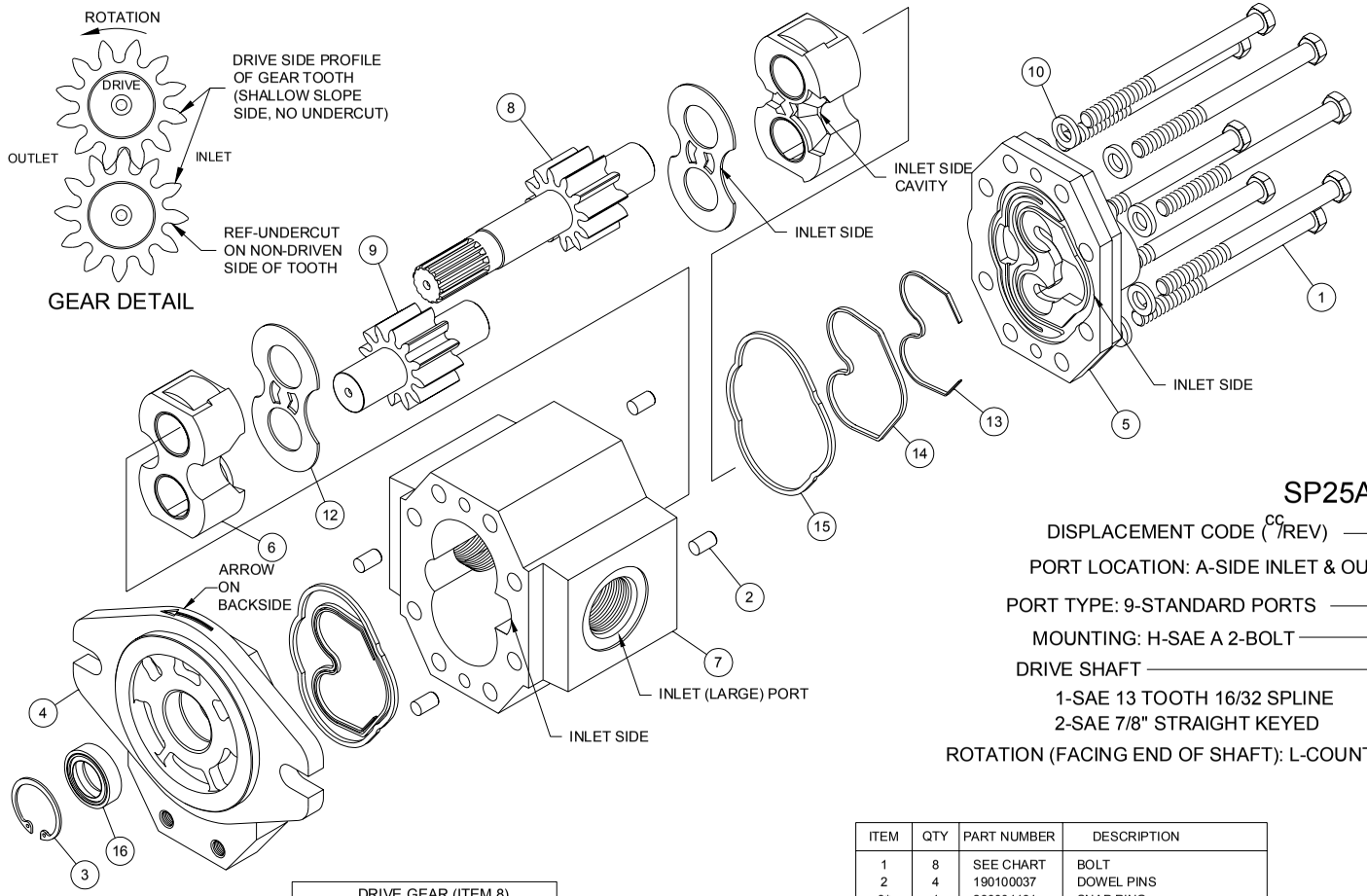
SP25A XX D 9 H X-R

- DISPLACEMENT CODE (cc/REV)
- PORT LOCATION: D-REAR INLET & OUTLET
- PORT TYPE: 9-STANDARD PORTS
- MOUNTING: H-SAE A 2-BOLT
- DRIVE SHAFT
  - 1-SAE 13 TOOTH 16/32 SPLINE
  - 2-SAE 7/8" STRAIGHT KEYED
- ROTATION (FACING END OF SHAFT): R-CLOCKWISE

			DRIVE GEAR (ITEM 8)			
PUMP SIZE	BOLTS (ITEM 1)	BODY (ITEM 7)	13 T SPLINE DRV	7/8 KEYED DRV	IDLER GEAR	WASHERS (ITEM 10)
SP25A 19	170002081 (4.5)	500503200	500504200	500504300	500506200	500507501 (.120)
SP25A 22	170002081 (4.5)	500503201	500504201	500504301	500506201	500507500 (.060)
SP25A 27	170002083 (5)	500503202	500504202	500504302	500506202	500507502 (.350)
SP25A 32	170002083 (5)	500503203	500504203	500504303	500506203	500507501 (.120)
SP25A 38	170002067 (5.5)	500503204	500504204	500504304	500506204	500507503 (.450)
SP25A 44	170002067 (5.5)	500503205	500504205	500504305	500506205	500507506 (.240)
SP25A 52	170002068 (6)	500503206	500504206	500504306	500506206	500507503 (.450)
SP25A 63	170002068 (6)	500503207	500504207	500504307	500506207	500507500 (.060)

ITEM	QTY	PART NUMBER	DESCRIPTION
1	8	SEE CHART	BOLT
2	4	190100037	DOWEL PINS
3*	1	230001131	SNAP RING
4	1	500501030	FRONT PLATE
5	1	500501520	BACK PLATE
6	2	500502010	BEARING CASE ASSY
7	1	SEE CHART	BODY
8	1	SEE CHART	DRIVE GEAR
9	1	SEE CHART	IDLER GEAR
10	8	SEE CHART	WASHER
11	1	500507505	KEY FOR 7/8 KEYED SHAFT
12	2	500510010	WEAR PLATE
13*	2	500512100	BACK-UP STRIP
14*	2	500512051	SEAL
15*	2	500512050	SEAL
16*	1	500512501	SHAFT SEAL STD.
16	1	500512505	SHAFT SEAL MED. PRESSURE
	*	PMCK-SP25	SEAL KIT (*ITEMS INCLUDED)

SP25 PUMP-CLOCKWISE ROTATION-REAR PORTS (SP25A__D9H_-R)



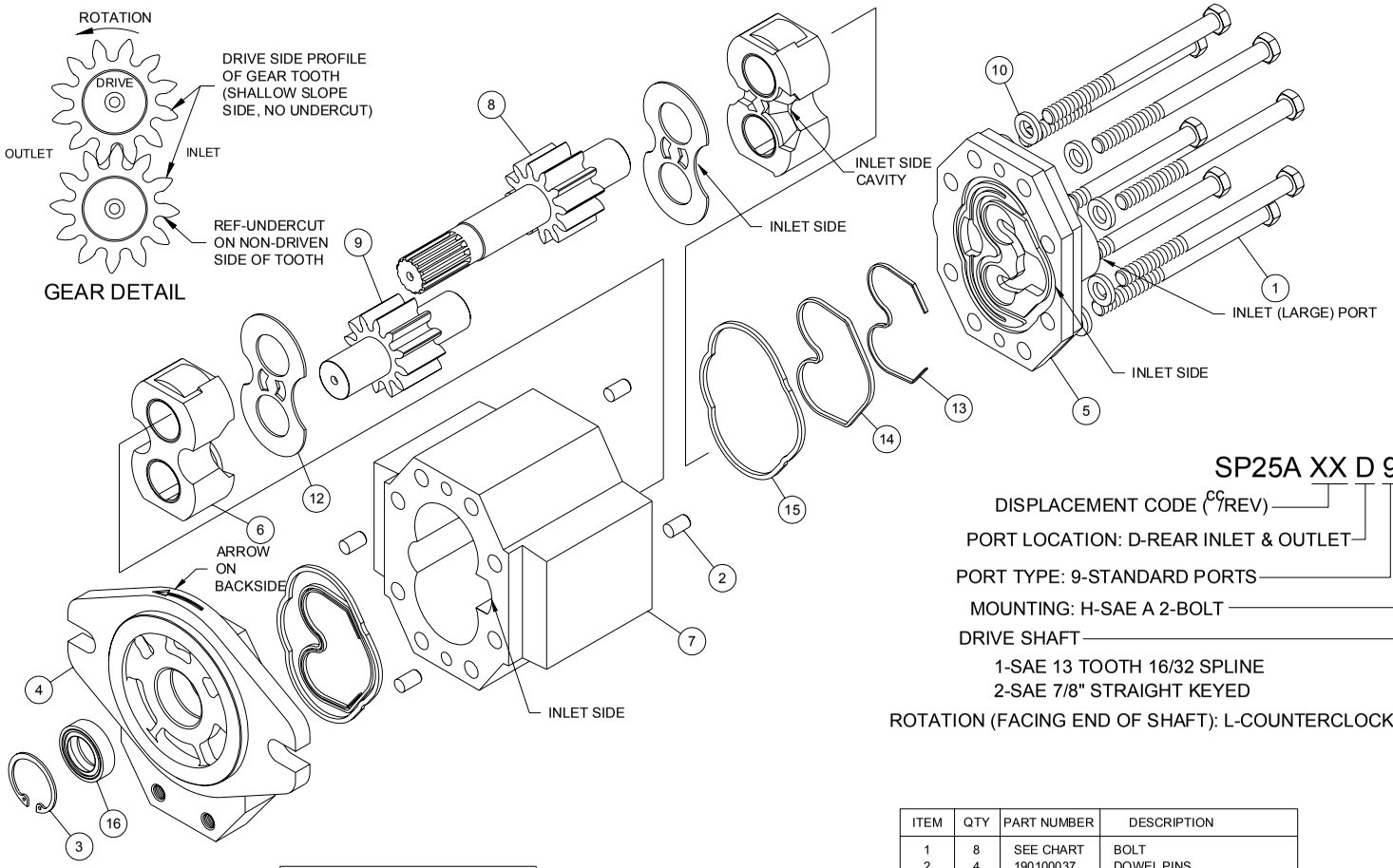
SP25A XX A 9 H X-L

- DISPLACEMENT CODE ($^{cc}/_{REV}$)
- PORT LOCATION: A-SIDE INLET & OUTLET
- PORT TYPE: 9-STANDARD PORTS
- MOUNTING: H-SAE A 2-BOLT
- DRIVE SHAFT
  - 1-SAE 13 TOOTH 16/32 SPLINE
  - 2-SAE 7/8" STRAIGHT KEYED
- ROTATION (FACING END OF SHAFT): L-COUNTERCLOCKWISE

PUMP SIZE	BOLTS (ITEM 1)	BODY (ITEM 7)	DRIVE GEAR (ITEM 8)		IDLER GEAR	WASHERS (ITEM 10)
			13 T SPLINE DRV	7/8 KEYED DRV		
SP25A 19	170002081 (4.5)	500503300	500505200	500505300	500506200	500507501 (.120)
SP25A 22	170002081 (4.5)	500503301	500505201	500505301	500506201	500507500 (.060)
SP25A 27	170002083 (5)	500503302	500505202	500505302	500506202	500507502 (.350)
SP25A 32	170002083 (5)	500503303	500505203	500505303	500506203	500507501 (.120)
SP25A 38	170002067 (5.5)	500503304	500505204	500505304	500506204	500507503 (.450)
SP25A 44	170002067 (5.5)	500503305	500505205	500505305	500506205	500507506 (.240)
SP25A 52	170002068 (6)	500503306	500505206	500505306	500506206	500507503 (.450)
SP25A 63	170002068 (6)	500503307	500505207	500505307	500506207	500507500 (.060)

ITEM	QTY	PART NUMBER	DESCRIPTION
1	8	SEE CHART	BOLT
2	4	190100037	DOWEL PINS
3*	1	230001131	SNAP RING
4	1	500501020	FRONT PLATE
5	1	500501521	BACK PLATE
6	2	500502010	BEARING CASE ASSY
7	1	SEE CHART	BODY
8	1	SEE CHART	DRIVE GEAR
9	1	SEE CHART	IDLER GEAR
10	8	SEE CHART	WASHER
11	1	500507505	KEY FOR 7/8 KEYED SHAFT
12	2	500510010	WEAR PLATE
13*	2	500512100	BACK-UP STRIP
14*	2	500512051	SEAL
15*	2	500512050	SEAL
16*	1	500512501	SHAFT SEAL STD.
16	1	500512505	SHAFT SEAL MED. PRESSURE
	*	PMCK-SP20	SEAL KIT (*ITEMS INCLUDED)

SP25 PUMP-COUNTER CLOCKWISE ROTATION -SIDE PORTS (SP25A__A9H_-L)



SP25A XX D 9 H X-L

- DISPLACEMENT CODE (cc/REV)
- PORT LOCATION: D-REAR INLET & OUTLET
- PORT TYPE: 9-STANDARD PORTS
- MOUNTING: H-SAE A 2-BOLT
- DRIVE SHAFT
  - 1-SAE 13 TOOTH 16/32 SPLINE
  - 2-SAE 7/8" STRAIGHT KEYED
- ROTATION (FACING END OF SHAFT): L-COUNTERCLOCKWISE

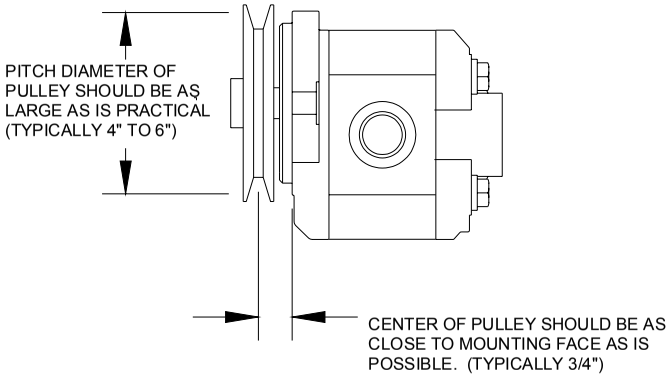
PUMP SIZE	BOLTS (ITEM 1)	BODY (ITEM 7)	DRIVE GEAR (ITEM 8) 13 T SPLINE DRV	DRIVE GEAR (ITEM 8) 7/8 KEYED DRV	IDLER GEAR	WASHERS (ITEM 10)
SP25A 19	170002081 (4.5)	500503200	500505200	500505300	500506200	500507501 (.120)
SP25A 22	170002081 (4.5)	500503201	500505201	500505301	500506201	500507500 (.060)
SP25A 27	170002083 (5)	500503202	500505202	500505302	500506202	500507502 (.350)
SP25A 32	170002083 (5)	500503203	500505203	500505303	500506203	500507501 (.120)
SP25A 38	170002067 (5.5)	500503204	500505204	500505304	500506204	500507503 (.450)
SP25A 44	170002067 (5.5)	500503205	500505205	500505305	500506205	500507506 (.240)
SP25A 52	170002068 (6)	500503206	500505206	500505306	500506206	500507503 (.450)
SP25A 63	170002068 (6)	500503207	500505207	500505307	500506207	500507500 (.060)

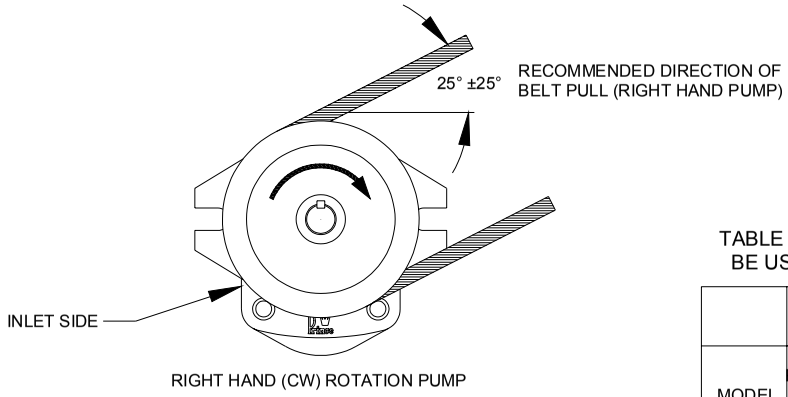
ITEM	QTY	PART NUMBER	DESCRIPTION
1	8	SEE CHART	BOLT
2	4	190100037	DOWEL PINS
3*	1	230001131	SNAP RING
4	1	500501020	FRONT PLATE
5	1	500501520	BACK PLATE
6	2	500502010	BEARING CASE ASSY
7	1	SEE CHART	BODY
8	1	SEE CHART	DRIVE GEAR
9	1	SEE CHART	IDLER GEAR
10	8	SEE CHART	WASHER
11	1	500507505	KEY FOR 7/8 KEYED SHAFT
12	2	500510010	WEAR PLATE
13*	2	500512100	BACK-UP STRIP
14*	2	500512051	SEAL
15*	2	500512050	SEAL
16*	1	500512501	SHAFT SEAL STD.
16	1	500512505	SHAFT SEAL MED. PRESSURE
	*	PMCK-SP25	SEAL KIT (*ITEMS INCLUDED)

SP25 PUMP-COUNTER CLOCKWISE ROTATION -REAR PORTS (SP25A__D9H_-L)

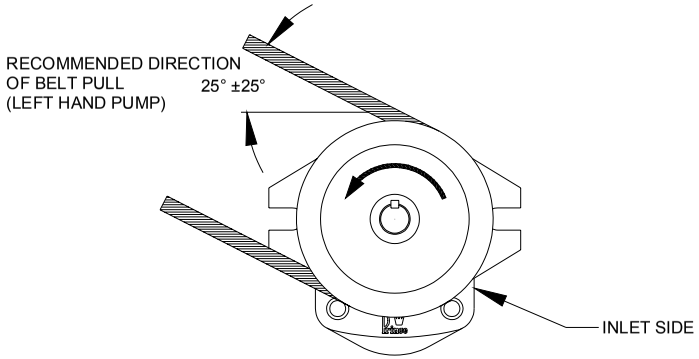
BELT DRIVE INSTRUCTIONS FOR SP20B SERIES PUMPS

THE PREFERRED METHOD OF DRIVING A PUMP IS WITH AN AXIAL DRIVE. EITHER THREE PIECE COUPLINGS OR RIGID SPINES ARE TYPICAL METHODS. IF THESE METHODS CANNOT BE USED THE PUMP CAN BE BELT DRIVEN PROVIDED CARE IS USED IN THE ORIENTATION OF THE MOUNTING AND IN THE BELT TENSIONING. OVER TIGHTENING MAY CAUSE THE PUMP TO LEAK OR TO FAIL. IT SHOULD BE NOTED THAT DUE TO LIMITATIONS ON THE AMOUNT OF HORSEPOWER THAT BELTS CAN TRANSMIT, OPERATING PRESSURES MAY BE GREATLY REDUCED.





RIGHT HAND (CW) ROTATION PUMP



LEFT HAND (CCW) ROTATION PUMP

TABLE SHOWING ALLOWABLE PRESSURES (AND RESULTING SHAFT LOADS) THAT MAY BE USED WITHOUT EXCEEDING RECOMMENDED HORSEPOWER RATINGS OF BELTS.

	1 B BELT 3500 RPM 9 HP MAX. RATING		1 B BELT 1750 RPM 6 HP MAX. RATING		2 A BELTS 3500 RPM 14 HP MAX. RATING		2 A BELTS 1750 RPM 9 HP MAX. RATING	
MODEL	MAX. PRESSURE (PSI)	APPROX. SHAFT SIDE LOAD (LB)	MAX. PRESSURE (PSI)	APPROX. SHAFT SIDE LOAD (LB)	MAX. PRESSURE (PSI)	APPROX. SHAFT SIDE LOAD (LB)	MAX. PRESSURE (PSI)	APPROX. SHAFT SIDE LOAD (LB)
SP20B6								
SP20B8	1700	75	2400	105	2600	120	3000	130
SP20B9	1500	75	2000	105	2300	120	3000	150
SP20B11	1300	75	1800	105	2000	120	2600	150
SP20B14	1100	75	1500	105	1600	120	2200	150
SP20B16	900	75	1300	105	1500	120	1900	150
SP20B20	800	75	1000	105	1200	120	1600	150
SP20B23	650	75	900	105	1000	120	1300	150
SP20B27	550	75	800	105	900	120	1100	150
SP20B30	500	75	700	105	800	120	1000	150
SP20B33			600	105	700	120	900	150

NOTES:1. APPROXIMATE SHAFT LOAD BASED ON 5" PITCH DIAMETER SHEAVES AND A SLACK SIDE TENSION EQUAL TO 20 PERCENT OF THE TIGHT SIDE TENSION WHEN RUNNING.
2. BELT RATINGS ARE BASED ON MANUFACTURES RECOMMENDATIONS USING A PREMIUM NOTCHED STYLE V BELT, 5" PITCH DIAMETER SHEAVES AND A 1.25 SERVICE FACTOR.
3. CAPACITIES WILL VARY DEPENDING ON STYLE OF BELT USED, SHEAVE SIZES ETC.
4. INDICATED VALUES ARE FOR REFERENCE ONLY. ACTUAL RATINGS SHOULD BE DETERMINED USING THE ACTUAL CONDITIONS.