15. JMP/JME MECHANICAL SEAL

Darley

Repair Service Instructions

Type **JMP** - PTO Driven Fire Pump, and
Type **JME** - Engine Driven Fire Pumps,
With Two Gear Transmission and
Mechanical Shaft Seal

Glossary of abbreviations:

HHCS: Hex Head Cap Screw
SHCS: Socket Head Cap Screw
NC: National Coarse Thread
SS: Stainless Steel
Q-ring: Quad Ring - A ring, similar to an o-ring, used for gasket type sealing.

Remove JMP Pump and Transmission from Truck Chassis

Refer to Drawings DJC0400, DJC0403

1. Drain oil from gear case.
2. Disconnect the following from the pump:
   Gage Line Tubing
   Primer Tubing
   Drain Line Tubing
   PTO Shaft if equipped
   Tachometer Drive Cable if equipped
3. Remove control valve shaft from control valve, for manually actuated pumps, or remove air lines from the staging valve air cylinder for power actuated pumps.
4. Remove tank to pump piping if necessary, then remove eight 3/8-NC nuts holding suction tee (75) to outboard head (39).
5. Remove six 3/8-NC nuts holding discharge head (2) to volute (36).
6. Provide a transmission jack to support the pump weight of approximately 350 pounds. Make sure transmission jack is snug to the bottom of the pump.
7. Remove two 3/8-NC cap screws at each side of gear case holding the mounting brackets to the pump transmission gear case. The pump is now ready to remove from the truck.

JMP/JME Pump Disassembly for Overhaul

Refer to drawing DJC0400
Addition reference drawings: DJC0403, DJC0410, and DJC0413

1. If the pump is a JME, using an overhead hoist capable of supporting not less than 500 pounds to support the weight of the pump assembly, remove the pump from the engine, by removing the flat engine adapter (2 – drawing DJC0413) from the engine's flywheel housing. After removing from the engine, remove four 3/8-NC SHCS (104 – drawing DJC0413) that hold the engine adapter to gear case cover (26), and remove the engine adapter.
2. Remove four 5/16-NC HHCS and remove control valve cap (5) and plug (4).
3. Tap 3/16" spring pin out of control valve plug (4) and slide plug out of control valve cap (5). Discard o-rings (3) and (6).
4. If necessary to replace, press bronze sleeve bushing (77) out of control valve cap (5).

5. Remove fifteen 3/8-NC nuts from studs and remove outboard head (39) from volute (36). Two 5/16-NC tapped puller holes will facilitate flange separation. Discard gasket (38).
6. Remove SS cotter key (49), impeller nut (50), and impeller washer (51).
7. Mark first stage impeller (48) with indelible marker to identify first stage position and slide impeller off impeller shaft (17).
8. Remove fourteen 3/8-NC nuts from studs and eight 3/8-NC hex head cap screws and remove volute (36) from inboard head (34).
9. Slide second stage impeller (7) off impeller shaft (17).

ANY PUMPS ORDERED OR BEING REPAIRED AFTER November 2008 SKIP TO STEPS #15 thru #18, OTHERWISE FOLLOW STEPS #10 thru #14.

OLD MECHANICAL SEAL RETAINER DESIGN:

10. Loosen two 10-32 SS set screws (73) in spring retainer (74).
11. Remove SS retaining ring (67) from impeller shaft (17), to remove spring retainer (74).
    ⚠**CAUTION:** There is spring pressure behind spring retainer.
12. Remove mechanical seal spring (68).
13. Using a small file, gently remove burrs on the impeller shaft (17), left by the set screws (73).
14. Remove mechanical seal (66) from impeller shaft (17). Do not let carbon rotating ring drop or fall.

NEW MECHANICAL SEAL RETAINER DESIGN: (REFERENCE DRAWING DJC0406)

15. Remove SS retaining ring (8) from impeller shaft (80), to remove spring retainer (112).

⚠***CAUTION:*** *There is spring pressure behind spring retainer.*

16. Using two 10-32 tapped holes on sprint retainer face as puller features if needed to remove spring retainer.

17. Remove mechanical seal spring (12).

18. Remove mechanical seal (111) from impeller shaft (80). Do not let carbon rotating ring drop or fall.

Continue with disassembly (referencing drawings DJC0400, DJC0403, DJC0410, & DJC0413):

19. Remove three 5/16-NC cap screws and remove bearing cap (14). Two 5/16-NC tapped puller holes will facilitate flange separation.
20. Remove four 5/16-NC nuts from studs and pry inboard head (34) away from gear case (28). Keep impeller shaft (17) with inboard head, if possible.

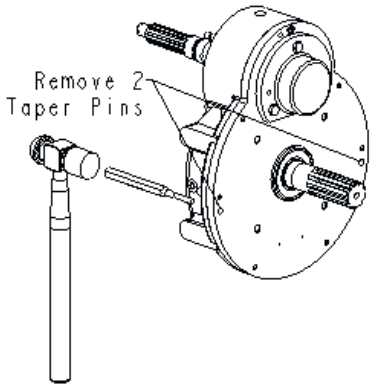
    NOTE: If pinion gear (13) will not clear bore of transmission case (28), slide the inboard head off impeller shaft (17), being careful to avoid damaging impeller shaft, mechanical seal seat, and seal housing (9). The impeller shaft will have to remain in the gear case until the gear case cover (26) is removed.
21. Gently tap the impeller shaft (17) out of inboard head (34), being careful to avoid damage to the impeller shaft, mechanical seal seat, and seal housing (9).
22. Remove and discard the oil seal (10) from the inboard head (34) with a hooked seal puller.
23. Press mechanical seal seat out of seal housing (9).
24. If necessary to replace, press seal housing out of inboard head (34).

    NOTE: If the mechanical shaft seal has been used before, do not put back into service until the seal faces of the carbon rotating ring and the stationary ring have either been re-lapped or replaced.

26. If necessary to replace, pry or tap seal ring (53) out of outboard head (39).
27. If necessary to replace, press interstage seal ring (8) out of volute (36).
28. Press bearing (19) off impeller shaft (17).
29. Press bearing (18), bearing spacer (15), pinion spacer (16), and pinion gear (13), off impeller shaft (17).

Transmission Disassembly

30. Remove three 5/16-NC HHCS and remove bearing cap (23) from gear case cover (26).
31. Remove and discard oil seal (21).
32. Remove three 5/16-NC HHCS and remove bearing cap (32) from gear case (28).
33. Mark one of the two taper pins in the flange of the gearcase (28), to ensure that durring reassembly, the same pin goes back into the same hole it came out of. Drive the two taper pins out of the gear case flange, from the gear case side, to the gear case cover (26) side.
34. Remove seven 5/16-NC SHCS and separate gear case cover (26) from gear case (28). A 5/16-NC tapped puller holes will facilitate flange separation. Drive shaft/gear assembly may remain with either gear case or gear case cover. Remove impeller shaft assembly if necessary.



35. Tap drive shaft/gear assembly out of gear case (28) or gearcase cover (26).
36. Press drive shaft (20) out of drive gear (30), spacer (25), and bearing (19) all at once.
37. Remove drive gear key (22).
38. If equipped, remove tachometer worm gear (86) from drive shaft (20).
39. If equipped, remove tachometer gear key (83).
40. Press bearing (19) off the drive shaft (20).

NOTE: Tachometer disassembly is usually not required unless parts are severely worn.

Tap the drive lock pin (84) out of the tachometer gear (79).

Remove tachometer shaft (80) from gear (79) and bushing (82). Remove tachometer gear.

Press or tap bushing (82) and tachometer plug (87) out of tachometer housing (23).

JMP/JME Pump with Mechanical Shaft Seal, and Two Gear Transmission Parts Inspection and Measurement

1. Clean all parts and examine carefully for wear or deterioration. Replace any questionable parts.
2. Measure the impeller seal rings, seal rings, and interstage seal ring for wear. Use the following table for comparison.

Impeller seal ring O.D.	3.489-3.491"
Impeller seal ring I.D.	3.255-3.257"
Impeller Interstage	1.369-1.371"
Seal Ring O.D.	3.502-3.504"
Seal Ring I.D.	3.242-3.244"
Interstage Seal Ring	1.382-1.384"
Clearance O.D. - original	0.011-0.015"
Clearance I.D. - original	0.011-0.015"
Clearance Interstage - original	0.011-0.015"

3. If clearance exceeds 0.025" on diameter, impeller seal rings can be restored to original size by soldering a ring over trued surface which retains at least 0.090" wall thickness. Stationary seal rings should also be replaced or you may purchase undersize seal rings. Call customer service for details.

4. Measure impeller shaft and stuffing box for wear. Use the following table for comparison.

Impeller Shaft diameter at packing area	1.249-1.250"
Stuffing Box bore - new	1.255-1.257"
Stuffing Box bore – max.	1.262"
Clearance - original	0.005-0.008"
Clearance - max. allowable	0.013"

5. Measure bearing housing bores for proper size. Use the following table for comparison. If any bore exceeds the high limit by 0.0005", the part should be replaced.

	Original Bore Dia.
Inboard Head	3.1496 - 3.1503"
Gear Case Cover	2.8346 - 2.8353"
Bearing Housing	2.4410 - 2.4415"
Rear Bearing Cover	2.8345 - 2.8355"
Bearing Cap/Engine Adapter	2.8345 - 2.8355"

6. Measure shaft bearing journals for proper size. Use the following table for comparison. The low limit under bearing is required to insure a press fit with inner bearing race.

	Original Journal Dia.
Impeller Shaft - center	1.3781 - 1.3785"
Impeller Shaft - end	1.1812 - 1.1816"
Drive Shaft	1.3781 - 1.3785"

7. The original impeller shaft diameter under the pinion gear is 1.3781 - 1.3785" or 1.1865 - 1.1870. The original pinion gear bore is 1.3785 - 1.3790" or 1.1870 - 1.1875 providing 0.0000 to 0.0009/.0010" clearance. The parts are still serviceable up to 0.0014" clearance. The pinion gear may be reversed to work other side of gear teeth.

8. The original drive shaft diameter under the drive gear is 1.3781 to 1.3785". The original drive gear bore is 1.3780 to 1.3785" providing 0.0005" press fit to 0.0004" clearance. The parts are still serviceable up to 0.0009" clearance. The drive gear may be reversed to work other side of gear teeth.

JMP/JME Pump and Two Gear Transmission Assembly

Refer to drawing DJC0400

Addition reference drawings: DJC0403, DJC0410, and DJC0413

- Before Starting Assembly: Please read the Darley Basic Assembling Techniques (document 1205529), for the proper techniques recommended for assembling most Darley pumps.
- When lubricating parts, with oil, for assembly, use the same oil used in the pump transmission gear case.
- When installing an o-ring or a q-ring in the transmission assembly, lubricate it prior to installation, with the same oil used in the pump transmission gear case.
- When installing an o-ring or a q-ring in the pump assembly, suction, or discharge, lightly lubricate it prior to installation with silicon based grease, such as Dow Corning 111. Be careful not to apply too thick of a film of lubricant, because over application of the grease can cause the o-ring/q-ring to bridge and leak.

NOTE: If not equipped with a tachometer or if the tachometer was not disassembled, skipped to step 7.

1. Press tachometer bushing (82) into tachometer housing (23), flush with inside of gear pocket.
2. Place tachometer gear (79) into position.
3. Insert tachometer shaft (80) through bushing (82) and into tachometer gear (79) with .104”square key drive hole end facing tachometer cable pocket.
4. Tap 3/32” x 7/16” drive lock pin (84) into tachometer gear (79) through the tachometer shaft (80).
5. Press the tachometer plug (87) into the tachometer housing (23). Allow approximately .015” gap between the tachometer gear (79) and the tachometer plug (87). Gear and shaft (80) must rotate freely.
6. Oil tachometer gear teeth (79).
7. Press oil seal (21) into tachometer housing (23), with the lip spring of the seal facing the tachometer pocket. Lubricate the oil seal lip with oil. If assembling a JME, press oil seal (69 – drawing DJC0413) into the oil seal pocket in engine adapter (2 – drawing DJC0413), and lubricate the oil seal lip with oil.

Drive Shaft Assembly

8. Apply a light coating of oil to drive shaft (20) and drive gear (30) bore. Place gear key (22) in shaft keyway. Align the key, with the key slot in the drive gear, and press the shaft evenly into the drive gear bore, until the shaft shoulder is tight against the side of the gear.
9. Slide spacer (25) onto drive shaft (20).
10. Apply a light coating of oil to the bore of bearing (19) [with no shields]. Press the bearing onto the drive shaft; until gear, spacer, and bearing are tight together.

11. Apply a light coating of oil to bore of bearing (19) [with one shield]. With the open side of the bearing toward drive shaft shoulder (20) and gear, press the bearing onto the drive shaft, until tight against the shaft shoulder.

12. If equipped with a tachometer, place woodruff key (83) into the slot in drive shaft (20) and lightly oil the bore of tachometer worm gear (86), and the drive shaft. Press the tachometer worm gear onto the drive shaft, shoulder first, until the worm gear and the inner race of bearing (19) are tight together.

Impeller Shaft Assembly

13. Apply a light coating of oil to impeller shaft (17) and the bore of pinion gear (13). Place key (12) in the impeller shaft keyway, align with key slot in the pinion gear, and press the shaft into the gear, until the shaft shoulder is tight against the side of the pinion gear.

14. Apply a light coating of oil to the bore of bearing (19) [with one shield]. With the open side of the bearing toward the shaft shoulder and gear, press the bearing onto impeller shaft (17), until tight against the shaft shoulder.

15. Slide spacer (15) onto impeller shaft (17), against pinion gear (13).

16. Slide spacer (16) onto impeller shaft (17), against spacer (15).
NOTE: Pumps that have a impeller shaft diameter under the pinion gear of 1.1865 - 1.1870 do not use spacer (16), and only use spacer (15).

17. Apply a light coating of oil to the bore of bearing (18) [with not shields] and press it onto impeller shaft (17), until bearing, two spacers, and gear are tight together.

Gear Case Assembly

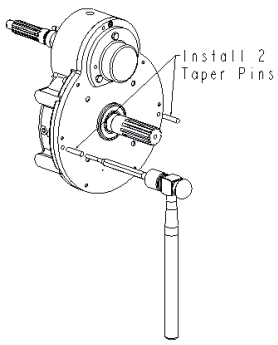
18. Place bearing cap gasket (76)/o-ring (62 – drawing DJC0413) into position on impeller shaft bearing cap (14). Apply Loctite 243 or equivalent, to three 5/16-NC HHCS, and attach the bearing cap to gear case cover (26), with these cap screws, and fully tighten. [Reference torque: 13 ft-lbs]

19. Apply Loctite 243 or equivalent, to three 5/16-NC HHCS, and attach bearing cap (32) and gasket (31)/o-ring (63 – drawing DJC0413) to gear case (28), with these cap screws. Only tighten finger tight, to allow the bearings on the drive shaft assembly to seat properly.

20. Apply a light coating of oil to the outside diameter of the drive shaft bearings (19). Insert drive shaft/gear assembly into gear case (28) and tap bearing (19) into gear case bearing bore until bearing is seated in bearing cap (32).

21. Place the gear case gasket (27)/o-ring into position on the gasket flange of gear case (28).

22. If pinion gear (13) will not fit through the impeller shaft bearing bore in gear case (28), apply a light coat of oil to the out side diameter of bearing (18), and set the impeller shaft assembly into position in the gear case. Tap gear case cover (26) over drive shaft bearing (19) and impeller shaft bearing (18). Locate the gear case to the gear case cover by tapping two tapered dowel pins into the gear case cover and gear case, from the cover side, ensuring to tap the marked pin into the marked hole that it came out of. The rounded end of taper pin must be inserted first. Tap in only until snug. If pinion gear (13) will fit through the impeller shaft bearing bore in the gear case, set the impeller shaft assembly aside in a clean location until step 32. Take necessary precautions to prevent contaminating the two bearings and gear teeth.



23. Attach gear case cover (26) to gear case (28) with six 5/16-NC x 1.00 long SHCS with lock washers, and one 5/16-NC x .62 long SHCS. The six 1.00 long SHCS with lock washers are installed from the gear case side. The one shorter .62 long SHCS is installed no lock washer from the gear case cover side. Evenly tighten the SHCS until fully tightened.

24. *For JMP pumps - Slide bearing housing assembly (23) and gasket (24)/o-ring (67 – drawing DJC0413) over drive shaft (20). Place lock washers on three 5/16-NC HHCS and apply Loctite 243 or equivalent to

the threads. Use these screws to attach bearing cap to gear case cover (26). Torque to 13 ft-lb.
*For JME pumps - Slide engine adapter (2 – drawing DJC0413) and o-ring (67 – drawing DJC0413) over drive shaft (20). Place high collar lock washers on four 3/8-NC HHCS and apply Loctite 243 or equivalent to the threads. Use these screws to attach the engine adapter to gear case cover (26). Torque to 23 ft-lb.

25. Evenly tighten the HHCS for bearing cap (32) until fully tightened. [Reference torque: 13 ft-lbs]
26. Rotate drive shaft. If drive shaft will not rotate, loosen bearing cap (32) and bearing cap (23)/engine adapter (2 – drawing DJC0413), reseat bearings, and retighten bearing caps and/or engine adapter.

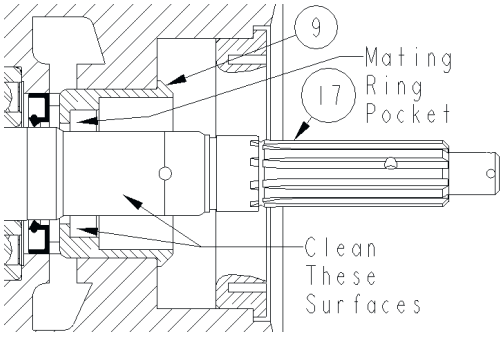
Pump Assembly

27. Apply a light coating of Loctite 609 retaining compound, or equivalent, to the entire outside diameter of mechanical seal housing (9), and press it into inboard head (34) until seated. Wipe any excess retaining compound off immediately.
28. Apply a light coating of Loctite 609 retaining compound, or equivalent, to the outside diameter of seal ring (53), and press it into inboard head (34) until seated. Wipe any excess retaining compound off immediately.
29. Apply a <u>light</u> coating of oil to the outside diameter of oil seal (10), and press it into inboard head (34) with lip spring of seal facing the bearing pocket. Lubricate the oil seal lips with oil.
30. Apply a light coating of Loctite 609 retaining compound, or equivalent, to the outside diameter of interstage seal ring (8). Press the interstage seal ring into volute (36) until seated. Wipe any excess retaining compound off immediately.
31. Apply a light coating of Loctite 609 retaining compound, or equivalent, to the outside diameter of seal ring (53). Press the seal ring into outboard head (39) until seated. Wipe any excess retaining compound off immediately.
32. *If pinion gear (13) fit through the impeller shaft bearing bore in gear case (28), oil the outside diameter of bearing (18), and insert the impeller shaft assembly into position in the gear case assembly until bearing (18) into the bearing pocket in bearing cap (14).
*If pinion gear (13) did not fit through the impeller shaft bearing bore in gear case (28), ensure that bearing (18) is seated into the bearing pocket in bearing cap (14).
33. If o-ring (65 – drawing DJC0413) is used to seal the inboard head to gear case (28), lubricate the o-ring with a light coating of oil, and install in the groove on inboard head (34). If an o-ring is not used, apply a small – continuous bead, about 1/8" in diameter, of Loctite 518 Gasket Eliminator or equivalent to flange of inboard head (34).
34. Apply a light coat of oil to the bearing bore in inboard head (34).
35. Carefully slide inboard head (34) over impeller shaft (17) until bearing (19) is seated in its pocket. Use caution, to avoid damaging oil seal (10), mechanical seal housing (9), and the precision ground surfaces on the impeller shaft. Attach the inboard head to gear case (28) using four 5/16 lock washers and 5/16-NC nuts on studs. Evenly tighten the four nuts, until fully tightened.

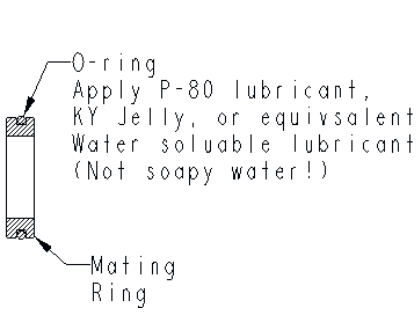
Mechanical Shaft Seal Installation

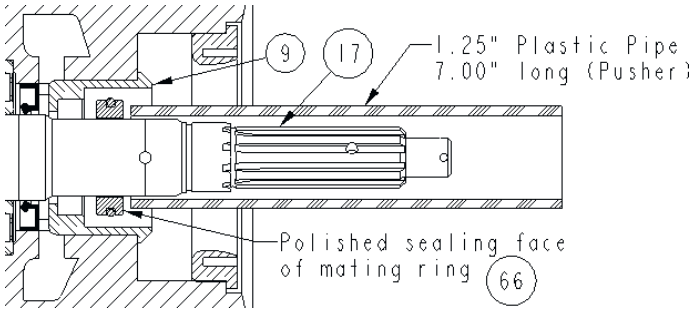
- <u>Before Starting The Mechanical Seal Installation:</u>
  - Please read the Darley Mechanical Shaft Seal Basics (document 1200583)
  - Clear a clean - flat work area, for unwrapping and setting the mechanical shaft seal, during installation.

36. Inspect the mating ring pocket in seal housing (9), and the surface of impeller shaft (17) under the bellows of shaft seal (66), ensuring they are clean, to provide a proper sealing surfaces for the stationary ring o-ring and the shaft seal bellows. Isopropyl alcohol may be used to clean surface if required.

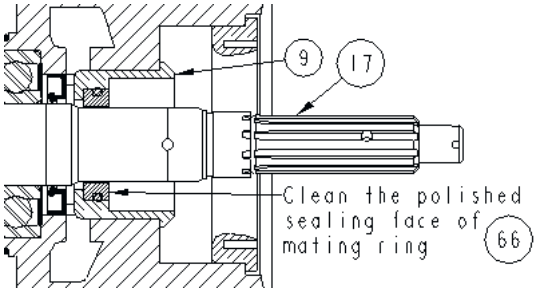


37. Take precautions not to get any oils or greases on the face of the mating ring (66). Apply P-80 Rubber Lubricant, KY jelly or equivalent water-soluble lubricant (not soapy water) to the o-ring on the mating ring and push it into the cavity, firmly seating it square. If it is not possible to insert stationary mating ring with your fingers, use a suitable plastic 1.25" (PVC) pipe free of contaminants. Firmly push the mating ring square into mating ring pocket.

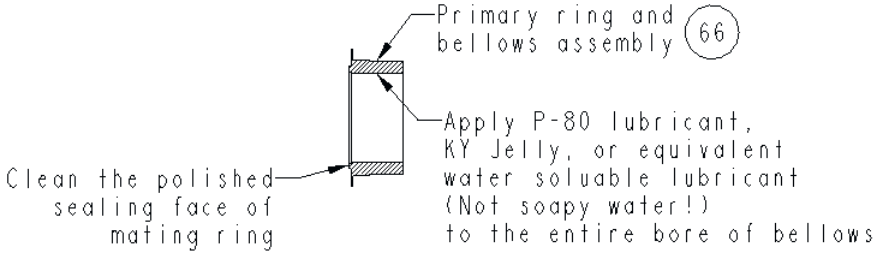




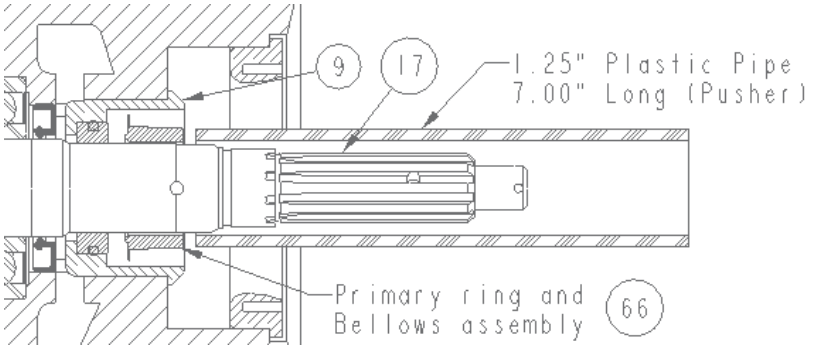
38. Clean mating ring (66) surface with isopropyl alcohol to remove any fingerprints left on mating ring.



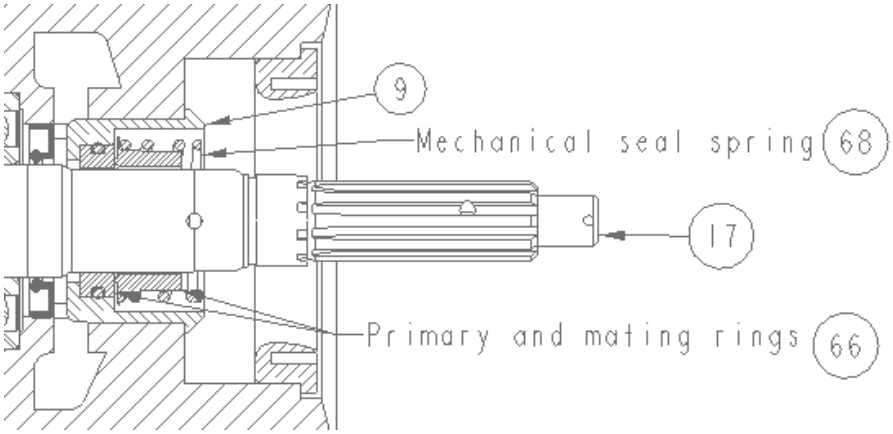
39. Apply P-80 Rubber Lubricant, KY jelly, or equivalent water-soluble lubricant (not soapy water) to the inside of bellows assembly (66), allowing it to be pushed easily into position.



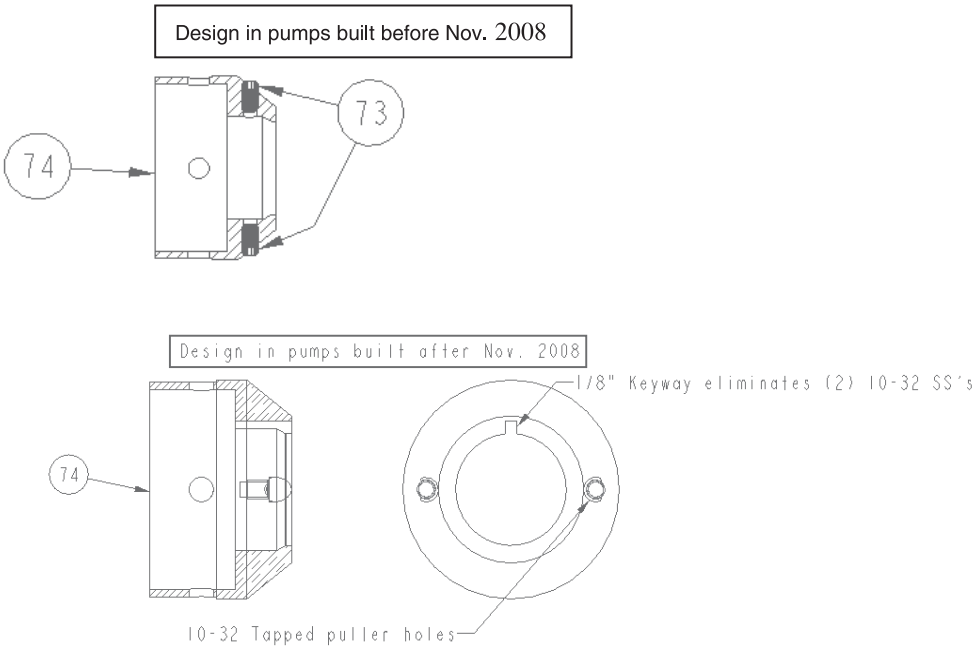
40. Place the primary ring and bellows assembly (66) on impeller shaft (17) [but not the spring yet] and slide the assembly into position so that seal surfaces are in contact. If it is not possible to slide bellows assembly into place with your fingers, use plastic pipe from Step 37.



41. Put spring (68) into position, seated against the retainer stop flange on primary ring (66).

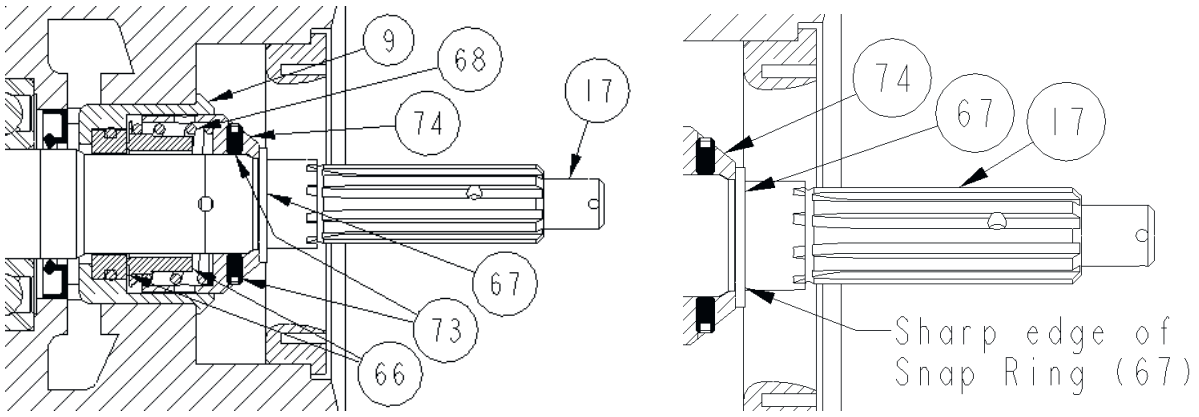


42. Start two SS set screws (73) in spring retainer (74) **or if your pump was ordered or being repaired <u>after November 2008</u>, you will not require the two SS set screws (see bottom image).**

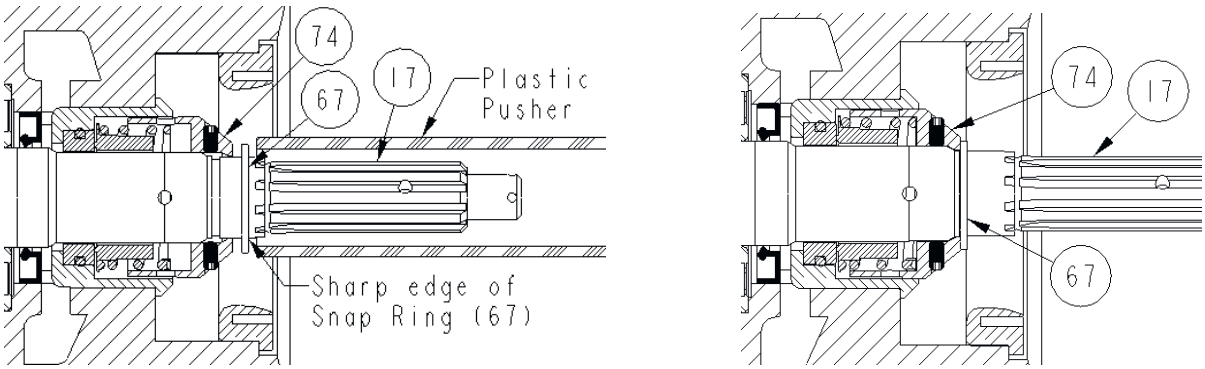


ANY PUMPS ORDERED OR BEING REPAIRED AFTER November 2008 SKIP TO STEPS #48 thru #18, OTHERWISE FOLLOW THESE STEPS.

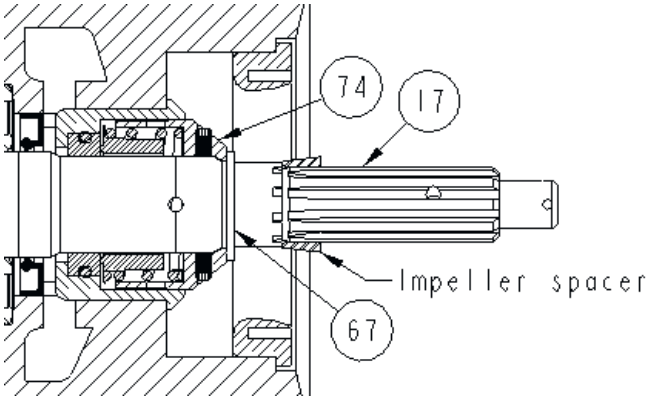
43. Slide spring retainer (74) onto impeller shaft (17), over spring (68). Push the spring retainer back until SS retaining ring (67) can be seated in the retaining ring groove. Install the SS retaining ring into its groove, with the sharp edge facing away from the spring retainer. Tighten set screws (73).



Suggestion for installing retaining ring (67): Slide spring retainer (74) onto impeller shaft (17), until it is touching spring (68). Place SS retaining ring (67), with the sharp side of the retaining ring, away from the spring retainer, on the impeller shaft shoulder, as shown in the image below. Using a piece of tubing, such as the plastic pusher from steps 37 and 40, push the SS retaining ring and spring retainer until the SS retaining ring is firmly seated in its groove on the impeller shaft. Tighten set screws (73).



44. Slide the impeller spacer onto impeller shaft (17). Note that many older pumps had the impeller spacer pressed onto the impeller shaft, and didn't allow for it to be removed.

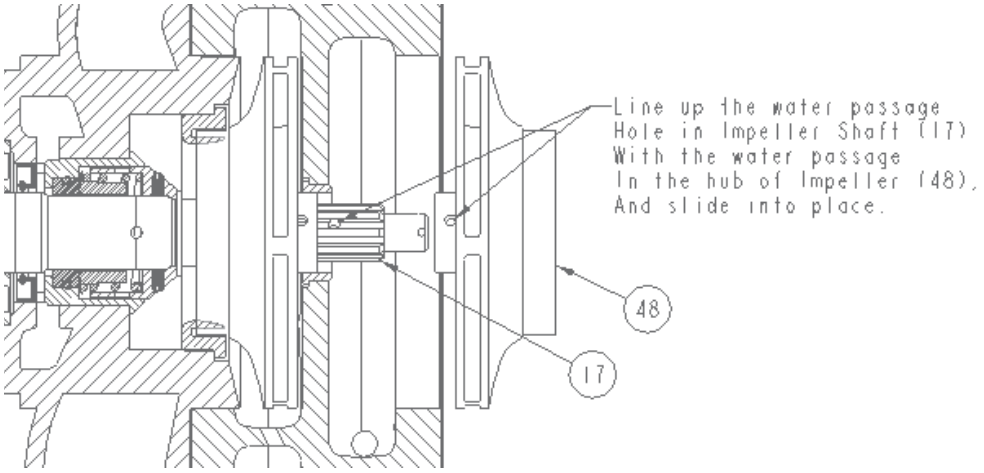


- Note: If mechanical shaft seal (66) leaks slightly after assembly, it may be necessary to run the pump for approximately 30 minutes at 50-60 psi to rinse out the lubricant and other contaminants.

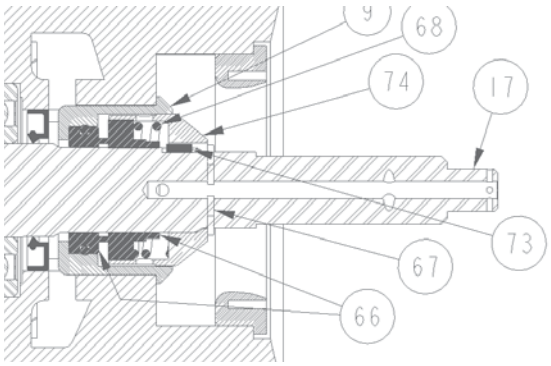
45. Slide second stage impeller (7) onto impeller shaft (17).

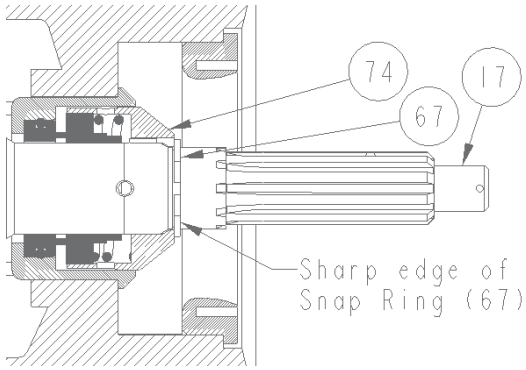
46. Place inboard head gasket (35) into position on studs of volute (36) and tap volute into position on inboard head (34). Attach the volute to the inboard head with fourteen 3/8-NC nuts on studs and eight 3/8-NC hex head cap screws with Loctite 243 or equivalent on the threads.

47. Slide first stage impeller (48) onto impeller shaft (17). Take care to ensure that the hole in the hub on the back side of the impeller lines up with the hole in the impeller shaft. These holes must line up to allow cooling water to get to the mechanical shaft seal.



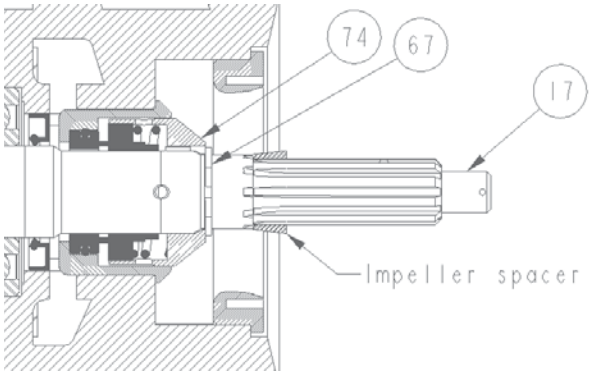
48. Align key (73) with spring retainer (74) keyway and slide spring retainer (74) onto impeller shaft (17), over spring (68). Push the spring retainer back until SS retaining ring (67) can be seated in the retaining ring groove. Install the SS retaining ring into its groove, with the sharp edge facing away from the spring retainer.





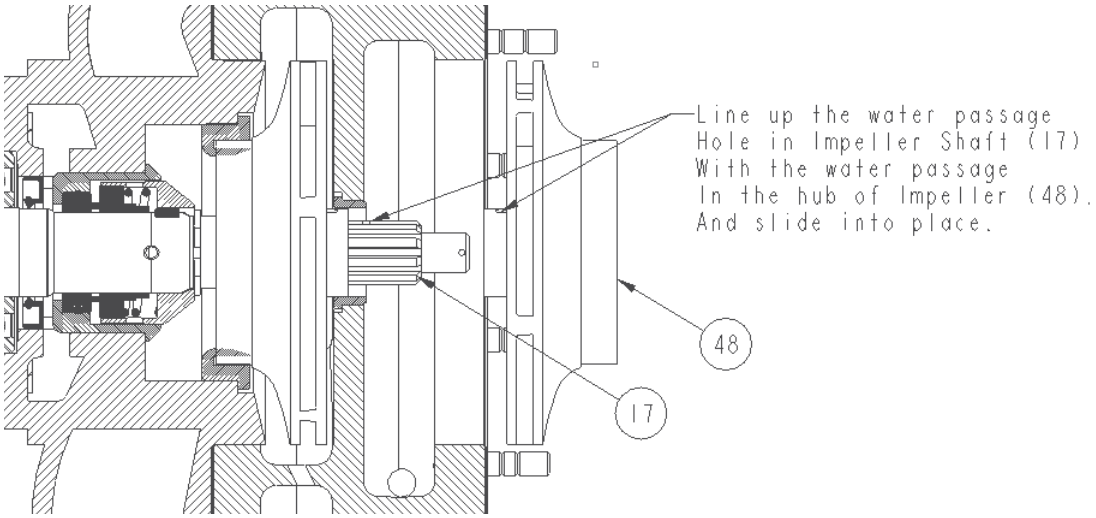
FOLLOW ABOVE STEP 43 Suggestions for installing retaining ring (67).

49. Slide the impeller spacer onto impeller shaft (17). Note that many older pumps had the impeller spacer pressed onto the impeller shaft, and didn't allow for it to be removed.

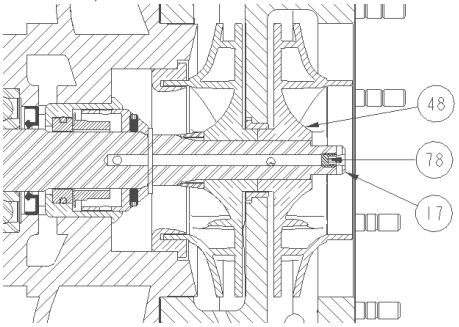


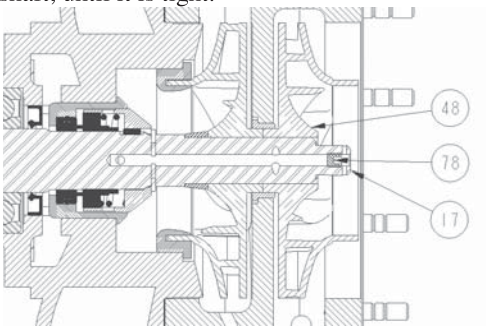
- Note: If mechanical shaft seal (66) leaks slightly after assembly, it may be necessary to run the pump for approximately 30 minutes at 50-60 psi to rinse out the lubricant and other contaminants.

50. Slide second stage impeller (7) onto impeller shaft (17).
51. Place inboard head gasket (35) into position on studs of volute (36) and tap volute into position on inboard head (34). Attach the volute to the inboard head with fourteen 3/8-NC nuts on studs and eight 3/8-NC hex head cap screws with Loctite 243 or equivalent on the threads.
52. Slide first stage impeller (48) onto impeller shaft (17). Take care to ensure that the hole in the hub on the back side of the impeller lines up with the hole in the impeller shaft. These holes must line up to allow cooling water to get to the mechanical shaft seal.



53. Clean and dry the threads of impeller shaft (17) and SS impeller nut (50), removing dirt, grease, and oil. Loctite Klean N' Prime, Part No.2556, can be used to clean the parts and shorten cure time.
54. Slide impeller washer (51) onto impeller shaft (17), with the flat side against from the impeller.
55. Apply Loctite 243 or equivalent thread locker to the threads of impeller shaft (17) and nut (50).
56. Install impeller nut (50) by tightening the SS impeller nut until it contacts the SS impeller washer (51); then, tighten it to the next cotter key hole.
CAUTION: DO NOT OVER TIGHTEN THE IMPELLER NUT! Over tightening of the impeller nut can damage the impeller washer and the impeller shaft, causing the pump to fail during use.
57. Ensure that the stainless steel socket set screw (78) has been installed in the end of impeller shaft (17). If the SS socket set screw is missing, apply Loctite 243 or equivalent to the threads of a SS 5/16-NC socket set screw, and install it in the threaded end of the impeller shaft, until it is tight.





58. Install a 3/32" x 1.00" STAINLESS STEEL cotter pin (49) in impeller shaft (17) cotter key hole.
59. Using four SS ¼-NC x .63 lg. SHCS (70), with Loctite 243 or equivalent, install check valve assembly (43. 44, & 45) on outboard head (36). When installed, the check valve cover (45) should swing up when open.
60. Place outboard head gasket (38) into position on the studs of volute (36).
61. Tap outboard head (39) into position on volute (36). Attach with fifteen 3/8-NC nuts and Loctite 243 or equivalent on studs.
62. Press control valve bushing (77) into control valve cap (5) flush with outside face of the cap.
63. Apply a silicon lubricant, such as Dow Corning Compound 111 (or equivalent) to control valve cap o-ring (3) and place it into position in the groove of control valve cap (5).
64. Apply silicon lubricant to control valve plug o-ring (6) and slide it onto stem of control valve plug (4).
65. Apply a light film of silicon lube to the stem of control valve plug (4) and slide into control valve cap (5).
66. Tap a 3/16" x 1" spring pin into hole in control valve plug (4) with the pin extending between the stop pins of the control valve cap (5) so that the control valve rotates about 3/8 of a revolution.
67. Apply a light coat of oil to control valve plug (4) and slide it into volute (36). Position control valve cap (5) so that the rectangular hole in the plug can swing from the upward position over to the left. Attach control valve cap (5) to volute with four 5/16-NC x 1" HHCS and lock washers.
68. Place discharge head gasket (55) [o-rings (61 – drawings DJC0413) for newer pumps] into position on studs of volute (36).
69. If the pump is a JME, using an overhead hoist capable of supporting not less than 500 pounds to support the weight of the pump assembly, install the pump onto the engine as follows:

    69.1.1. If the flexible drive disc (24 – drawings DJC0413) was removed from the engine, install it per the Darley Engine Driven Pump Layout for your engine. If you do not have the Darley Engine Driven Pump Layout for your engine, contact Darley Engineering for assistance. Use SHCS with Loctite 262 or equivalent for a diesel engine application or Loctite 243 or equivalent for a gasoline engine application, to hold the drive disc to the flywheel.

    69.1.2. Apply a light coating of oil or grease to the external splines of drive shaft (20) and drive disc (24 – drawing DJC0413), and install the pump onto the engine by lining up splines of the drive shaft, with the splines of the drive disk, and slide them together. Attach the flat engine adapter (2 – drawing DJC0413) to the engine's flywheel housing, using HHCS with Loctite 262 or equivalent for a diesel engine application or Loctite 243 or equivalent for a gasoline engine application.

Install the JMP Pump and Transmission into the Truck Chassis

Refer to Drawings DJC0400, DJC0403

Reverse the procedures outlined under removal instructions.

Lubricate universal joint slip yoke on the pump drive shaft.

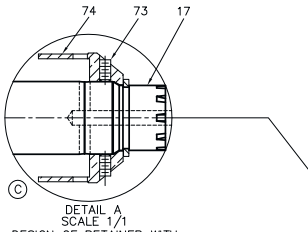
Fill the gear case with SAE 80W/90 Gear Lube oil to the bottom of the 1/8 NPT oil level plug in the gear case. The oil level plug is marked with an oil level tag. The oil fill is at the top of the gear case.

Maintain oil level even with bottom of the oil level plug every 25 hours, or every 3 month, which ever comes first. Use SAE 80W/90 Gear Lube oil in the pump transmission.

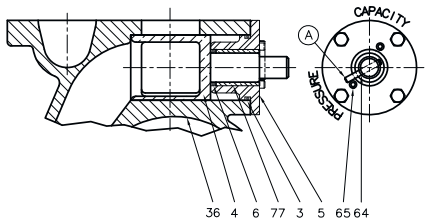
CAUTION: Do not overfill

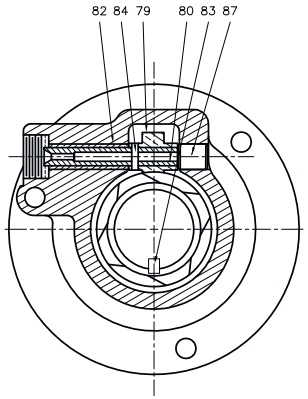
Change the pump transmission oil every 50 hours, or every 6 month, which ever comes first.

REP NO.	NAME OF PART	QTY
1	O'RING–DISCHARGE CAP	2
2	DISCHARGE HEAD	1
3	O'RING–CONTROL VALVE	1
4	CONTROL VALVE PLUG	1
5	CONTROL VALVE CAP	1
6	O'RING–CONTROL VALVE	1
7	IMPELLER	1
8	INTERSTAGE SEAL RING	1
9	SEAL HOUSING	1
10	OIL SEAL–IMPELLER SHAFT	1
11	GEAR CASE VENT	1
12	PINION GEAR KEY	1
13	PINION GEAR	1
14	BEARING CAP	1
15	SPACER BUSHING	1
16	PINION SPACER	1
17	IMPELLER SHAFT	1
18	BEARING	1
19	BEARING	3
20	DRIVE SHAFT	1
21	OIL SEAL–DRIVE SHAFT	1
22	DRIVE GEAR KEY	1
23	TACHOMETER HOUSING	1
24	GASKET–TACHOMETER HOUSING	1
25	DRIVE GEAR SPACER	1
26	GEAR CASE COVER	1
27	GASKET–GEAR CASE	1
28	GEAR CASE	1
29	OIL DRAIN PLUG	1
30	DRIVE GEAR	1
31	GASKET–BEARING CAP	1
32	BEARING CAP	1
34	INBOARD HEAD	1
35	GASKET–INBOARD HEAD	1
36	VOLUTE	1
37	DRAIN FITTINGS	3
38	GASKET–OUTBOARD HEAD	1
39	OUTBOARD HEAD	1
40	GLAND NUT	1
43	CHECK VALVE HINGE PIN	1
44	CHECK VALVE SEAT	1
45	CHECK VALVE COVER	1
47	DISCHARGE FLANGE	3
48	IMPELLER	1
49	COTTER KEY–IMPELLER SHAFT	1
50	IMPELLER NUT	1
51	IMPELLER WASHER	1
53	SEAL RING	2
55	O'RING–DISCHARGE HEAD	1
56	CHECK VALVE SEAT	2
57	CHECK VALVE DIFFUSER	2
58	CHECK VALVE RUBBER	2
59	CHECK VALVE PLATE	2
60	CHECK VALVE STEM NUT	2
61	CHECK VALVE STEM	2
62	CHECK VALVE BUSHING	2
63	DISCHARGE HEAD CAP	2
64	SPRING PIN	1
65	SPRING PIN	2
66	MECHANICAL SEAL	1
67	RETAINING RING	1
68	MECHANICAL SEAL SPRING	1
69	OIL LEVEL PLUG	1
70	SOCKET HEAD CAP SCREW	4
71	GASKET–SUCTION TEE	1
72	O'RING–DISCHARGE FLANGE	3
73	SET SCREW	2
74	SPRING RETAINER	1
75	SUCTION TEE	1
76	GASKET–BEARING CAP	1
77	CONTROL VALVE BUSHING	1
78	SOCKET HEAD SET SCREW	1
79	TACHOMETER GEAR	1
80	TACHOMETER DRIVE SHAFT	1
82	TACHOMETER BUSHING	1
83	TACHOMETER GEAR KEY	1
84	TACHOMETER GEAR PIN	1
86	TACHOMETER WORM GEAR	1
87	TACHOMETER PLUG	1
88	1/8" SQ. X 3/8" LG, 316 SST KEY	1
C 89	RETAINER – SPRING, MECH. SEAL	1
90	IMPELLER SHAFT	1

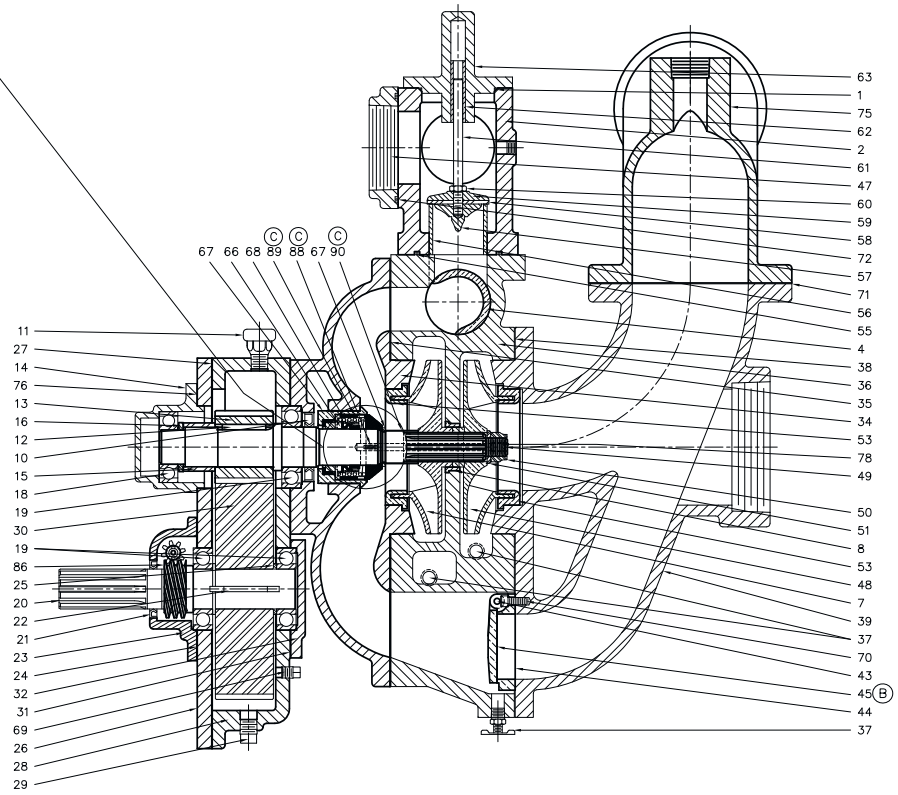


DETAIL A
SCALE 1/1
DESIGN OF RETAINER WITH SET SCREWS; & SHAFT WITH NO KEYWAY AND NO KEY.
PRIOR TO 12/12/08





TACHOMETER DETAIL
FULL SCALE



C 2008–304 12/16/08	ADDED KEYSEAT, KEY & NEW RING RETAINER; & ADDED VIEW AND NOTES	RJG
B 2007–462 12/04/07	CLOSED SWING CHECK VALVE	RJG
A 2007–462 12/04/07	CORRECTED PIN ORIENTATION	RJG

W.S. DARLEY & CO.
MELROSE PARK, IL – CHIPPEWA FALLS, WI

OLD PART NO. J287

DWG – JMP, 2 GEAR, MECH SEAL CROSS SECTION

DRN S.LEE/TED | DATE AUG9,94
CHKD
TRCD | SCALE 1/2

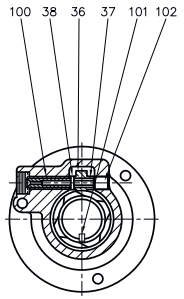
DJC0400

ALL DIMENSIONS IN INCHES UNLESS NOTED

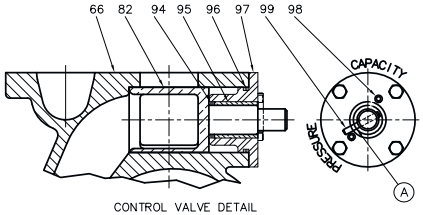
DO NOT SCALE PRINT

REP. NO.	DESCRIPTION	QTY.
1	O'RING – DISCHARGE HEAD COVER	2
2	DISCHARGE HEAD	1
3	O'RING – DISCHARGE FLANGE	3
4	DISCHARGE ADAPTER FLANGE	2
8	RETAINING RING	1
9	SET SCREW	2
10	SPRING RETAINER	1
11	MECHANICAL SEAL SPRING	1
12	MECHANICAL SEAL	1
13	SEAL HOUSING	1
14	GEAR CASE VENT	1
15	OIL SEAL – IMPELLER SHAFT	1
16	BEARING – IMPELLER SHAFT	1
17	GEAR KEY – PINION	1
18	PINION GEAR	1
19	GASKET – BEARING CAP	1
20	BEARING HOUSING	1
22	SPACER BUSHING	1
23	BEARING – IMPELLER SHAFT	1
24	IMPELLER SHAFT	1
25	PINION SPACER	1
34	BEARING CAP	1
36	TACHOMETER GEAR	1
37	TACHOMETER DRIVE SHAFT	1
38	TACHOMETER GEAR PIN	1
40	TACHOMETER WORM GEAR	1
43	DRIVE GEAR SPACER	1
45	DRIVE SHAFT	1
46	KEY – DRIVE GEAR	1
47	OIL SEAL – DRIVE SHAFT	1
48	BEARING – DRIVE SHAFT	1
49	GASKET – TACHOMETER HOUSING	1
50	GEAR CASE COVER	1
51	DRIVE GEAR	1
52	GASKET – GEAR CASE	1
53	GEARCASE	1
54	OIL DRAIN PLUG	1
57	GASKET – REAR BEARING COVER	1
58	OIL LEVEL PLUG	1
59	REAR BEARING COVER	1
64	INBOARD HEAD	1
65	GASKET – INBOARD HEAD	1
66	VOLUTE	1
67	CHECK VALVE COVER	1
68	DRAIN FITTING	3
69	SPRING PIN	1
70	OUTBOARD HEAD	1
71	CHECK VALVE SEAT	1
72	SOCKET HEAD CAP SCREW	4
73	GASKET – OUTBOARD HEAD	1
74	IMPELLER	1
75	IMPELLER	1
76	IMPELLER SEAL RING	2
77	INTERSTAGE SEAL RING	1
78	IMPELLER WASHER	1
79	IMPELLER NUT	1
80	SOCKET HEAD SET SCREW	1
81	IMPELLER SHAFT COTTER KEY	1
82	CONTROL VALVE PLUG	1
83	DISCHARGE HEAD O'RING	2
84	CHECK VALVE SEAT	2
85	SUCTION TEE GASKET	1
86	CHECK VALVE DIFFUSER	2
87	CHECK VALVE RUBBER	2
88	CHECK VALVE PLATE	2
89	CHECK VALVE STEM NUT	2

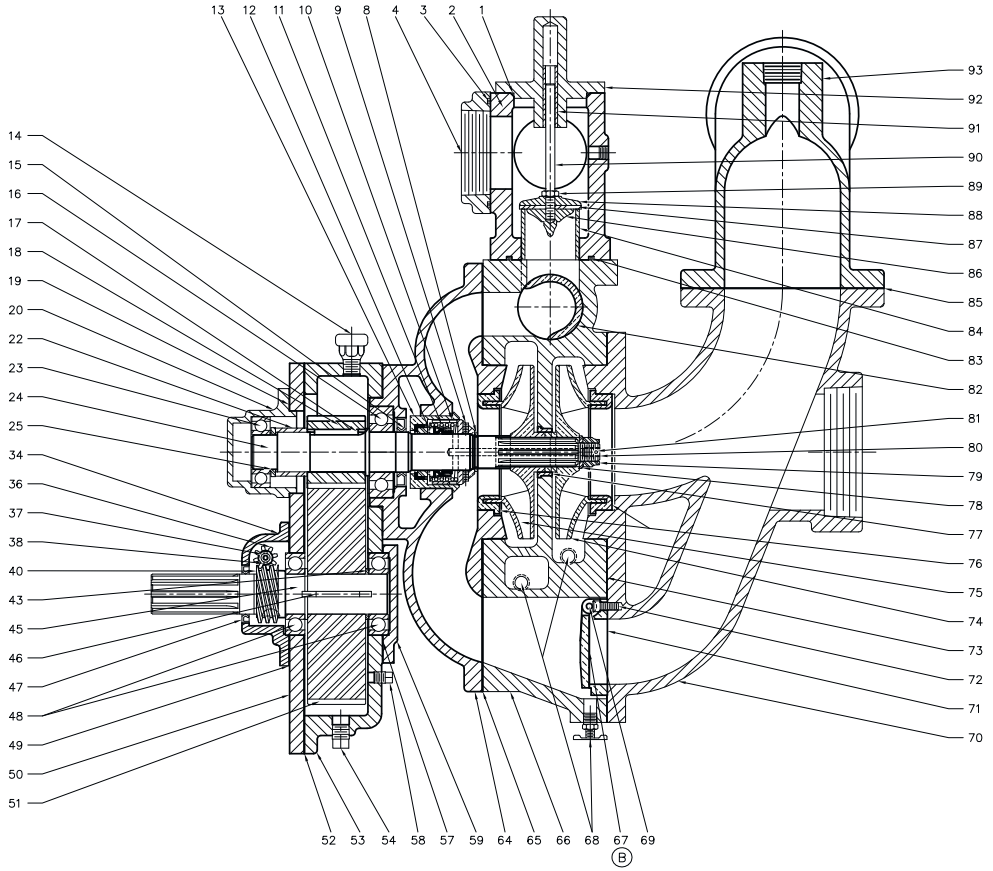
REP. NO.	DESCRIPTION	QTY.
90	CHECK VALVE STEM	2
91	CHECK VALVE BUSHING	2
92	DISCHARGE HEAD CAP	2
93	SUCTION TEE	1
94	O'RING – CONTROL VALVE	1
95	CONTROL VALVE BUSHING	1
96	O'RING – CONTROL VALVE	1
97	CONTROL VALVE CAP	1
98	SPRING PIN	2
99	SPRING PIN	1
100	BUSHING – TACHOMETER	1
101	TACHOMETER GEAR KEY	1
102	PLUG – TACHOMETER	1



TACHOMETER DETAIL



CONTROL VALVE DETAIL



B 2007–462 12/04/07 CLOSED SWING CHECK VALVE RJG

A 2007–462 12/04/07 CORRECTED PIN ORIENTATION RJG

W.S. DARLEY & CO.
MELROSE PARK, IL – CHIPPEWA FALLS, WI

OLD PART NO. –

DWG – JMP, 2 GEAR, MECH SEAL CROSS SECTION

DR'N DLW | DATE 11FEB00
CHKD SJL | SCALE 1/2
TRCD

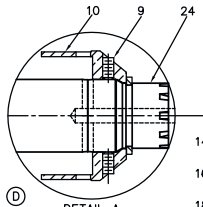
DJC0403

ALL DIMENSIONS IN INCHES UNLESS NOTED

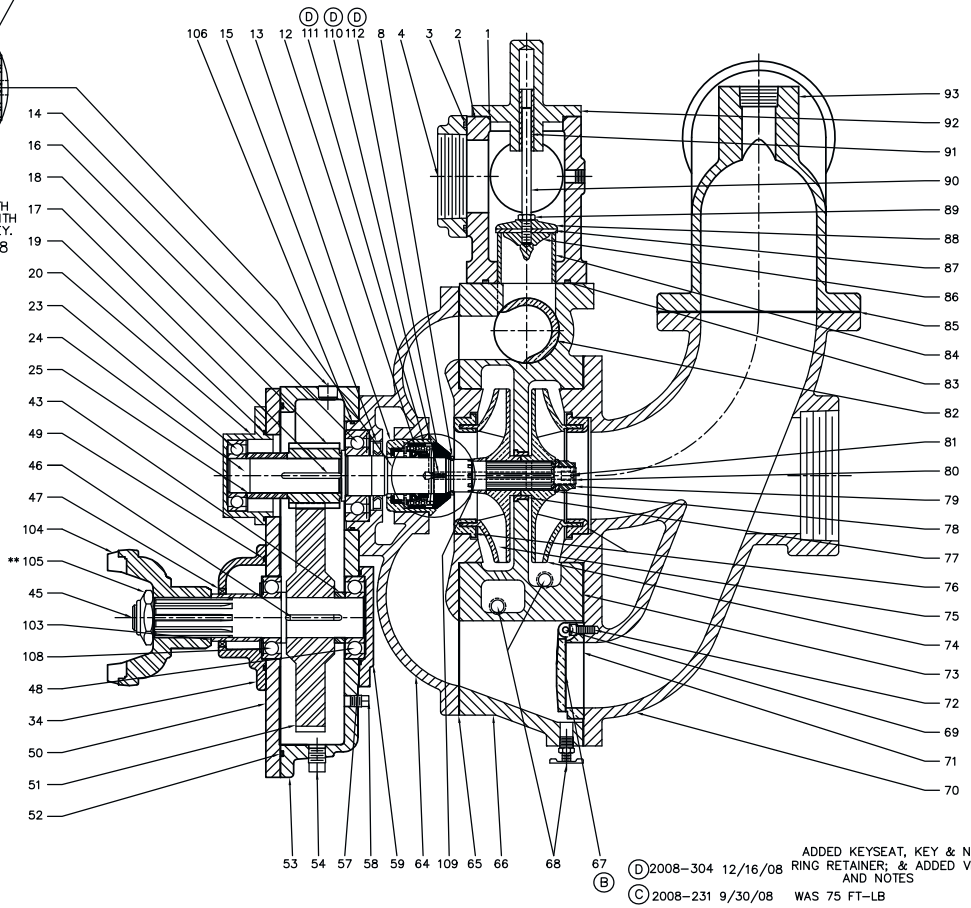
DO NOT SCALE PRINT

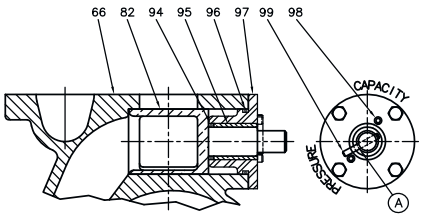
REP. NO.	DESCRIPTION	QTY.
1	O'RING – DISCHARGE HEAD COVER	2
2	DISCHARGE HEAD	1
3	O'RING – DISCHARGE FLANGE	3
4	DISCHARGE ADAPTER FLANGE	2
8	RETAINING RING	1
9	SET SCREW	2
10	SPRING RETAINER	1
12	MECHANICAL SEAL	1
13	SEAL HOUSING	1
14	OIL FILL PLUG	1
15	OIL SEAL – IMPELLER SHAFT	1
16	BEARING – IMPELLER SHAFT	1
17	GEAR KEY – PINION	1
18	PINION GEAR	1
19	O'RING – BEARING CAP	1
20	BEARING HOUSING	1
23	BEARING – IMPELLER SHAFT	1
24	IMPELLER SHAFT	1
25	PINION SPACER	1
34	BEARING CAP	1
43	DRIVE GEAR SPACER	1
45	DRIVE SHAFT	1
46	KEY – DRIVE GEAR	1
47	OIL SEAL – DRIVE SHAFT	1
48	BEARING – DRIVE SHAFT	1
49	O'RING – TACHOMETER HOUSING	1
50	GEAR CASE COVER	1
51	DRIVE GEAR	1
52	O'RING – GEAR CASE	1
53	GEARCASE	1
54	OIL DRAIN PLUG	1
57	O'RING – REAR BEARING COVER	1
58	OIL LEVEL PLUG	1
59	REAR BEARING COVER	1
64	INBOARD HEAD	1
65	GASKET – INBOARD HEAD	2
66	VOLUTE	1
67	CHECK VALVE COVER	1
68	DRAIN FITTING	3
69	SPRING PIN	1
70	OUTBOARD HEAD	1
71	CHECK VALVE SEAT	1
72	SOCKET HEAD CAP SCREW	4
73	GASKET – OUTBOARD HEAD	1
74	IMPELLER	1
75	IMPELLER	1
76	IMPELLER SEAL RING	2
77	INTERSTAGE SEAL RING	1
78	IMPELLER WASHER	1
79	IMPELLER NUT	1
80	SOCKET HEAD SET SCREW	1
81	IMPELLER SHAFT COTTER KEY	1
82	CONTROL VALVE PLUG	1
83	DISCHARGE HEAD O'RING	2
84	CHECK VALVE SEAT	2
85	SUCTION TEE GASKET	1
86	CHECK VALVE DIFFUSER	2
87	CHECK VALVE RUBBER	2
88	CHECK VALVE PLATE	2
89	CHECK VALVE STEM NUT	4

REP. NO.	DESCRIPTION	QTY.
90	CHECK VALVE STEM	2
91	CHECK VALVE BUSHING	2
92	DISCHARGE HEAD CAP	2
93	SUCTION TEE	1
94	O'RING – CONTROL VALVE	1
95	CONTROL VALVE BUSHING	1
96	O'RING – CONTROL VALVE	1
97	CONTROL VALVE CAP	1
98	SPRING PIN	2
99	SPRING PIN	1
103	SPACER – NO TACH (REF)	1
104	LOCK–ON YOKE	1
105	LOCK NUT – YOKE	1
106	O'RING – INBOARD HEAD	1
108	BEARING – DRIVE SHAFT	1
109	SPACER – IMPELLER SHAFT	1
(D) 110	1/8" SQ. X 3/8" LG, 316 SST KEY	1
(D) 111	RETAINER – SPRING, MECH. SEAL	1
112	IMPELLER SHAFT	1



DETAIL A
SCALE 1/1
DESIGN OF RETAINER WITH SET SCREWS; & SHAFT WITH NO KEYWAY AND NO KEY.
PRIOR TO 12/12/08





CONTROL VALVE DETAIL

** TORQUE YOKE NUT TO 125 LB–FT (C)
OPTIONAL TACHOMETER ASSEMBLY AVAILABLE

(D)	2008–304	12/16/08	ADDED KEYSEAT, KEY & NEW RING RETAINER; & ADDED VIEW AND NOTES — RJG
(C)	2008–231	9/30/08	WAS 75 FT–LB — AAN
(B)	2007–462	12/04/07	CLOSED SWING CHECK VALVE — RJG
(A)	2007–462	12/04/07	CORRECTED PIN ORIENTATION — RJG

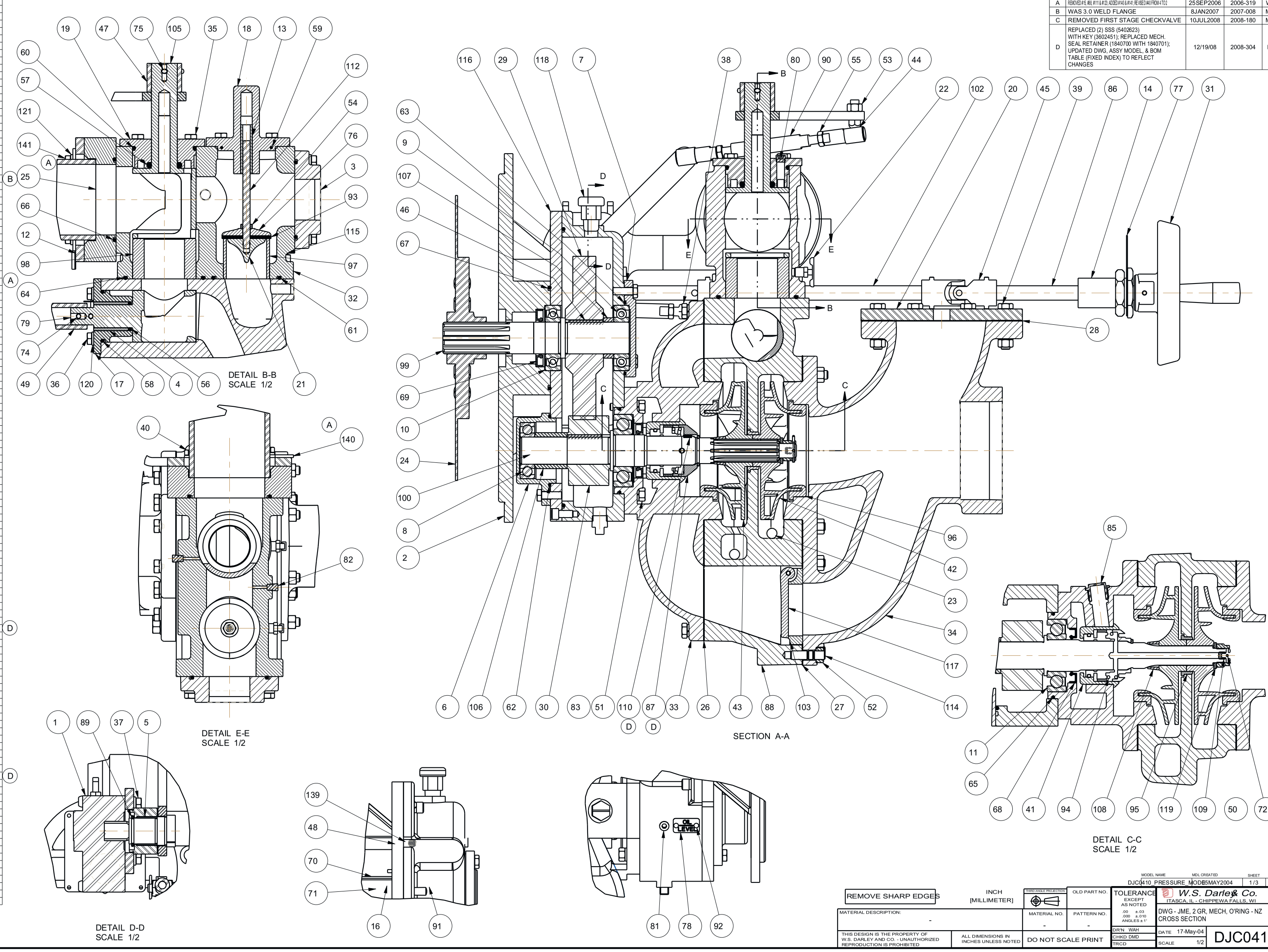
OLD PART NO. –

W.S. DARLEY & CO.
MELROSE PARK, IL – CHIPPEWA FALLS, WI

DWG – JMP, 2 GEAR, MECH SEAL, O'RING CROSS SECTION

DRN. CKE | CHKD SJL | TRCD | DATE 24JAN2003 | SCALE 1/2 | DJC0406

NO.	DESCRIPTION	PART NO.	QTY.
1	ACTUATOR - MANUAL, DEMCO BFV	-	1
2	ADAPTER - ENGINE, SAE#4, HE	-	1
3	ASSY - FLANGE, 1.5 BSP, CI	-	1
4	BEARING - OILITE, 1.000 ID	-	1
5	BEARING - OILITE, 1.1245 ID	-	1
6	BEARING CAP	-	1
7	BEARING CAP	-	1
8	BEARING-BALL, 206	-	1
9	BEARING-BALL, 207S	-	1
10	BEARING-BALL, 207SF	-	1
11	BEARING-BALL, 307SF	-	1
12	BRACKET - LEVER PIVOT	-	1
13	BUSHING - CHECK VALVE GUIDE	-	1
14	BUSHING - PANEL	-	1
16	CLEVIS - 3/8"	-	2
17	COVER - CONTROL VALVE	-	1
18	COVER - DISCHARGE HEAD	-	1
19	COVER - DISCHARGE HEAD	-	1
20	COVER - PLATE	-	1
21	DIFFUSER - CHECK VALVE	-	1
22	DRAINCOCK - 0.125 NPTM, 9KA	-	2
23	DRAINCOCK - 0.250 NPTM, 9KC BR	-	3
24	DRIVE DISC - TF, W/ISOLATOR	-	1
25	DISCHARGE HEAD ASSY	-	1
26	GASKET - INBOARD HEAD, J	-	1
27	GASKET - OUTBOARD HEAD, J	-	1
28	GASKET - SUCTION ELBOW	-	1
29	GEAR - DRIVE, H100, 12 DP	-	1
30	GEAR - PINION, H100, 12DP	-	1
31	HANDWHEEL - BFV GEAR	-	1
32	HEAD - DISCHARGE, J	-	1
33	HEAD - INBOARD, JMP, O'RING	-	1
34	HEAD - OUTBOARD, JMP	-	1
35	HHCS - .313-18 x 0.88, GR5	-	14
36	HHCS - .313-18 x 1.00, GR5	-	4
37	HHCS - .375-16 x 0.88, GR5	-	4
38	HHCS - .375-16 x 1.25, GR5	-	10
39	HHCS - .375-16 x 1.75, GR5	-	8
40	HHCS - .375-16 x 2.25, GR5	-	2
41	HOUSING - MECHANICAL SEAL	-	1
42	IMPELLER - JMP, 500, LH	-	1
43	IMPELLER - JMP, 500, RH	-	1
44	JOINT - BALL, .38"	-	2
45	JOINT - UNIVERSAL, 0.625"	-	2
46	KEY - SQ., 0.19X1.50 GR2	-	2
47	LEVER - SHUTTLE VALVE	-	1
48	LEVER - STAGING SHIFT	-	1
49	LEVER - STAGING VALVE	-	1
50	NUT - CASTLE, .625-18, 303	-	1
51	NUT - HEX, .313-18, GR2	-	4
52	NUT - HEX, .375-16, GR2	-	41
53	NUT - HEX, .375-24, GR2	-	2
54	NUT - JAM, .313-24, SST	-	1
55	NUT - JAM, .375-24, SST	-	4
56	O-RING - 1.00 x 1.25 x 0.12	-	1
57	O-RING - 1.13 x 1.50 x 0.19	-	1
58	O-RING - 2.00 x 2.25 x 0.12	-	1
59	O-RING - 2.06 x 2.25 x 0.09	-	1
60	O-RING - 2.50 x 2.75 x 0.12	-	1
61	O-RING - 2.75 x 3.00 x 0.12	-	1
62	O-RING - 2.88 x 3.06 X 0.09	-	1
63	O-RING - 3.00 x 3.19 X 0.09	-	1
64	O-RING - 3.25 x 3.50 x 0.12	-	1
65	O-RING - 3.50 x 3.69 X 0.09	-	1
66	O-RING - 3.38 x 3.62 x 0.12	-	1
67	O-RING - 4.25 x 4.50 X 0.12	-	1
68	OIL SEAL - 1.375 ID X 2.378 OD	-	1
69	OIL SEAL - 1.375 ID X 2.506 OD	-	1
70	PIN - CLEVIS, .375 X .938 G.L.	-	2
71	PIN - COTTER, .094 x .750, SST	-	2
72	PIN - COTTER, .094 x 1.00, SST	-	1
73	PIN - PUMP MODE INDICATOR	-	1
74	PIN - SPRING, 0.19 X 1.38	-	7
75	PIN - SPRING, 0.19 X 2.25, SST	-	1
76	PLATE - CHECK VALVE	-	1
77	PLATE - HANDWHEEL ORIENTATION	-	1
78	PLATE - OIL LEVEL	-	1
79	PLUG - CONTROL VALVE, JME-NZ	-	1
80	PLUG - PIPE, 0.125, SST SOC HD	-	2
81	PLUG - PIPE, 0.125, ZN SOC HD	-	4
82	PLUG - PIPE, 0.250, SST SOC HD	-	2
83	PLUG - PIPE, 0.375, MAG SQ HD	-	1
84	PLUG - PIPE, 0.375, ZN SOC HD	-	2
85	PLUG - PLASTIC	-	1
86	SHAFT - SHIFT EXTENSION, 23.875"	-	1
87	RETAINER - SPRING, MECH. SEAL	-	1
88	PUMP CASING - JMP, LH	-	1
89	RING - RETAINER, 5160-112-S-ST	-	2
90	ROD - CONNECTING	-	1
91	ROD - CONNECTING	-	1
92	SCREW - DRIVE, NO.4 X 0.25 AL	-	2
93	SEAL - CHECK VALVE, H	-	1
94	MECHANICAL SEAL - 1.25" WELD SPRING	-	1
95	SEAL RING - J, INTERSTAGE	-	1
96	SEAL RING - JMP500	-	2
97	SEAT - CHECK VALVE	-	1
98	SEAT - CHECK VALVE, JME-NZ	-	1
99	SHAFT - DRIVE, HE/JME	-	1
100	SHAFT - IMPELLER, JMP 2GR CARB	-	1
102	SHAFT - SHIFT EXTENSION, 35.875"	-	1
103	SHCS - .250-20 X 0.63, SST	-	4
104	SHCS - .375-16 x 1.25, GR8	-	4
105	SHUTTLE VALVE	-	1
106	SPACER - 1.19 X 1.56 X 1.406	-	1
107	SPACER - 1.38 X 1.75 X .448	-	1
108	SPACER - IMPELLER SHAFT	-	1
109	SSS - .313 x 0.31, SST	-	1
110	KEY - SQ., .125 x 0.375 LG 316 SST	-	1
112	STEM - CHECK VALVE	-	1
113	STUD - 0.31 X 1.5	-	4
114	STUD - 0.375-16 X 1.500, GR5	-	23
115	STUD - 0.375-16 X 1.625, GR5	-	10
116	TRANS - GEARCASE ASSY, JME/JMF	-	1
117	VALVE - SUCT CHECK, JMP500	-	1
118	VENT - GEARCASE	-	1
119	WASHER - .64 X 1.12 X .12, 303	-	1
120	WASHER - LOCK, 0.313 ID	-	8
121	WASHER - LOCK, 0.375 ID	-	28
122	WASHER - LOCK, HC, 0.375 ID	-	14
139	PIN - SPRING, 0.12 X 0.62	-	1
140	BRACKET - PUMP POSITION INDICATOR	-	1
141	HHCS - .375-16 x 2.50, GR5	-	2
142	WASHER - FLAT, 3/8, SST	-	1



REVISIONS

LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REMOVED #16, #88, #111 & #123; ADDED #140 & #141; REVISED #40 FROM 4 TO 2	25SEP2006	2006-319	WAH
B	WAS 3.0 WELD FLANGE	8JAN2007	2007-008	MWE
C	REMOVED FIRST STAGE CHECKVALVE	10JUL2008	2008-180	MWE
D	REPLACED (2) SSS (5402623) WITH KEY (3602451); REPLACED MECH. SEAL RETAINER (1840700 WITH 1840701); UPDATED DWG, ASSY MODEL, & BOM TABLE (FIXED INDEX) TO REFLECT CHANGES	12/19/08	2008-304	RJG

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

MATERIAL DESCRIPTION: -

MATERIAL NO. -

PATTERN NO. -

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

MODEL NAME DJC0410_PRESSURE_MODE
MDL CREATED 5MAY2004
SHEET 1/3 D

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

DWG - JME, 2 GR, MECH, O'RING - NZ
CROSS SECTION

DR'N WAH
CHKD DMD
TRCD

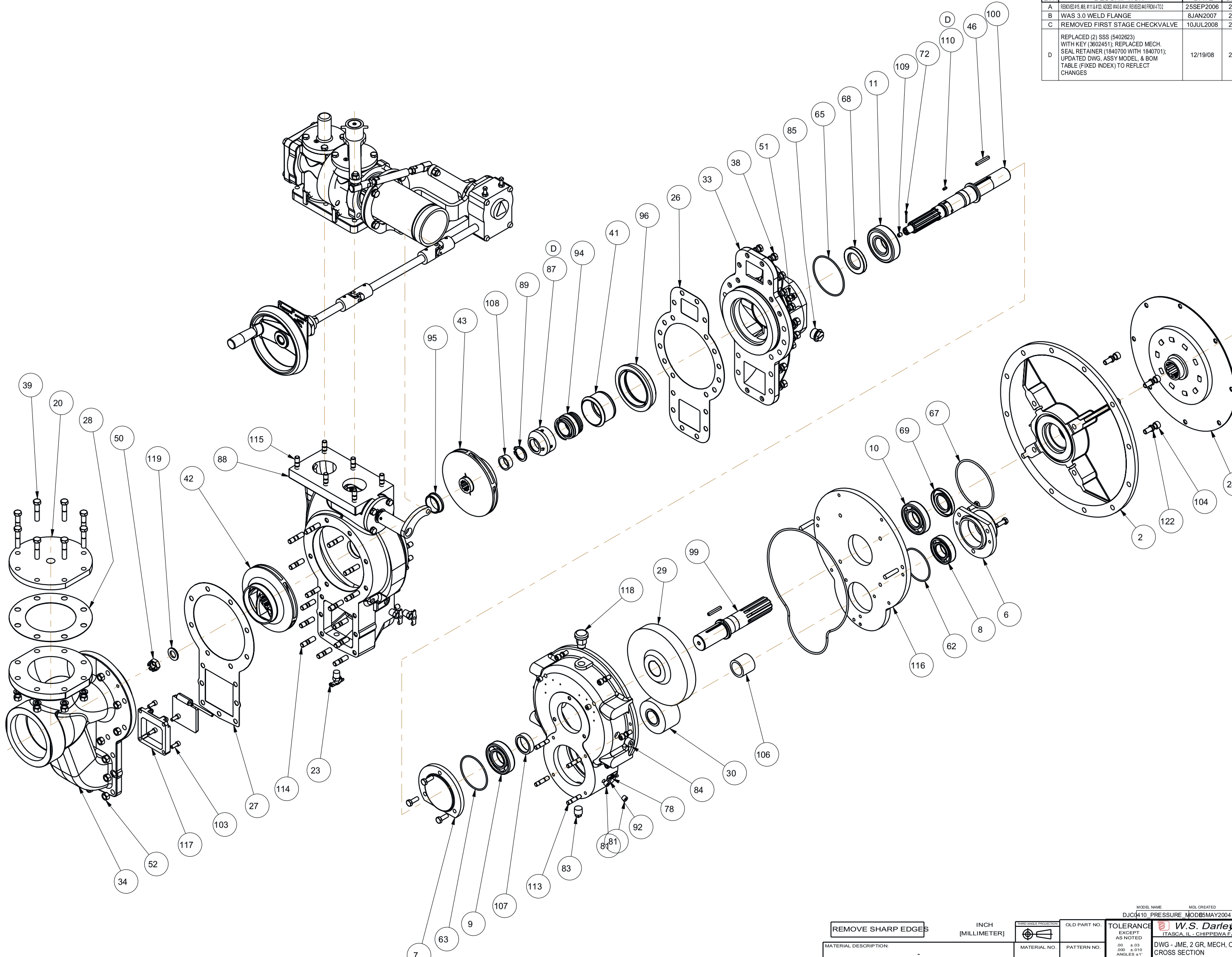
DATE 17-May-04
SCALE 1/2

DJC0410

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

NO.	DESCRIPTION	PART NO.	QTY.
1	ACTUATOR - MANUAL, DEMCO BFV	-	1
2	ADAPTER - ENGINE, SAE#4, HE	-	1
3	ASSY - FLANGE, 1.5 BSP, CI	-	1
4	BEARING - OILITE, 1.000 ID	-	1
5	BEARING - OILITE, 1.1245 ID	-	1
6	BEARING CAP	-	1
7	BEARING CAP	-	1
8	BEARING-BALL, 206	-	1
9	BEARING-BALL, 207S	-	1
10	BEARING-BALL, 207SF	-	1
11	BEARING-BALL, 307SF	-	1
12	BRACKET - LEVER PIVOT	-	1
13	BUSHING - CHECK VALVE GUIDE	-	1
14	BUSHING - PANEL	-	1
16	CLEVIS - 3/8"	-	2
17	COVER - CONTROL VALVE	-	1
18	COVER - DISCHARGE HEAD	-	1
19	COVER - DISCHARGE HEAD	-	1
20	COVER - PLATE	-	1
21	DIFFUSER - CHECK VALVE	-	1
22	DRAINCOCK - 0.125 NPTM, 9KA	-	2
23	DRAINCOCK - 0.250 NPTM, 9KC BR	-	3
24	DRIVE DISC - TF, W/ISOLATOR	-	1
25	DISCHARGE HEAD ASSY	-	1
26	GASKET - INBOARD HEAD, J	-	1 (B)
27	GASKET - OUTBOARD HEAD, J	-	1
28	GASKET - SUCTION ELBOW	-	1
29	GEAR - DRIVE, H100, 12 DP	-	1
30	GEAR - PINION, H100, 12DP	-	1
31	HANDWHEEL - BFV GEAR	-	1
32	HEAD - DISCHARGE, J	-	1
33	HEAD - INBOARD, JMP, O'RING	-	1
34	HEAD - OUTBOARD, JMP	-	1
35	HHCS - .313-18 x 0.88, GR5	-	14
36	HHCS - .313-18 x 1.00, GR5	-	4
37	HHCS - .375-16 x 0.88, GR5	-	4
38	HHCS - .375-16 x 1.25, GR5	-	10
39	HHCS - .375-16 x 1.75, GR5	-	8
40	HHCS - .375-16 x 2.25, GR5	-	2 (A)
41	HOUSING - MECHANICAL SEAL	-	1
42	IMPELLER - JMP, 500, LH	-	1
43	IMPELLER - JMP, 500, RH	-	1
44	JOINT - BALL, .38"	-	2
45	JOINT - UNIVERSAL, 0.625"	-	2
46	KEY - SQ., 0.19X1.50 GR2	-	2
47	LEVER - SHUTTLE VALVE	-	1
48	LEVER - STAGING SHIFT	-	1
49	LEVER - STAGING VALVE	-	1
50	NUT - CASTLE, .625-18, 303	-	1
51	NUT - HEX, .313-18, GR2	-	4
52	NUT - HEX, .375-16, GR2	-	41
53	NUT - HEX, .375-24, GR2	-	2
54	NUT - JAM, .313-24, SST	-	1
55	NUT - JAM, .375-24, SST	-	4
56	O-RING - 1.00 x 1.25 x 0.12	-	1
57	O-RING - 1.13 x 1.50 x 0.19	-	1
58	O-RING - 2.00 x 2.25 x 0.12	-	1
59	O-RING - 2.06 x 2.25 x 0.09	-	1
60	O-RING - 2.50 x 2.75 x 0.12	-	1
61	O-RING - 2.75 x 3.00 x 0.12	-	1
62	O-RING - 2.88 x 3.06 X 0.09	-	1
63	O-RING - 3.00 x 3.19 X 0.09	-	1
64	O-RING - 3.25 x 3.50 x 0.12	-	1
65	O-RING - 3.50 x 3.69 X 0.09	-	1
66	O-RING - 3.38 x 3.62 x 0.12	-	1
67	O-RING - 4.25 x 4.50 X 0.12	-	1
68	OIL SEAL - 1.375 ID X 2.378 OD	-	1
69	OIL SEAL - 1.375 ID X 2.506 OD	-	1
70	PIN - CLEVIS, .375 X .938 G.L.	-	2
71	PIN - COTTER, .094 x .750, SST	-	2
72	PIN - COTTER, .094 x 1.00, SST	-	1
73	PIN - PUMP MODE INDICATOR	-	1
74	PIN - SPRING, 0.19 X 1.38	-	7
75	PIN - SPRING, 0.19 X 2.25, SST	-	1
76	PLATE - CHECK VALVE	-	1
77	PLATE - HANDWHEEL ORIENTATION	-	1
78	PLATE - OIL LEVEL	-	1
79	PLUG - CONTROL VALVE, JME-NZ	-	1
80	PLUG - PIPE, 0.125, SST SOC HD	-	2
81	PLUG - PIPE, 0.125, ZN SOC HD	-	4
82	PLUG - PIPE, 0.250, SST SOC HD	-	2
83	PLUG - PIPE, 0.375, MAG SQ HD	-	1
84	PLUG - PIPE, 0.375, ZN SOC HD	-	2
85	PLUG - PLASTIC	-	1
86	SHAFT - SHIFT EXTENSION, 23.875"	-	1 (D)
87	RETAINER - SPRING, MECH. SEAL	-	1
88	PUMP CASING - JMP, LH	-	1
89	RING - RETAINER, 5160-112-S-ST	-	2
90	ROD - CONNECTING	-	1
91	ROD - CONNECTING	-	1
92	SCREW - DRIVE, NO.4 X 0.25 AL	-	2
93	SEAL - CHECK VALVE, H	-	1
94	MECHANICAL SEAL - 1.25" WELD SPRING	-	1
95	SEAL RING - J, INTERSTAGE	-	1
96	SEAL RING - JMP500	-	2
97	SEAT - CHECK VALVE	-	1
98	SEAT - CHECK VALVE, JME-NZ	-	1
99	SHAFT - DRIVE, HE/JME	-	1
100	SHAFT - IMPELLER, JMP 2GR CARB	-	1
102	SHAFT - SHIFT EXTENSION, 35.875"	-	1
103	SHCS - .250-20 X 0.63, SST	-	4
104	SHCS - .375-16 x 1.25, GR8	-	4
105	SHUTTLE VALVE	-	1
106	SPACER - 1.19 X 1.56 X 1.406	-	1
107	SPACER - 1.38 X 1.75 X .448	-	1
108	SPACER - IMPELLER SHAFT	-	1 (D)
109	SSS - .313 x 0.31, SST	-	1
110	KEY - SQ., .125 x 0.375 LG 316 SST	-	1
112	STEM - CHECK VALVE	-	1
113	STUD - 0.31 X 1.5	-	4
114	STUD - 0.375-16 X 1.500, GR5	-	23
115	STUD - 0.375-16 X 1.625, GR5	-	10
116	TRANS - GEARCASE ASSY, JME/JMF	-	1
117	VALVE - SUCT CHECK, JMP500	-	1
118	VENT - GEARCASE	-	1
119	WASHER - .64 X 1.12 X .12, 303	-	1
120	WASHER - LOCK, 0.313 ID	-	8
121	WASHER - LOCK, 0.375 ID	-	28
122	WASHER - LOCK, HC, 0.375 ID	-	14
139	PIN - SPRING, 0.12 X 0.62	-	1
140	BRACKET - PUMP POSITION INDICATOR	-	1
141	HHCS - .375-16 x 2.50, GR5	-	2
142	WASHER - FLAT, 3/8, SST	-	1



REVISIONS

LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REMOVED #15, #88, #111 & #123; ADDED #140 & #141; REVISED #40 FROM 4 TO 2	25SEP2006	2006-319	WAH
B	WAS 3.0 WELD FLANGE	8JAN2007	2007-008	MWE
C	REMOVED FIRST STAGE CHECKVALVE	10JUL2008	2008-180	MWE
D	REPLACED (2) SSS (5402623) WITH KEY (3602451); REPLACED MECH. SEAL RETAINER (1840700 WITH 1840701); UPDATED DWG, ASSY MODEL, & BOM TABLE (FIXED INDEX) TO REFLECT CHANGES	12/19/08	2008-304	RJG

MODEL NAME: DJC0410_PRESSURE_MODE
MDL CREATED: 05MAY2004
SHEET: 2/3 D

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

TOLERANCE EXCEPT AS NOTED
.00 ±.03
.000 ±.010
ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

MATERIAL DESCRIPTION: -

MATERIAL NO. -

PATTERN NO. -

DWG - JME, 2 GR, MECH, O'RING - NZ CROSS SECTION

DR'N JSS
CHKD WAH
TRCD

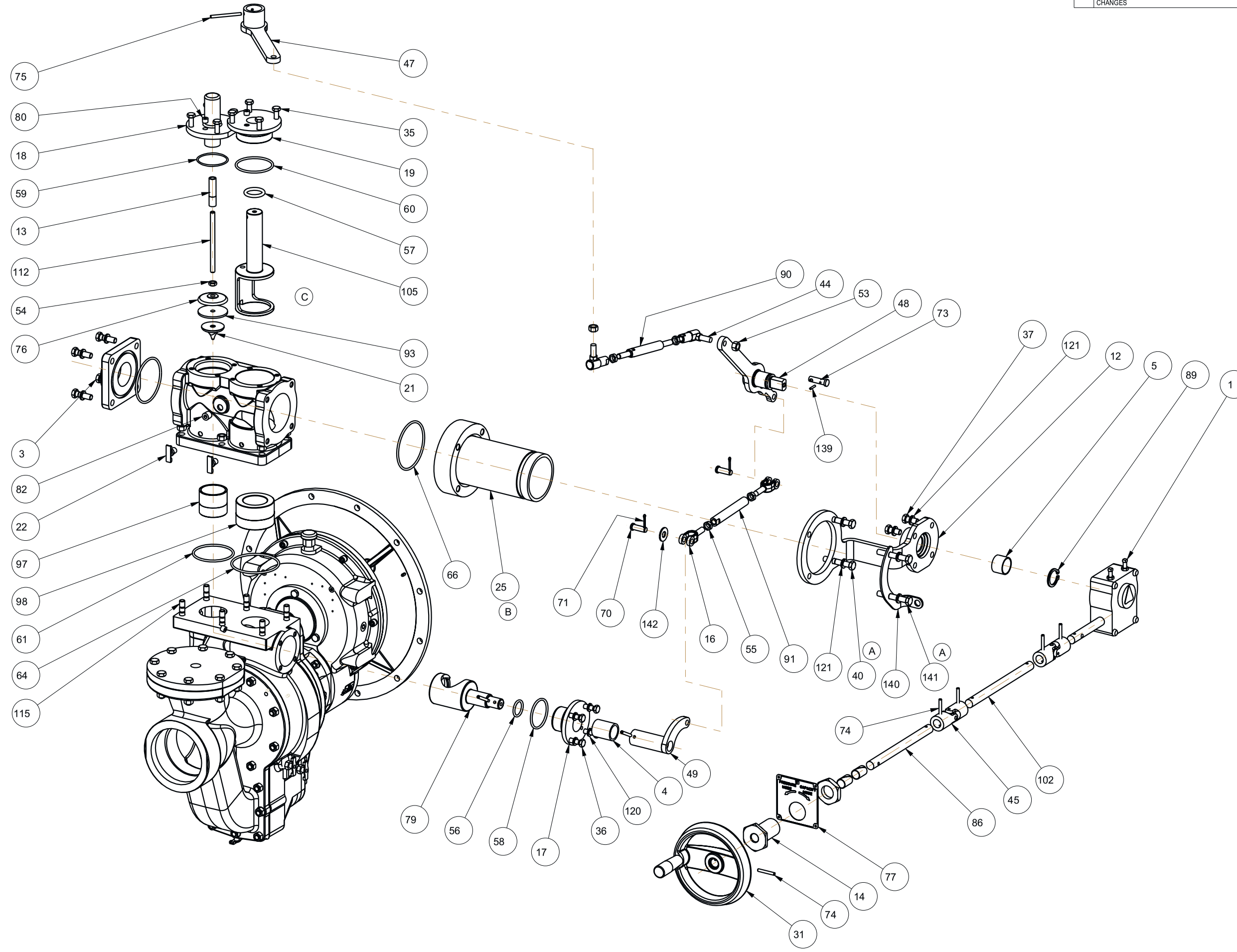
DATE 24-Jun-04
SCALE 1/4

DJC0410

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

NO.	DESCRIPTION	PART NO.	QTY.	
1	ACTUATOR - MANUAL, DEMCO BFV	2603103	1	
2	ADAPTER - ENGINE, SAE#4, HE	2001517	1	
3	ASSY - FLANGE, 1.5 BSP, CI	YF01001	1	
4	BEARING - OILITE, 1.000 ID	1760008	1	
5	BEARING - OILITE, 1.1245 ID	1760028	1	
6	BEARING CAP	2300601	1	
7	BEARING CAP	2301008	1	
8	BEARING-BALL, 206	1720702	1	
9	BEARING-BALL, 207S	1720104	1	
10	BEARING-BALL, 207SF	1720103	1	
11	BEARING-BALL, 307SF	1721903	1	
12	BRACKET - LEVER PIVOT	4030800	1	
13	BUSHING - CHECK VALVE GUIDE	5320400	1	
14	BUSHING - PANEL	1762201	1	
16	CLEVIS - 3/8"	4400300	2	
17	COVER - CONTROL VALVE	2502901	1	
18	COVER - DISCHARGE HEAD	2502800	1	
19	COVER - DISCHARGE HEAD	2507500	1	
20	COVER - PLATE	2506800	1	
21	DIFFUSER - CHECK VALVE	5300500	1	
22	DRAINCOCK - 0.125 NPTM, 9KA	5200900	2	
23	DRAINCOCK - 0.250 NPTM, 9KC BR	5203600	3	
24	DRIVE DISC - TF, W/ISOLATOR	2003301	1	
25	DISCHARGE HEAD ASSY	2811000	1	B
26	GASKET - INBOARD HEAD, J	3811000	1	
27	GASKET - OUTBOARD HEAD, J	3810900	1	
28	GASKET - SUCTION ELBOW	3810000	1	
29	GEAR - DRIVE, H100, 12 DP	2713214	1	
30	GEAR - PINION, H100, 12DP	2713915	1	
31	HANDWHEEL - BFV GEAR	3001100	1	
32	HEAD - DISCHARGE, J	2810300	1	
33	HEAD - INBOARD, JMP, O'RING	2804808	1	
34	HEAD - OUTBOARD, JMP	2804900	1	
35	HHCS - .313-18 x 0.88, GR5	5400019	14	
36	HHCS - .313-18 x 1.00, GR5	5400020	4	
37	HHCS - .375-16 x 0.88, GR5	5400035	4	
38	HHCS - .375-16 x 1.25, GR5	5400037	10	
39	HHCS - .375-16 x 1.75, GR5	5400039	8	
40	HHCS - .375-16 x 2.25, GR5	5400041	2	A
41	HOUSING - MECHANICAL SEAL	1840800	1	
42	IMPELLER - JMP, 500, LH	2906800	1	
43	IMPELLER - JMP, 500, RH	2906801	1	
44	JOINT - BALL, .38"	4403100_BALL	2	
45	JOINT - UNIVERSAL, 0.625"	4814800	2	
46	KEY - SQ., 0.19X1.50 GR2	3602441	2	
47	LEVER - SHUTTLE VALVE	3004000	1	
48	LEVER - STAGING SHIFT	3005200	1	
49	LEVER - STAGING VALVE	3007902	1	
50	NUT - CASTLE, .625-18, 303	5403430	1	
51	NUT - HEX, .313-18, GR2	5403001	4	
52	NUT - HEX, .375-16, GR2	5403002	41	
53	NUT - HEX, .375-24, GR2	5403004	2	
54	NUT - JAM, .313-24, SST	5403204	1	
55	NUT - JAM, .375-24, SST	5403209	4	
56	O-RING - 1.00 x 1.25 x 0.12	3601211	1	
57	O-RING - 1.13 x 1.50 x 0.19	3601310	1	
58	O-RING - 2.00 x 2.25 x 0.12	3601208	1	
59	O-RING - 2.06 x 2.25 x 0.09	3601109	1	
60	O-RING - 2.50 x 2.75 x 0.12	3601204	1	
61	O-RING - 2.75 x 3.00 x 0.12	3601206	1	
62	O-RING - 2.88 x 3.06 X 0.09	3601126	1	
63	O-RING - 3.00 x 3.19 X 0.09	3601125	1	
64	O-RING - 3.25 x 3.50 x 0.12	3601246	1	
65	O-RING - 3.50 x 3.69 X 0.09	3601124	1	
66	O-RING - 3.38 x 3.62 x 0.12	3601214	1	
67	O-RING - 4.25 x 4.50 X 0.12	3601239	1	
68	OIL SEAL - 1.375 ID X 2.378 OD	3600550	1	
69	OIL SEAL - 1.375 ID X 2.506 OD	3600542	1	
70	PIN - CLEVIS, .375 X .938 G.L.	4401500	2	
71	PIN - COTTER, .094 x .750, SST	3605201	2	
72	PIN - COTTER, .094 x 1.00, SST	3605202	1	
73	PIN - PUMP MODE INDICATOR	5329500	1	
74	PIN - SPRING, 0.19 X 1.38	3605007	7	
75	PIN - SPRING, 0.19 X 2.25, SST	3605027	1	
76	PLATE - CHECK VALVE	5280800	1	
77	PLATE - HANDWHEEL ORIENTATION	1975900	1	
78	PLATE - OIL LEVEL	1960400	1	
79	PLUG - CONTROL VALVE, JME-NZ	5325502	1	
80	PLUG - PIPE, 0.125, SST SOC HD	1080533	2	
81	PLUG - PIPE, 0.125, ZN SOC HD	1080537	4	
82	PLUG - PIPE, 0.250, SST SOC HD	1080535	2	
83	PLUG - PIPE, 0.375, MAG SQ HD	1080536	1	
84	PLUG - PIPE, 0.375, ZN SOC HD	1080541	2	
85	PLUG - PLASTIC	4208800	1	
86	SHAFT - SHIFT EXTENSION, 23.875"	5020401	1	D
87	RETAINER - SPRING, MECH. SEAL	1840701	1	
88	PUMP CASING - JMP, LH	2054300	1	
89	RING - RETAINER, 5160-112-S-ST	3600416	2	
90	ROD - CONNECTING	1042100	1	
91	ROD - CONNECTING	1042200	1	
92	SCREW - DRIVE, NO.4 X 0.25 AL	5402820	2	
93	SEAL - CHECK VALVE, H	3809900	1	
94	MECHANICAL SEAL - 1.25" WELD SPRING	1841205	1	
95	SEAL RING - J, INTERSTAGE	3402500	1	
96	SEAL RING - JMP500	3406900	2	
97	SEAT - CHECK VALVE	5261400	1	
98	SEAT - CHECK VALVE, JME-NZ	5262400	1	
99	SHAFT - DRIVE, HE/JME	5002837	1	
100	SHAFT - IMPELLER, JMP 2GR CARB	5005102	1	
102	SHAFT - SHIFT EXTENSION, 35.875"	5020400	1	
103	SHCS - .250-20 X 0.63, SST	5401403	4	
104	SHCS - .375-16 x 1.25, GR8	5401024	4	
105	SHUTTLE VALVE	5329200	1	
106	SPACER - 1.19 X 1.56 X 1.406	3307700	1	
107	SPACER - 1.38 X 1.75 X .448	3302010	1	
108	SPACER - IMPELLER SHAFT	1885000	1	D
109	SSS - .313 x 0.31, SST	5402607	1	
110	KEY - SQ., .125 x 0.375 LG 316 SST	3602451	1	
112	STEM - CHECK VALVE	5241902	1	
113	STUD - 0.31 X 1.5	3606102	4	
114	STUD - 0.375-16 X 1.500, GR5	3606203	23	
115	STUD - 0.375-16 X 1.625, GR5	3606204	10	
116	TRANS - GEARCASE ASSY, JME/JMF	TG00317	1	
117	VALVE - SUCT CHECK, JMP500	VK00405	1	
118	VENT - GEARCASE	4401800	1	
119	WASHER - .64 X 1.12 X .12, 303	3603318	1	
120	WASHER - LOCK, 0.313 ID	3603502	8	
121	WASHER - LOCK, 0.375 ID	3603503	28	
122	WASHER - LOCK, HC, 0.375 ID	3603512	14	
139	PIN - SPRING, 0.12 X 0.62	3605000	1	
140	BRACKET - PUMP POSITION INDICATOR	4033600	1	
141	HHCS - .375-16 x 2.50, GR5	5400042	2	
142	WASHER - FLAT, 3/8, SST	3603809	1	



REVISIONS

LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REMOVED #15, #88, #111 & #123; ADDED #140 & #141; REVISED #40 FROM 4 TO 2	25SEP2006	2006-319	WAH
B	WAS 3.0 WELD FLANGE	8JAN2007	2007-008	MWE
C	REMOVED FIRST STAGE CHECKVALVE	10JUL2008	2008-180	MWE
D	REPLACED (2) SSS (5402623) WITH KEY (3602451); REPLACED MECH. SEAL RETAINER (1840700 WITH 1840701); UPDATED DWG, ASSY MODEL, & BOM TABLE (FIXED INDEX) TO REFLECT CHANGES	12/19/08	2008-304	RJG

MODEL NAME: DJC0410_PRESSURE_MODE | MDL CREATED: 05MAY2004 | SHEET: 3/3 | D

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

MATERIAL DESCRIPTION: -

MATERIAL NO. -

PATTERN NO. -

DWG - JME, 2 GR, MECH, O'RING - NZ CROSS SECTION

THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

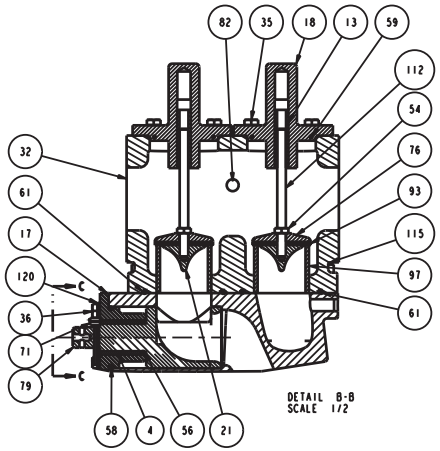
DR'N JSS
CHKD WAH
TRCD

DATE 24-Jun-04
SCALE 1/4

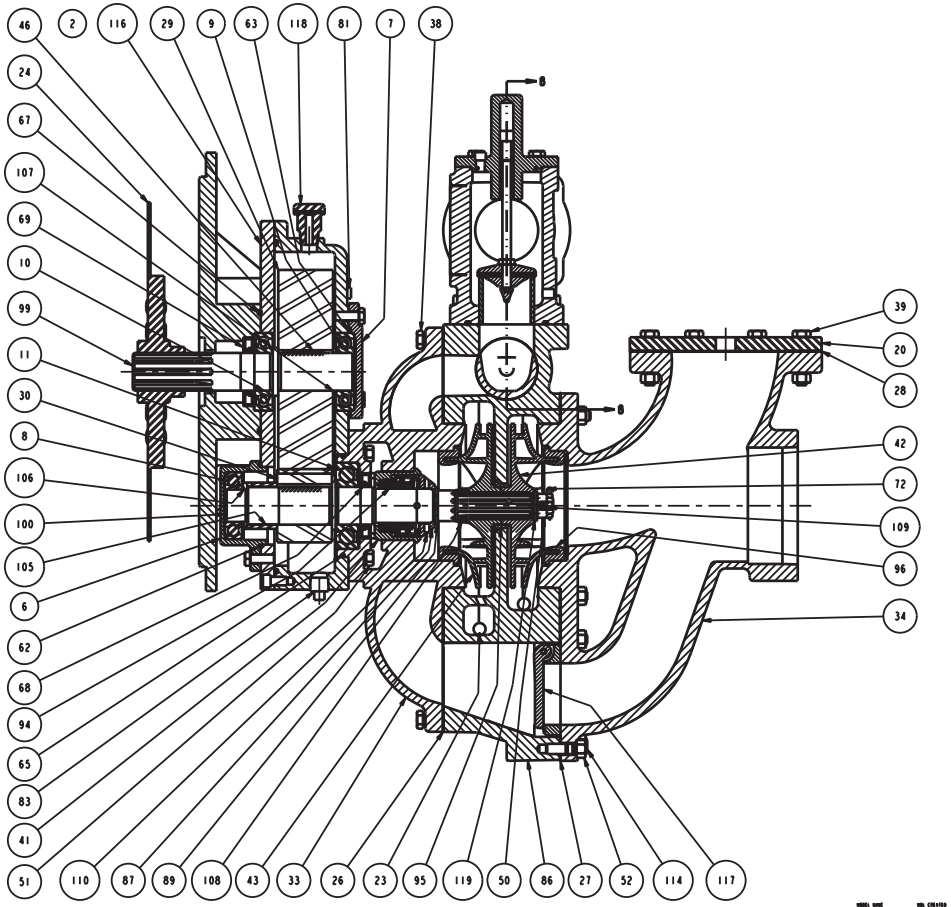
DJC0410

NO.	DESCRIPTION	PART NO.	QTY.
2	ADAPTER - ENGINE, SAE#4, HC	-	1
4	BEARING - OILITE, 1.000 ID	-	1
6	BEARING CAP	-	1
7	BEARING CAP	-	1
8	BEARING-BALL, 206	-	1
9	BEARING-BALL, 207S	-	1
10	BEARING-BALL, 207SF	-	1
11	BEARING-BALL, 307SF	-	1
13	BUSHING - CHECK VALVE GUIDE	-	2
17	COVER - CONTROL VALVE	-	1
18	COVER - DISCHARGE HEAD	-	2
20	COVER - PLATE	-	1
21	DIFFUSER - CHECK VALVE	-	2
22	DRAINCOCK - 0.125 NPTH, 90A	-	1
23	DRAINCOCK - 0.250 NPTH, 90C BR	-	3
24	DRIVE DISC - TF, W/ISOLATOR	-	1
26	GASKET - INBOARD HEAD, J	-	1
27	GASKET - OUTBOARD HEAD, J	-	1
28	GASKET - SUCTION ELBOW	-	1
29	GEAR - DRIVE, JMP, 12DP	-	1
30	GEAR - PINION, JMP, 12DP	-	1
32	HEAD - DISCHARGE, J	-	1
33	HEAD - INBOARD, JMP, O'RING	-	1
34	HEAD - OUTBOARD, JMP	-	1
35	HHCS - .313-18 x 0.88, GR5	-	14
36	HHCS - .313-18 x 1.00, GR5	-	4
38	HHCS - .375-16 x 1.25, GR5	-	10
39	HHCS - .375-16 x 1.75, GR5	-	8
41	HOUSING - MECHANICAL SEAL	-	1
42	IMPELLER - JMP, 500, LH	-	1
43	IMPELLER - JMP, 500, RH	-	1
46	KEY - SQ, 0.1981.50 GR2	-	2
50	NUT - CASTLE, .625-18, 303	-	1
51	NUT - HEX, .313-18, GR2	-	4
52	NUT - HEX, .375-16, GR2	-	41
54	NUT - JAM, .313-24, SST	-	2
56	O-RING - 1.00 x 1.25 x 0.12	-	1
58	O-RING - 2.00 x 2.25 x 0.12	-	1
59	O-RING - 2.06 x 2.25 x 0.09	-	2
61	O-RING - 2.75 x 3.00 x 0.12	-	2
62	O-RING - 2.88 x 3.06 X 0.09	-	1
63	O-RING - 3.00 x 3.19 X 0.09	-	1
65	O-RING - 3.50 x 3.69 X 0.09	-	1
67	O-RING - 4.25 x 4.50 X 0.12	-	1
68	OIL SEAL - 1.375 ID X 2.378 OD	-	1
69	OIL SEAL - 1.375 ID X 2.500 OD	-	2
71	PIN - SPRING, 0.25 X 0.62	-	2
72	PIN - COTTER, .094 x 1.00, SST	-	1
74	PIN - SPRING, 0.19 X 1.38	-	1
76	PLATE - CHECK VALVE	-	2
78	PLATE - OIL LEVEL	-	1
79	PLUG - CONTROL VALVE, JMP500	-	1
80	PLUG - PIPE, 0.125, SST SOC HD	-	2
81	PLUG - PIPE, 0.125, ZN SOC HD	-	3
82	PLUG - PIPE, 0.250, SST SOC HD	-	1
83	PLUG - PIPE, 0.375, MAG SO HD	-	1
84	PLUG - PIPE, 0.375, ZN SOC HD	-	2
85	PLUG - PLASTIC	-	1
86	PUMP CASING - JMP, LH	-	1
87	RETAINER - SPRING, MECH. SEAL	-	1
89	RING - RETAINER, 5160-112-S-ST	-	1
92	SCREW - DRIVE, NO.4 X 0.25 AL	-	2
93	SEAL - CHECK VALVE, N	-	2
94	FLORSERVE SEAL - 1.25" WELD SPRING	-	1
95	SEAL RING - J, INTERSTAGE	-	1
96	SEAL RING - JMP500	-	2
97	SEAT - CHECK VALVE	-	2
99	SHAFT - DRIVE, HC/JMC	-	1
100	SHAFT - IMPELLER, JMP, MECH SEAL	-	1
103	SHCS - .250-20 X 0.63, SST	-	4
104	SHCS - .375-16 x 1.25, GR8	-	4
105	SPACER - 1.38 X 1.69 X 1.09	-	1
106	SPACER - 1.19 X 1.69 X 0.19	-	1
107	SPACER - 1.38 X 1.75 X 0.10	-	1
108	SPACER - IMPELLER SHAFT	-	1
109	SSS - .313 x 0.31, SST	-	2
110	SSS - NO.10-32 x 0.38, SST	-	2
112	STEM - CHECK VALVE	-	2
113	STUD - 0.31 X 1.5	-	4
114	STUD - 0.375-16 X 1.500, GR5	-	22
115	STUD - 0.375-16 X 1.625, GR5	-	10
116	TRANS - GEARCASE ASST, JMC/JMF	-	1
117	VALVE - SWCT CHECK, JMP500	-	1
118	VENT - GEARCASE	-	1
119	WASHER - .64 X 1.12 X .12, 303	-	1
120	WASHER - LOCK, 0.313 ID	-	8
121	WASHER - LOCK, 0.375 ID	-	20
122	WASHER - LOCK, HC, 0.375 ID	-	14

DETAIL C-C



DETAIL B-B
SCALE 1/2



REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D

REMOVE SHARP EDGES

INCH (MILLIMETER)

MATERIAL DESCRIPTION:

MATERIAL NO. | PATTERN NO. | OLD PART NO.

TOLERANCE EXCEPT AS NOTED
.00 ± .03
.000 ± .010
ANGLES ±1°

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ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

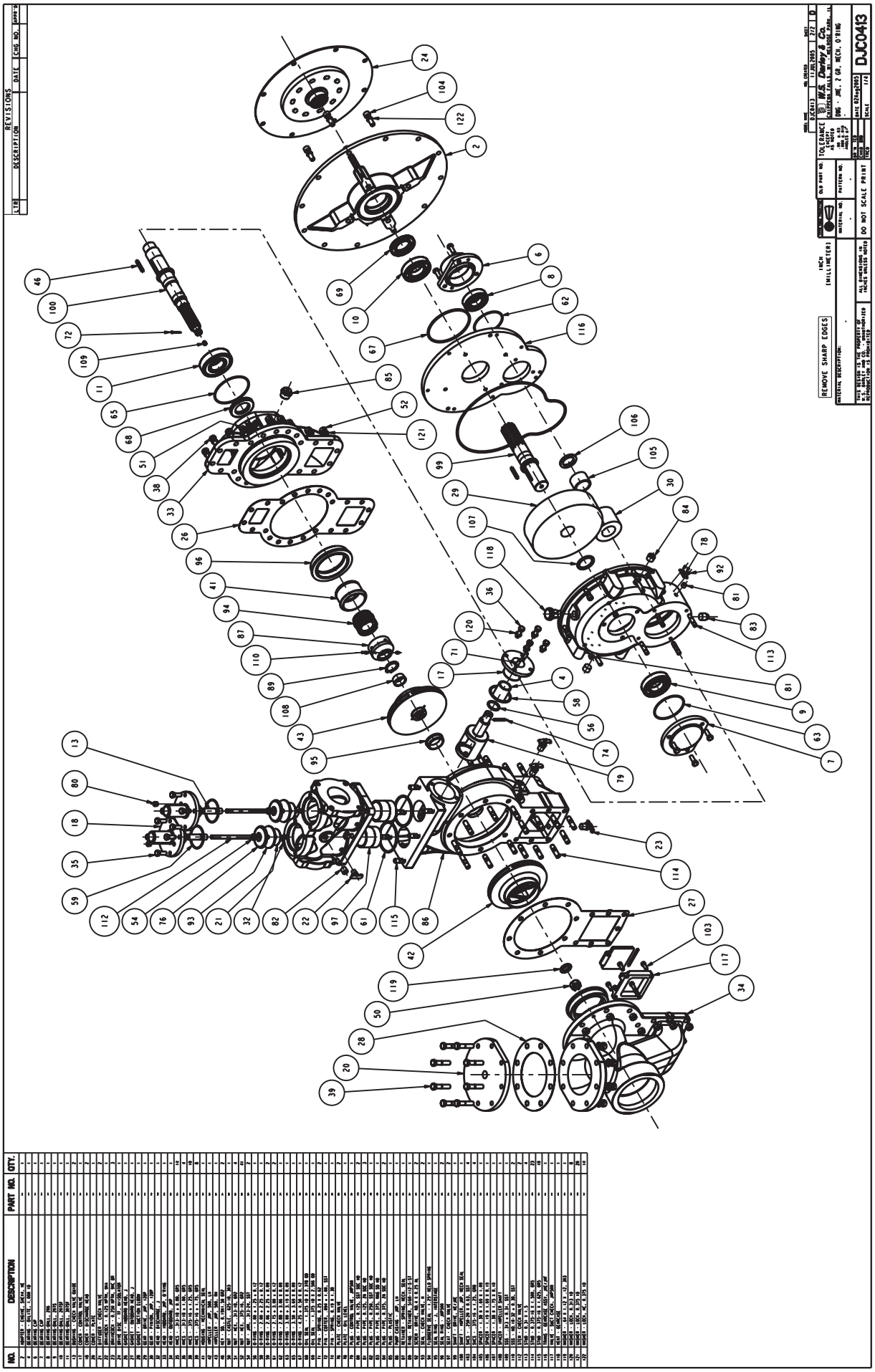
DRN
CHKD
APP'D
DATE 19JUL2005
SCALE 1/2

MODEL NAME	NEW CREATED	SHEET
DJC0413	11JUL2005	1/2

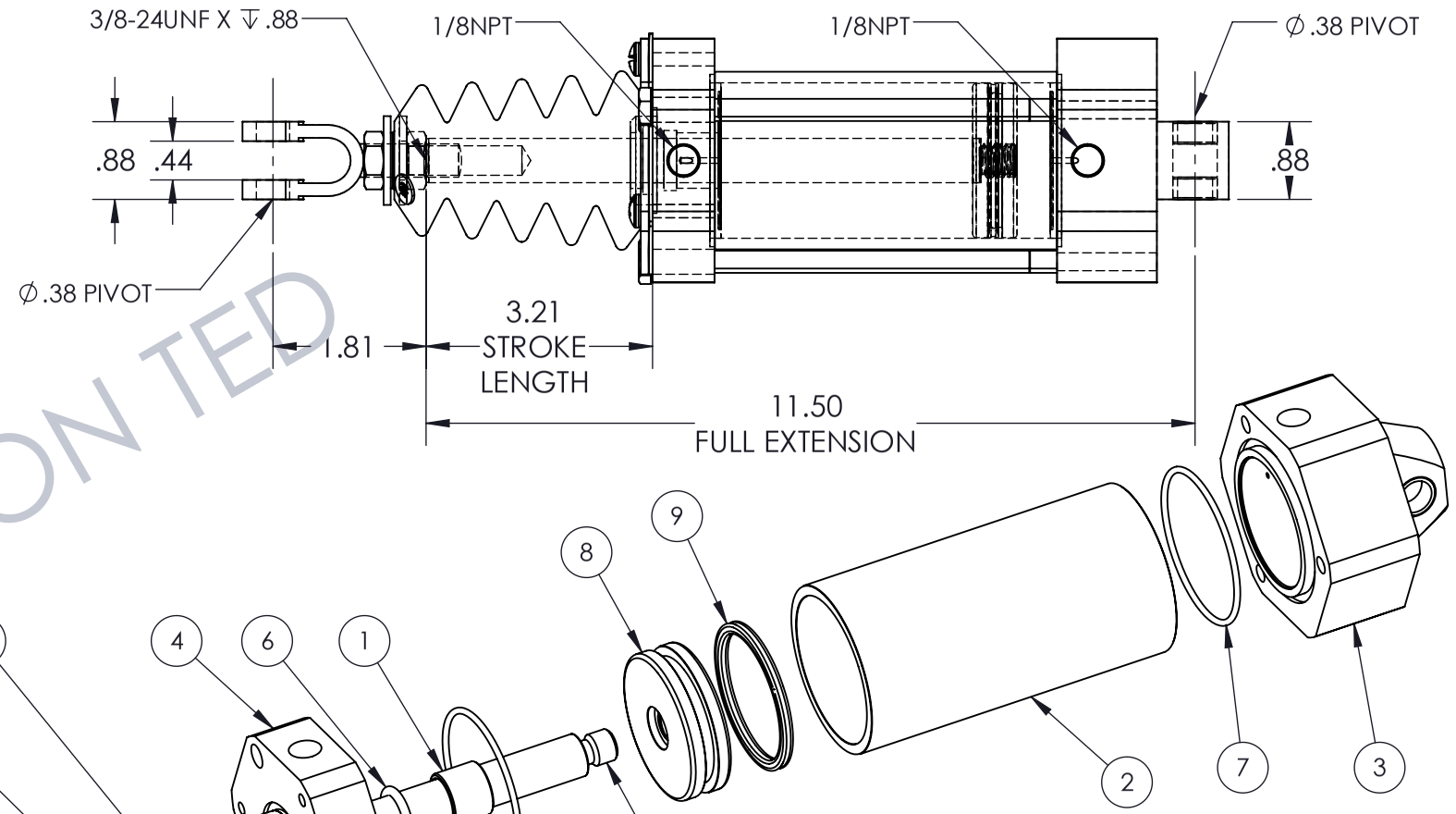
W.S. Darley & Co.
CHICAGO, IL - MELROSE PARK, IL

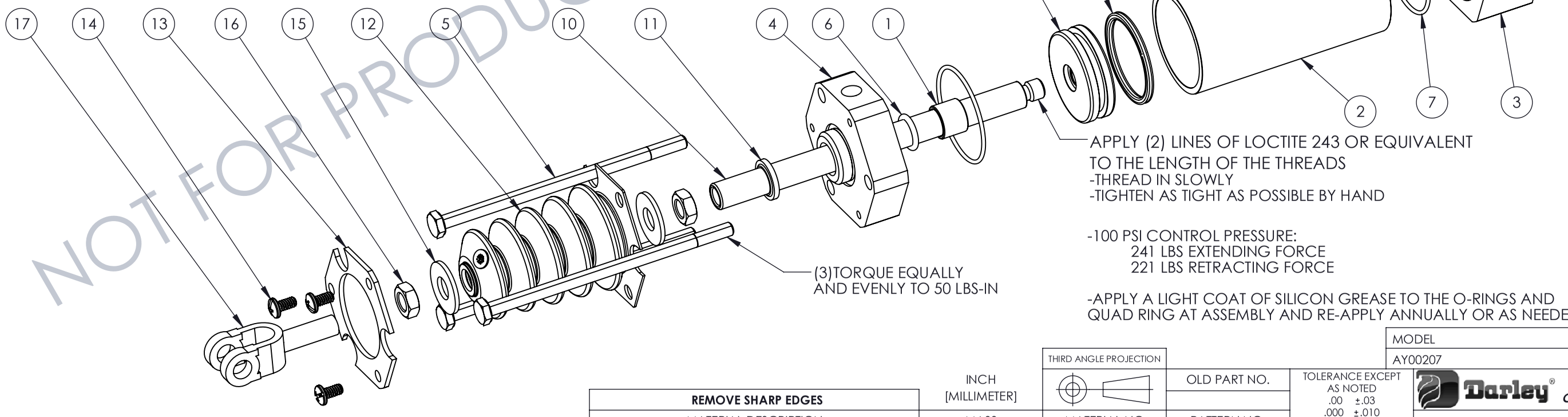
DWG - JMF, 2 GR. MECH. O'RING

DJC0413



ITEM NO.	File Name	Darley Item Description	QTY.
1	1760021	BEARING - OILITE, 0.500 ID	1
2	1020704	CYLINDER - 1.75 ID X 3.860 LG	1
3	2502204	CYLINDER END - 1.75 ID	1
4	2802700	HEAD - CYLINDER, 1.75 ID	1
5	5400690	HHCS - .250-20 X 5.00, GRADE 8	3
6	3601118	O-RING - 0.50 x 0.69 x 0.09	1
7	3601015	O-RING - 1.75 x 1.88 x 0.06	2
8	4421200	PISTON - CYLINDER, 1.75 ID	1
9	3601602	QUAD RING - 1.50 x 1.75 x 0.12	1
10	4416102	ROD - PISTON	1
11	1841000	RING - WIPER, F9002	1
12	2509100	BELLOWS - .477 COMP., 5.10 EXT	1
13	4435900	PLATE - BELLOWS, 2.5" HEX	1
14	5402868	PHMS - NO. 10-24 x .375, 18-8	3
15	3603809	WASHER - FLAT, 0.375 SST	2
16	5403209	NUT - JAM, .375-24, SST	2
17	4400300	CLEVIS - .375" THREADED	1





APPLY (2) LINES OF LOCTITE 243 OR EQUIVALENT
TO THE LENGTH OF THE THREADS
-THREAD IN SLOWLY
-TIGHTEN AS TIGHT AS POSSIBLE BY HAND

-100 PSI CONTROL PRESSURE:
241 LBS EXTENDING FORCE
221 LBS RETRACTING FORCE

-APPLY A LIGHT COAT OF SILICON GREASE TO THE O-RINGS AND
QUAD RING AT ASSEMBLY AND RE-APPLY ANNUALLY OR AS NEEDED

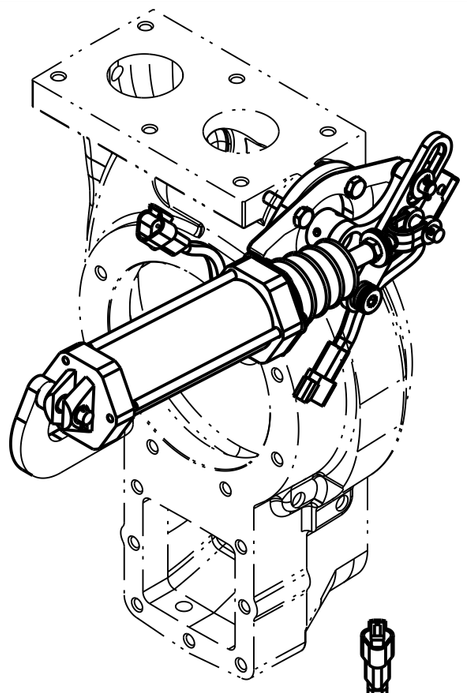
		THIRD ANGLE PROJECTION		MODEL	SHEET
				AY00207	1/1 B
REMOVE SHARP EDGES	INCH [MILLIMETER]		OLD PART NO.	TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1	Darley® ITASCA, IL CHIPPEWA FALLS, WI
MATERIAL DESCRIPTION	MASS	MATERIAL NO.	PATTERN NO.		ASSY - 1.75 AIR CYLINDER 2.92 STROKE WITH PIVOT
	1.99 LBS			DRWN TED	
THIS DESIGN IS THE PROPERTY OF WS. DARLEY CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED	ALL DIMENSIONS IN INCHES UNLESS NOTED	**DO NOT SCALE PRINT**		CKHD GDY	DATE: 08/28/2018 DGC0146
				TRCD	SCALE: 1:2

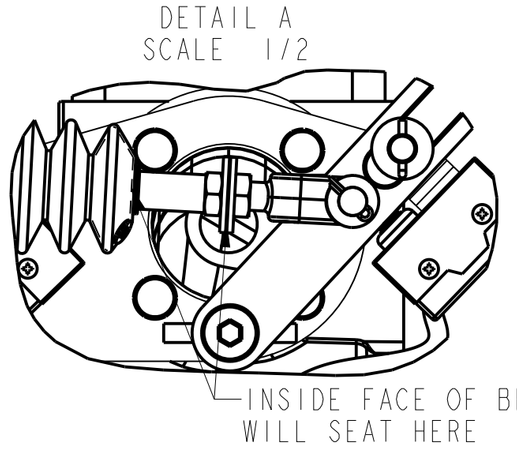
NO.	DESCRIPTION	PART NO.	QTY.	
1	ASSY - 1.75 AIR CYLINDER	AY00203_JMP_LINKAGE	1	
2	ASSY - CYLINDER BRACKET, JMP, RH	4012920	1	
3	BEARING - OILITE, 0.3765 ID	1760035	1	
4	BRACKET - MICROSWITCH, JMP	4019604_BENT	1	
5	CLEVIS - 3/8"	4400300	1	
6	HEAD - DISCHARGE, J	2804503	1	
7	HHCS - .313-18 x 1.25, GR5	5400021	4	
8	HHCS - SHOULDER BOLT, 1/2" DIA SHLDR	5402864	1	
9	LEVER - STAGING JMP	3007901	1	
10	LINKAGE - PRESCRIBED MOTION	4435410	1	
11	MICROSWITCH - OMRON	2600056	2	
12	NUT - JAM, .375-24, SST	5403209	2	
13	PIN - CLEVIS, .375 X .890 G.L.	4401507	1	
14	PIN - COTTER, .094 x .500, 18-8 SST	3605212	3	
15	PIN - SPRING, 0.19 X 1.38	3605007	1	
16	PUMP CASING - JMP, LH	2054300	1	
17	WASHER - 0.39 x 0.61 x .06 BR	3603705	2	B
18	WASHER - 0.50 x 0.75 x .125 THK	3603721	2	
19	WASHER - FLAT, 3/8 SAE, STEEL	3603826	1	
20	WASHER - LOCK, 0.313 ID	3603502	4	
21	NUT - HEX, NO.6-32, BR	5403008	4	
22	RHMS - NO.6-32 X1.00, BR	5402012	4	
23	WASHER - LOCK, NO.6 ID, SST	3603508	4	
24	BELLOWS - .477 COMP., 5.10 EXT., 2.91 NOM.	2509100	1	
25	PLATE - BELLOWS, 2.5" HEX	4435900	1	A
27	WASHER - FLAT, 3/8, SST	3603809	2	E C

LTR	DESCRIPTION	DATE	CHG. NO.	APPR'D
E	3603809 WAS 3603802	8/28/13	10293	KMD
F	ADDED NOTE FOR AIR TAP ORIENTATION, CORRECTED SCREW ORIENTATION	24FEB2017	ED-11600	TED

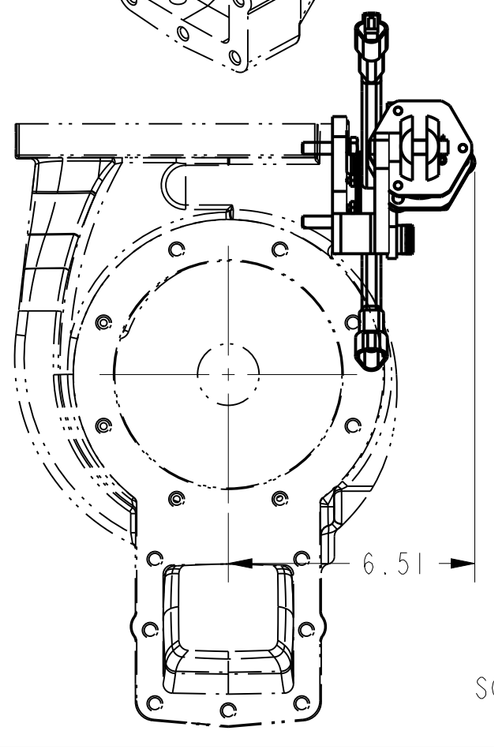
REVISIONS

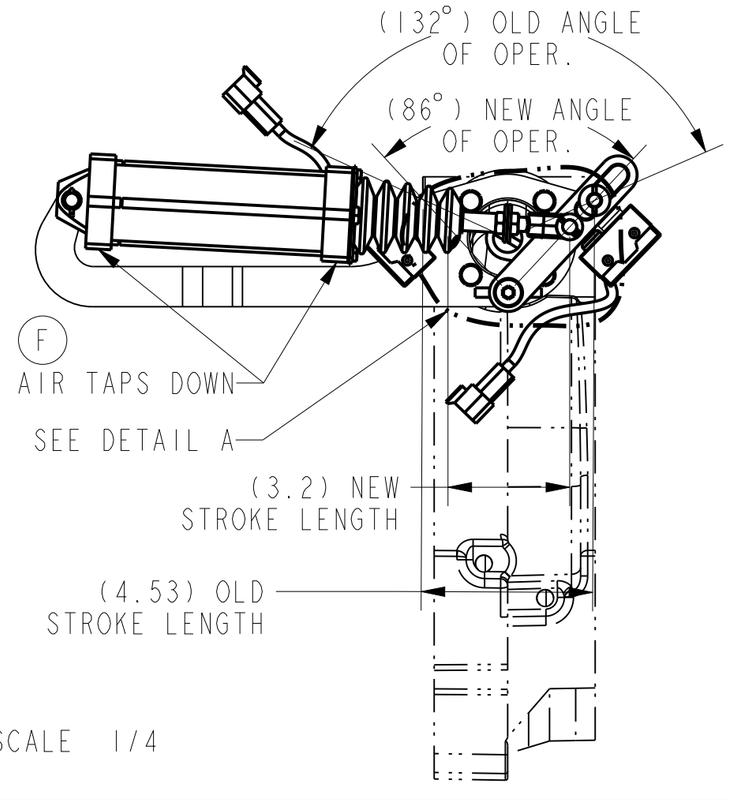
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	ADDED BELLOWS PLATE - 4435900	7/8/13	10235	CWY
B/C	WAS 3, ADDED (2) 3603802	07/17/13	10242	RJG



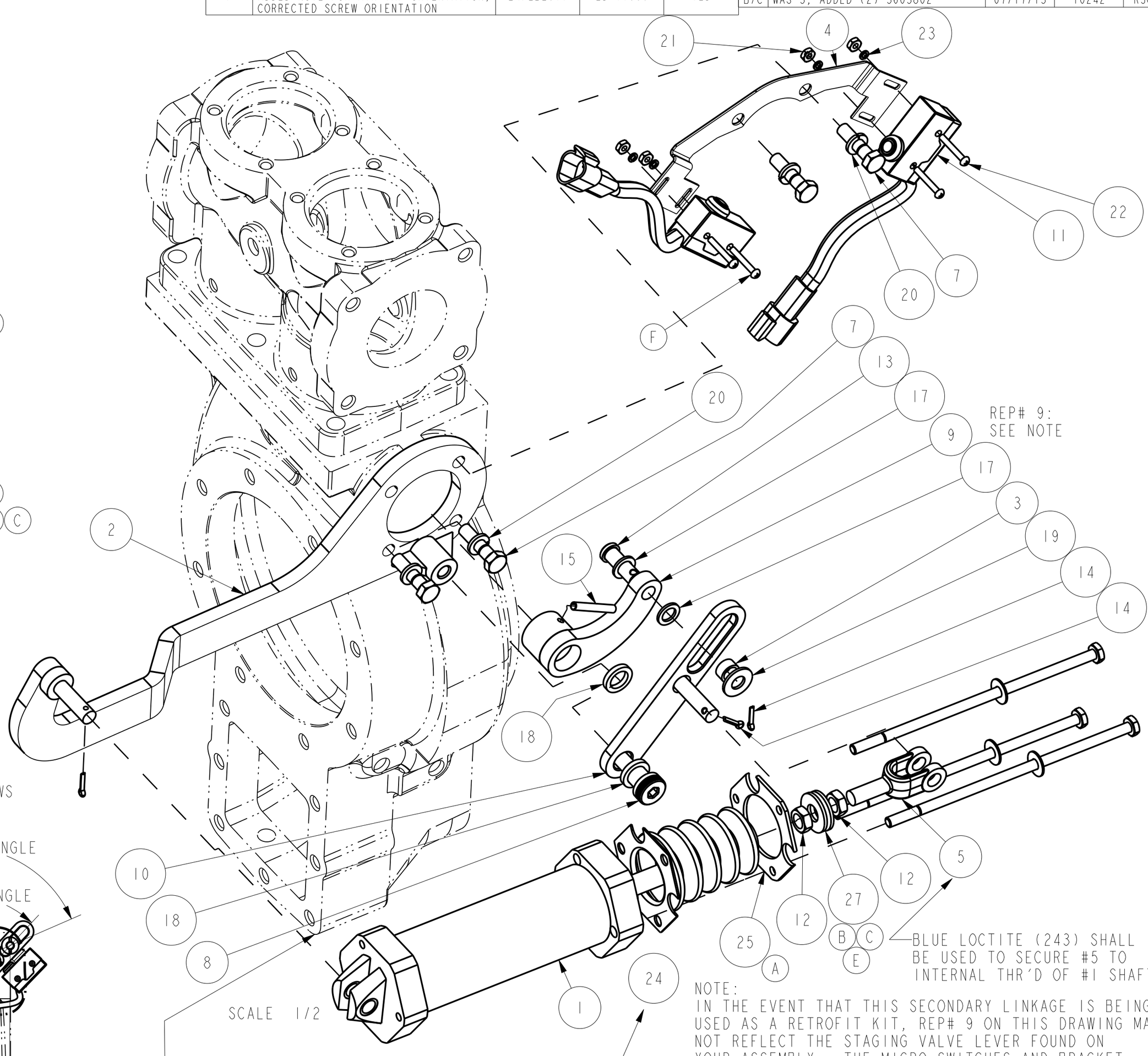


DETAIL A
SCALE 1/2





SCALE 1/4



SCALE 1/2

SMALL ID OF #24, SHOULD BE SANDWICHED BETWEEN (2) OF ITEM #17

JMP VOLUTE SHOWN FOR REFERENCE ONLY
SHOWN VOLUTE WATERWAY ROTATION MAY NOT
REFLECT ACTUAL ROTATION IN PHYSICAL PRODUCT

NOTE:
IN THE EVENT THAT THIS SECONDARY LINKAGE IS BEING USED AS A RETROFIT KIT, REP# 9 ON THIS DRAWING MAY NOT REFLECT THE STAGING VALVE LEVER FOUND ON YOUR ASSEMBLY. THE MICRO SWITCHES AND BRACKET PROVIDED WITH THIS SECONDARY LINKAGE ASSEMBLY WILL STILL WORK. MICRO SWITCHES WILL HAVE TO BE MOUNTED IN A DIFFERENT ORIENTATION TO ALLOW PROPER ENGAGEMENT WITH A DIFFERENT HAND STAGING VALVE LEVER (REP# 9)

MODEL NAME	MDL CREATED	SHEET	
AA00247	10/05/12	1/1	C

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

TOLERANCE EXCEPT AS NOTED
.00 ±.03
.000 ±.010
ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

MATERIAL DESCRIPTION: SEE TABLE

MATERIAL NO. -

PATTERN NO. -

DWG - JMP POWER STG, 1.75", RH
1.75" CYL., SECONDARY LINKAGE

DR'N RJG
CHKD -
TRCD

DATE 05-Mar-13

SCALE 1/8

DJM0105

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

Mechanical Shaft Seal

This pump assembly incorporates high quality mechanical shaft seal(s) separating the pump housing components from atmosphere. Depending on the pump design, there may be one or two seals on each impeller shaft.

The seal size, design type, component materials, and housing configuration have been specifically designed for this pump application and rated operating parameters.

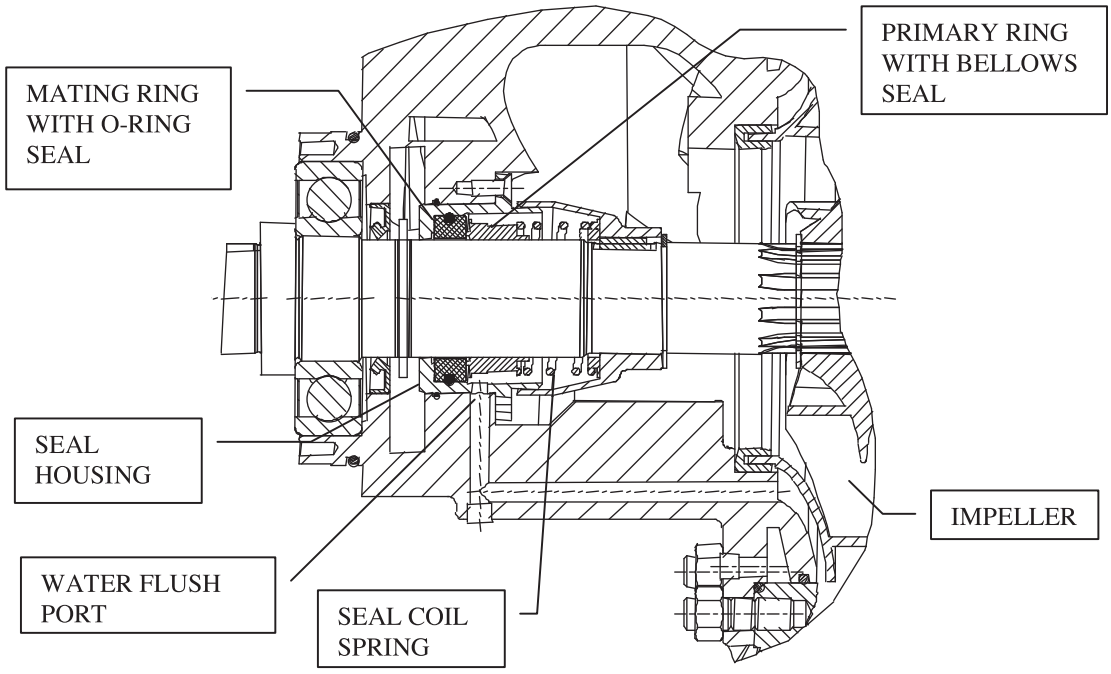
Mechanical Seal Basics

A mechanical seal is a device that houses two highly polished components (known as faces). One face rotates, the other is stationary. A secondary elastomer bellows seals the primary ring to the shaft. An o-ring or cup seal seals the mating ring in the housing. The polished seal faces of the primary and mating rings are pressed together by a spring mechanism to provide adequate force to affect a seal. The force acting between the seal faces increases in direct proportion to product pressure.

The elastomer bellows seal utilized in this pump has the following design features:

- Mechanical drive of the primary seal ring. The drive band's notch design eliminates overstressing the elastomer sealing bellows.
- Bellows design provides automatic compensation for shaft endplay, run out, and primary ring wear.
- Seal face contact pressure is controlled by a single, non-clogging coil spring. This coil spring has been custom welded per Darley specifications to eliminate high-speed spring distortion.

The seal housing is designed and ported to provide optimal water flow and pressure assuring proper cooling and flushing of the seal components.



Operation and Maintenance

When operated within rated operating conditions of this pump, these seals will provide trouble free service for extended periods.

Properly selected and applied mechanical shaft seals are leak free and require no adjustment. Should the seal area develop a leak, investigate the cause as soon as possible. Seal failure, leakage, may be the result of; worn seal faces, leaking bellows, or damaged o-rings. These failures may be attributed to bearing failure, impeller blockage, impeller imbalance, seal housing contamination, operating beyond pump design rating, or dry running,

Mechanical shaft seal design relies on the sealed media, in this case, water, to cool and lubricate the sealing surfaces. Therefore, extended dry operation may cause overheating and scoring or damage to the sealing surfaces, resulting in excessive leakage or a much shortened seal life.

To maximize seal life, minimize operation at pump pressures higher than pump rating. While operating at pressures beyond rating will not immediately damage the seal, it will increase sealing surface wear rate.

CAUTION: **DO NOT RUN THE PUMP DRY EXCEPT MOMENTARILY AND AT LOW SPEEDS**

CAUTION: **DO NOT USE THIS PUMP FOR HOSE TESTING**

CAUTION: **THE MECHANICAL SEAL SHOULD NOT BE RUN DRY, WHILE THE PUMP IS NOT ENTRAINED WITH WATER, FOR A PERIOD LONGER THAN 2 MINUTES. FAILURE TO FOLLOW THIS RECOMMENDATION WILL LEAD TO PREMATURE WEAR AND FAILURE OF YOUR MECHANICAL SHAFT SEAL.**

DARLEY

INSTALLATION OF MECHANICAL FACE SEAL WITH O'RING

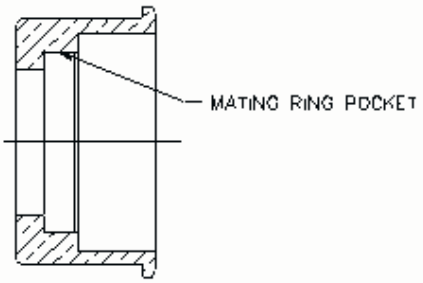
SPECIAL HANDLING

Study the engineering layout before installing the seal. This shaft seal is a precision product and should be handled and treated with care. Take special care to prevent scratches on the lapped faces of the primary and mating ring. Provide a very clean work area where the assembly will take place. Clean hands prior to assembly.

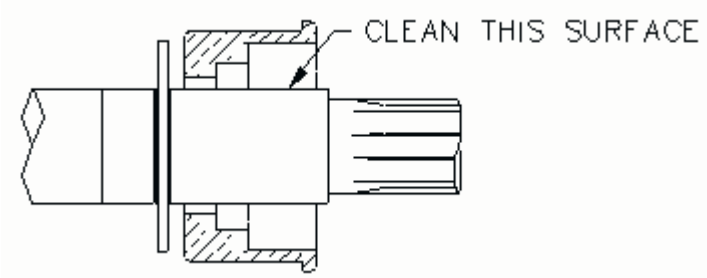
INSTRUCTION STEPS:

Instructions for Installing a Mechanical Shaft Seal

1. Inspect mating ring pocket in seal housing ensuring it is clean, free of chips, and nick free, to provide a proper sealing surface. Isopropyl alcohol may be used to clean the surfaces if required.

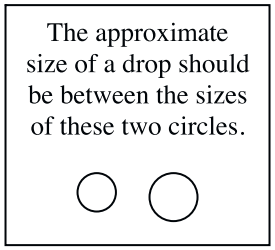


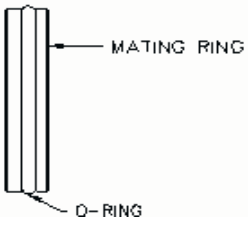
2. Inspect the pump shaft surface under the bellows, ensuring it is clean and nick free to provide a proper sealing surface. Isopropyl alcohol may be used to clean surface if required.

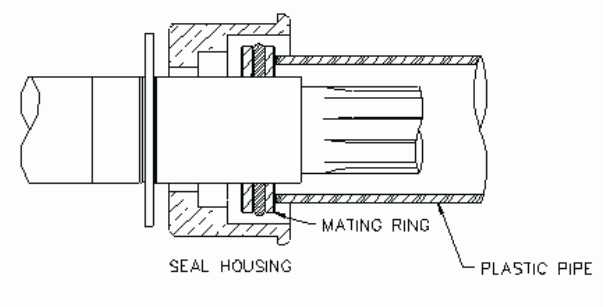


3. Lightly lubricate the o-ring on the mating ring with a single drop of P-80 water soluble rubber lubricant (do not over lubricate) and push it into the cavity using the recommended installation tool or other suitable plastic tube free of contaminants, firmly seating the mating ring square.
   Note: The polished face of the mating ring must face out – away from the pump's gear case. Try to not touch the polished sealing face with your fingers; the oils from your fingerprint can cause the seal to leak. Remove any P-80 from the sealing face after installation.

The approximate size of a drop should be between the sizes of these two circles.





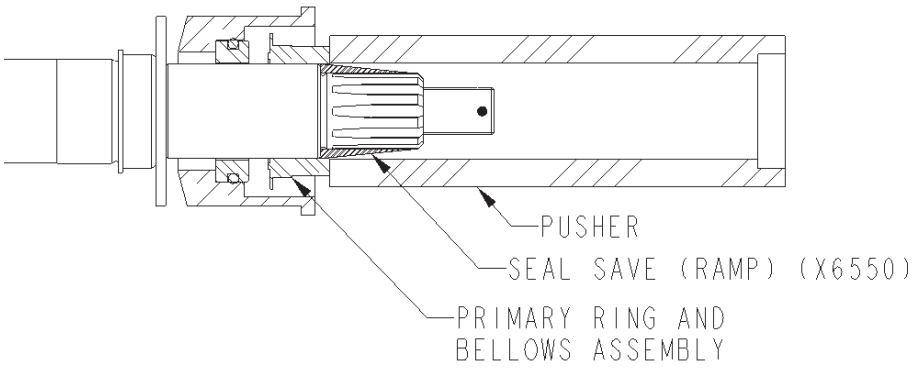


4. Clean the mating ring surface with isopropyl alcohol to remove any fingerprints and any other contaminants left on mating ring.

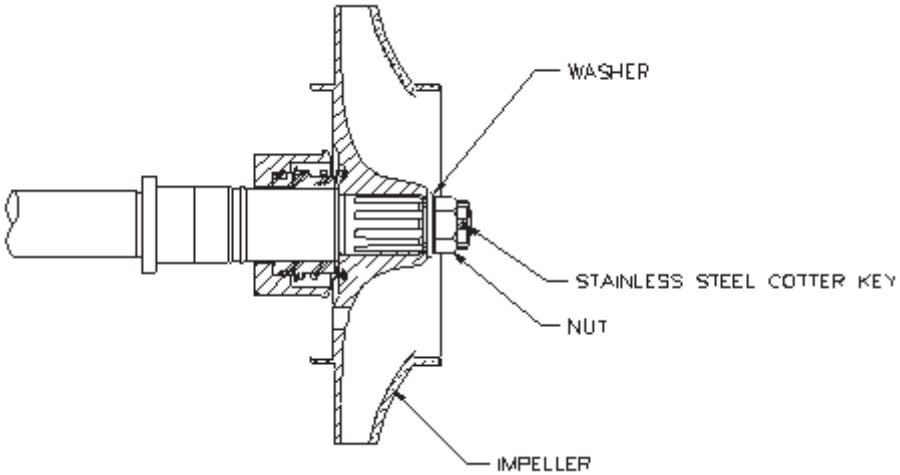
Note: Steps 5 – 9 need to all be completed with in 15 minutes or less.

5. Apply a small drop of P-80 rubber lubricant or water-soluble lubricant (not soapy water) to the inside diameter of the bellows assembly allowing it to be pushed easily into position.
6. Clean the polished sealing face of the primary ring with a clean lint free rag with isopropyl alcohol to remove all fingerprints and other contaminants.
7. Slide a seal save, similar to X6550, over the shaft splines to ensure that the seal is not damaged during installation. Place the primary ring and lubricated bellows assembly (without the spring) on the shaft, using a proper pusher - push the assembly into position so that the seal surfaces are in contact. Remove the seal save from the shaft.

The approximate size of a drop should be between the sizes of these two circles.



8. Put the spring in place, seated tight against the spring retainer on the primary ring.
   Note: Some springs may be slightly tapered, so one end fits the seal better than the other. The end of the spring that best fits the seal should go towards the seal to ensure even spring pressure all the way around.
9. Slide impeller onto impeller shaft, engage the spring into the groove of the impeller hub and install impeller washer, impeller nut, and stainless steel cotter key.



** *Reference pump configuration for individual mechanical seal instructions.*
** *Reference pump assembly drawings and pump assembly tips for further assembly.*

Note: If the seal leaks slightly after assembly, it may be necessary to run the pump for approximately 30 minutes at 50-60 psi to rinse out excess lubricant and other contaminants.

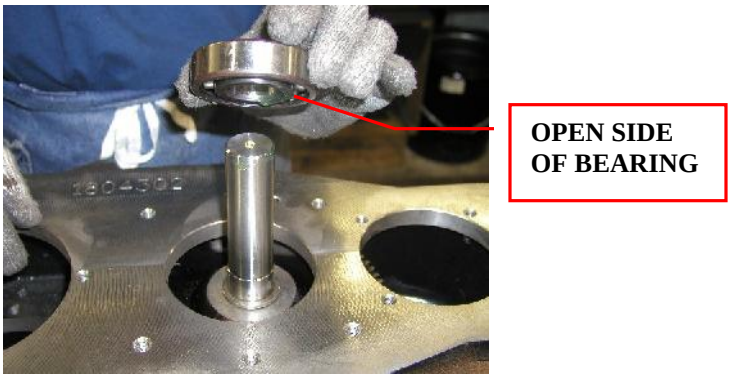
Once a mechanical seal has been installed, it is recommended that it not be reused.

If further information is needed, call **DARLEY** in
Chippewa Falls, WI. at 800-634-7812 or 715-726-2650

DARLEY
BASIC ASSEMBLING TECHNIQUES

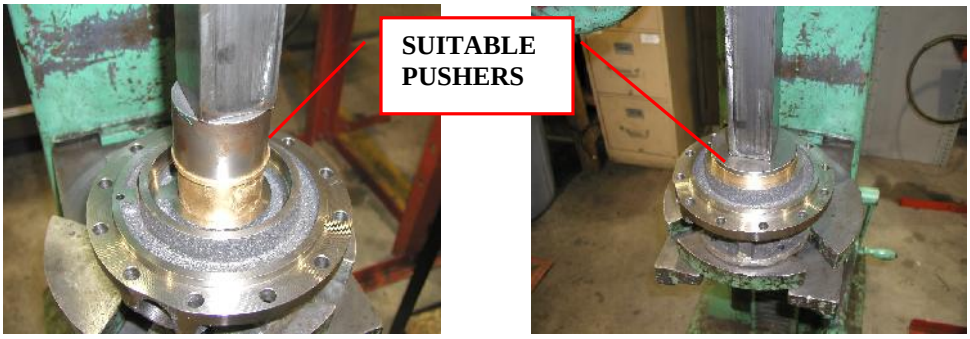
- Work with clean tools in clean surroundings during assembly.
- Clean parts thoroughly and keep free from nicks and abrasions.
- Keep loose parts marked otherwise identified to avoid error in assembly.
- **Bearings:** Keep bearings in original containers until ready to install.
- **Bearings/Press fits:** Clean and oil bearing seats and other parts having press fits to prevent galling.
- **Bearings:** When pressing a bearing onto a shaft, the bearing must be started perpendicular (square) to the shaft.

- **Bearings:** When pressing bearings onto a shaft all forces applied to the bearing need to be applied to the inner race.
- **Bearings:** When pressing bearings into a pocket all forces applied to the bearing need to be applied to the outer race.
- **Bearings:** When installing a bearing with one shield, the open side goes toward the oil cavity/gear case. Typically the single shield will be next to an oil seal.



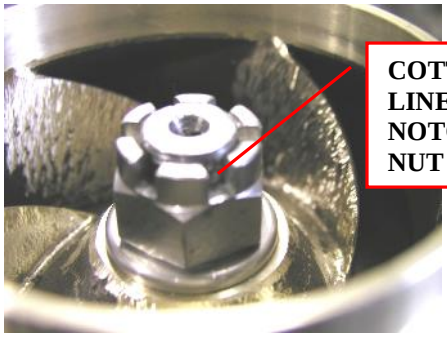
- **Bearings:** When pressing a bearing onto a shaft, lightly lube the bore of the bearing and the shaft journal for the bearing with oil. Also when installing bearings into bearing pockets, lightly lube the OD of the bearing and the bore of the bearing pocket with oil.

- **Bearings:** If necessary to remove a ball bearing from a shaft by forcing against the outer race, the bearing should be discarded and replaced.
- **Press fits:** Use suitable machined pushers (The end faces of the pusher should be flat, parallel and burr free) for pressing operations.

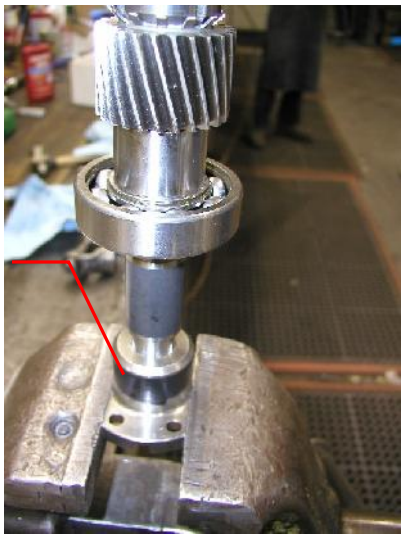


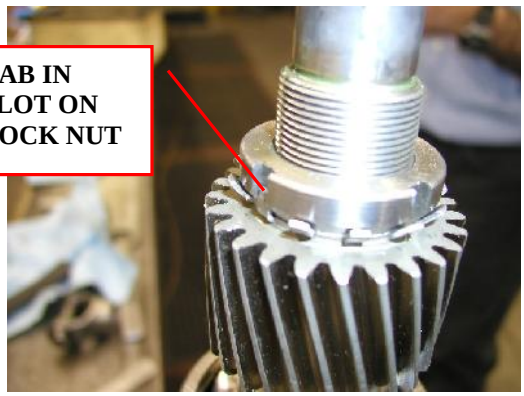
- **Press fits:** When pressing a part into housing (ex. Stuffing box, seal ring, etc.), the part needs to be started perpendicular to the housing.

- **Press fits:** Use a press for forcing press fits whenever possible. If necessary to use a hammer, use one having soft plastic heads. Do not use brass or lead hammers, for the face of the hammer may easily chip or flake, contaminating the assembly, which can cause severe damage to bearings and other precision components.
- **Impeller Nuts:** When installing impeller nuts, DO NOT use an impact wrench. Use of impact wrenches has proven to damage the impeller washers, impellers, and impeller shafts. Proper tightening procedure is to bring it snug tight, and then tighten it to the next available cotter pin hole in shaft and notch in the castle nut. Then install stainless steel cotter pin.



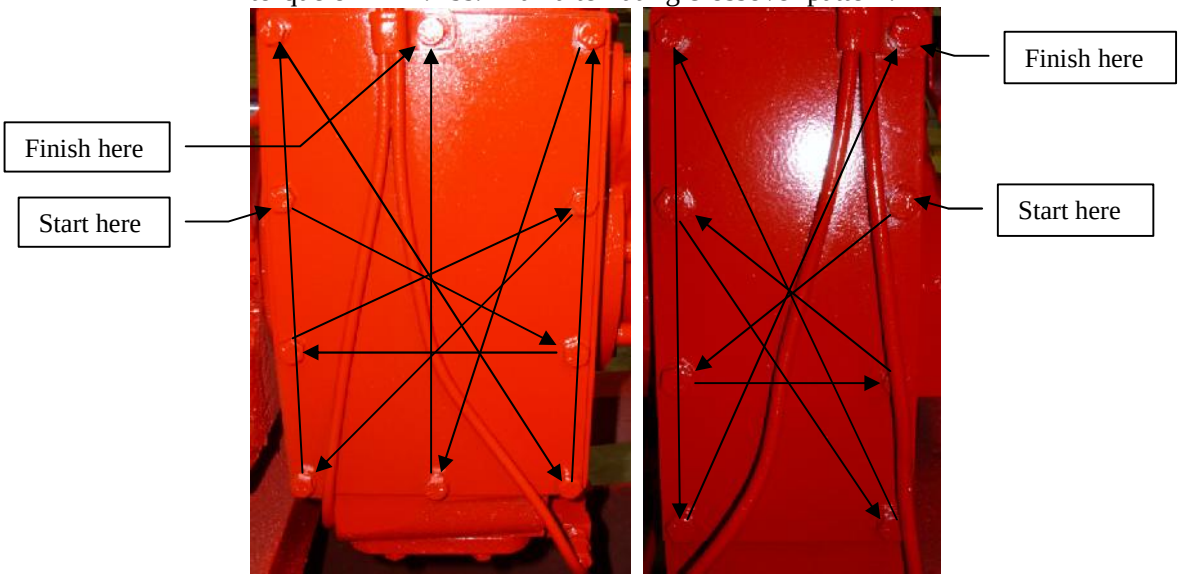
- **Lock Washer/Lock Nut:** Secure shaft so that it doesn't rotate when tightening lock nut. Line up tab on lock washer with keyway slot in shaft and slide washer onto shaft. Screw lock nut onto shaft until snug, then turn until a tab and slot line up. Using a punch, tap tab from lock washer into slot on lock nut.





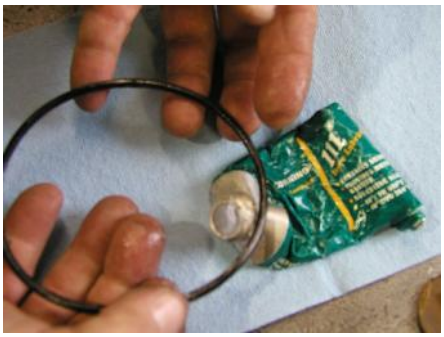
- **Loctite/thread locker:** When applying Loctite/thread lockers, only use one small drop per hole, unless explicitly told differently by engineering, a WI, or assembly/repair instruction or assembly supervisor.
- **Loctite/thread locker:** When applying Loctite/thread lockers to lock fasteners going into captive holes (a hole that is only open on one end), apply the thread locker to the threads of the hole.

- **Loctite/thread locker:** When applying Loctite/thread lockers, to lock fasteners that are going to be installed with a pneumatic/power wrench, apply the thread locker to the female threads.
- **Transmission Threads:** Use only lock washers on captive holes. The only exception is if it is an aluminum gear case, then use Loctite 243, or equivalent, and no lock washers.
- **Transmission Threads:** Use lock washers and Loctite 243, or equivalent, if holes are tapped thru.
- **Inspection Plate Fasteners:** Use Loctite 243, or equivalent, on the fasteners that hold the rectangular inspection plate to the side of the transmissions gear case. When installing these fasteners, install all of the fasteners to finger tight, then torque them to a final torque of 72 in.-lbs. in an alternating crossover pattern.



- **Fastener Lock Washers and Aluminum:** Do not use lock washers against aluminum. Use the appropriate thread locker instead.

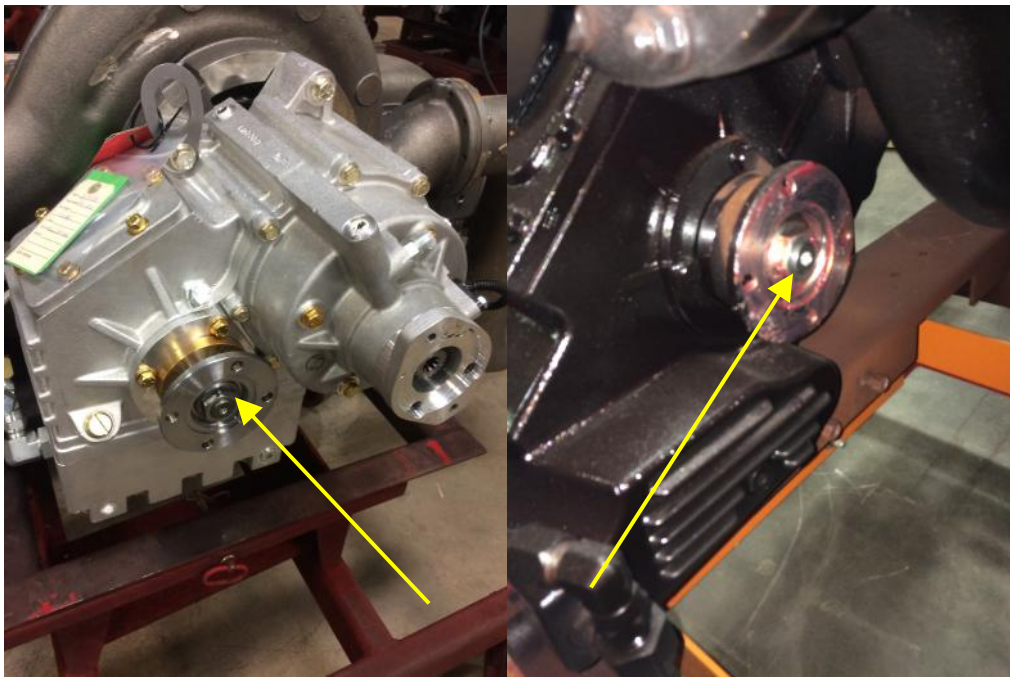
- **O-rings/Quad rings:** When installing o-rings and quad rings LIGHTLY lube with oil or silicon grease (Dow Corning 111). Be careful not to apply too thick of a film of lubricant when using the silicone grease because over application of the grease can cause the o-ring/quad ring to bridge and leak.



- **Gear Lube:** When filling the gear case with oil, fill with SAE80W/90 gear lube oil to the bottom of the oil level plug on the gear case, or the oil level mark on the dipstick. Maintain the gear case oil level every 25 hours or 3 months, which ever comes first, and change the oil every 50 hours or 6 months.

- **Oil Seal lubrication:** When lubricating oil seals prior to installation, apply a minimal amount of SAE 80/W90 oil on the outside diameter of the seal and the sealing lip on the inside diameter of the seal. Do not use any lubricant other than SAE 80W/90 oil unless a Darley document dated after February 14, 2012 specifically calls it out.

- **Yoke nut installation torque for PUC and PUC-3G pumps:** Torque PUC and PUC-3G yoke nuts to 300-350 ft-lb. After the yoke nut has been torqued down, check to make sure the yoke nut engages the yoke face it bumps up against.

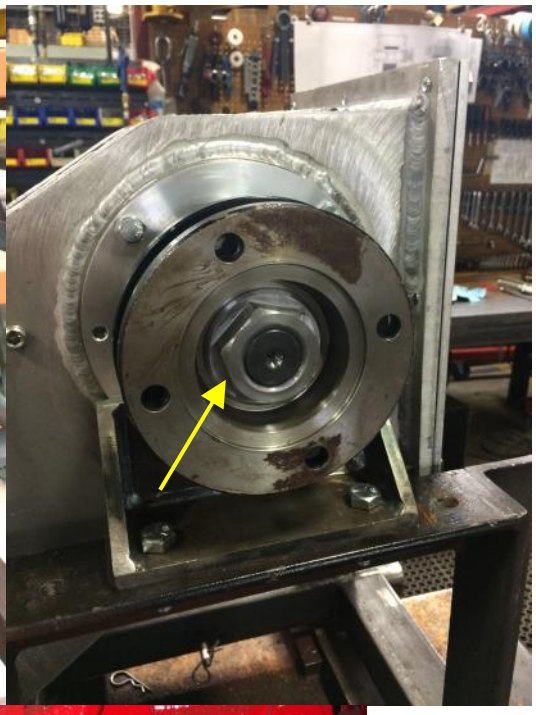


PUC and PUC-3G yoke nuts are tightened to 300-350 lb-ft.

- **Yoke nut torque for 1.75-12 thread, 1.25-12 thread and 7/8-14 thread yoke nuts:** Unless otherwise specified, torque 1.75-12 interference threaded yoke nuts to 150-200 ft-lb. Unless otherwise specified, torque all 1.25-12 thread yoke nuts to 150-200 ft-lb. Unless otherwise specified, torque all 7/8-14 interference threaded yoke nuts to 125 ft-lb. After the yoke nut has been torqued down, check to make sure the yoke nut engages the yoke face it bumps up against.

1.75-12 thread yoke nuts are typically used on Midship pump.
1.25-12 thread yoke nuts are typically used on ZSD & ZSP pumps.
7/8-14 thread yoke nuts are used on PTO pumps.

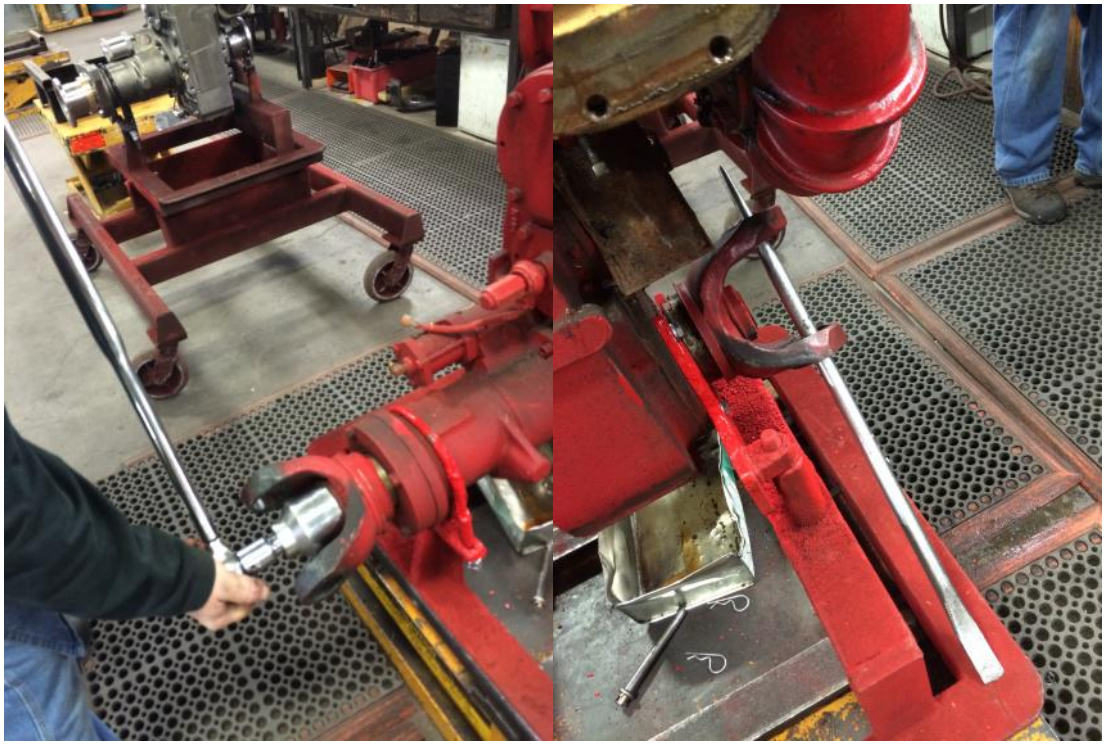
All 1.75-12 interference threaded yoke nuts are torqued to 150-200 ft-lb.



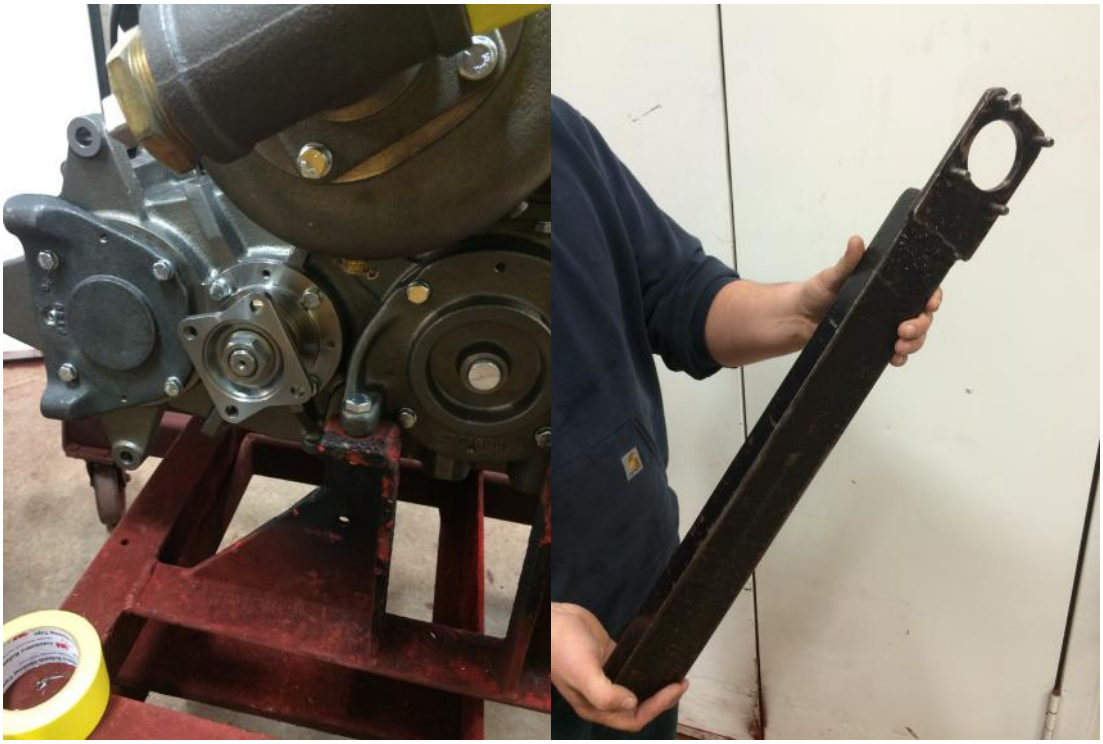
All 1.25-12 threaded yoke nuts are torqued to 150-200 ft-lb.

All 7/8-14 interference thread yoke nuts are tightened to 125 ft-lb.

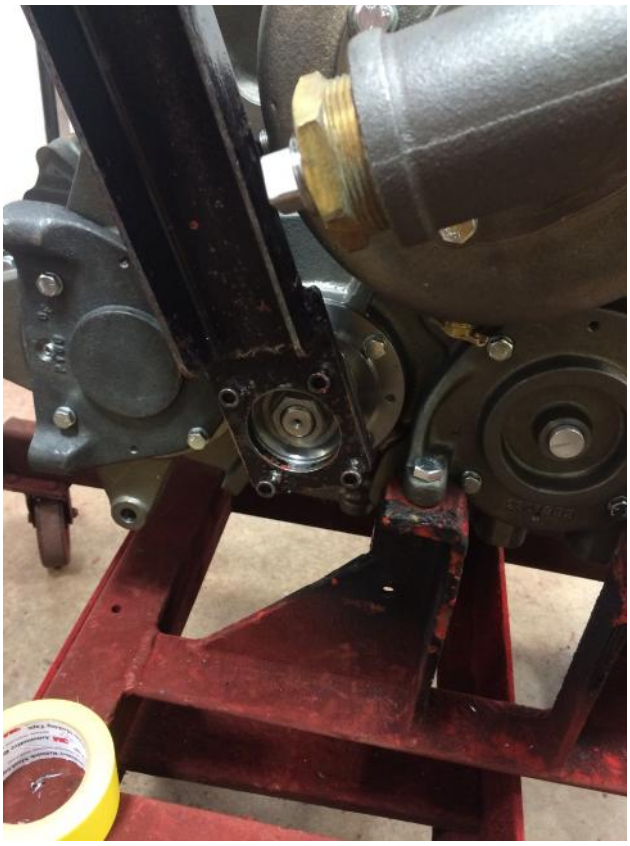
After torqueing the yoke nut down, check to make sure there is not a gap between the yoke nut and the yoke.



To help with the yoke nut torqueing on midship pumps, shift the transmission into road mode. Put a bar thru the yoke that is not being torqued down to stop the driveline from rotating. Then the driveline will not rotate as the yoke nut is being torqued.



To help with tightening yoke nuts on PTO pumps use the tool shown in the above picture.



Place the tool over the companion flange as shown above. Make sure to finger tighten a nut on one of the tool's fasteners to secure the tool to the yoke.

Now let the tool bump up against a rigid surface and use the torque wrench to tighten the yoke nut as shown above.

Recommended fastener tightening torque unless otherwise specified: The following tables will give recommended tightening torques depending upon the fasteners material and if a Loctite type product was used. Use these recommended tightening torques if you are not confident torqueing a fastener. For fasteners that had a Loctite type product applied to their threads, use the K = .20 (Clean non-plated bolt) recommended tightening torque even if either the nut or bolt was zinc electroplated.

Best practice is to; use an SAE Grade 8 bolt with an SAE Grade 8 nut, use an SAE Grade 5 bolt with and SAE Grade 5 nut, use an SAE Grade 2 bolt with an SAE Grade 2 nut and use the same bolt material as what the nut is made from.

Fastener Size	Recommended tightening torque	Clamp load
#6 – 32 Grade 8	18 to 27 in-lb	654 to 981 lb
#6 – 40 Grade 8	20 to 30 in-lb	730 to 1,095 lb
#8 – 32 Grade 8	33 to 50 in-lb	1,009 to 1,513 lb
#8 – 36 Grade 8	35 to 52 in-lb	1,060 to 1,591 lb
#10 – 24 Grade 8	48 to 72 in-lb	1,262 to 1,893 lb
#10 – 32 Grade 8	55 to 82 in-lb	1,440 to 2,159 lb
¼ - 20 Grade 8	115 to 172 in-lb	2,291 to 3,437 lb
¼ - 28 Grade 8	131 to 196 in-lb	2,619 to 3,928 lb
5/16 – 18 Grade 8	20 to 29 ft-lb	3,775 to 5,662 lb
5/16 – 24 Grade 8	22 to 33 ft-lb	4,181 to 6,271 lb
3/8 – 16 Grade 8	35 to 52 ft-lb	5,579 to 8,369 lb
3/8 – 24 Grade 8	40 to 59 ft-lb	6,324 to 9,485 lb
7/16 – 14 Grade 8	56 to 84 ft-lb	7,654 to 11,481 lb
7/16 – 20 Grade 8	62 to 93 ft-lb	8,548 to 12,821 lb
½ - 13 Grade 8	85 to 128 ft-lb	10,217 to 15,325 lb
½ - 20 Grade 8	96 to 144 ft-lb	11,517 to 17,275 lb
5/8 – 11 Grade 8	170 to 254 ft-lb	16,272 to 24,408 lb
5/8 – 18 Grade 8	192 to 288 ft-lb	18,429 to 27,643 lb
¾ - 10 Grade 8	301 to 452 ft-lb	24,081 to 36,122 lb
¾ - 16 Grade 8	336 to 503 ft-lb	26,853 to 40,280 lb
7/8 – 9 Grade 8	485 to 727 ft-lb	33,245 to 49,867 lb
7/8 – 14 Grade 8	535 to 802 ft-lb	36,682 to 55,023 lb
1 – 8 Grade 8	727 to 1,090 ft-lb	43,614 to 65,421 lb
1 – 12 Grade 8	796 to 1,193 ft-lb	47,739 to 71,608 lb

The above table is for SAE Grade 8 fasteners, K = .20 (Clean non-plated fasteners or Loctited zinc electroplated fasteners)

Fastener Size	Recommended tightening torque	Clamp load
#6 – 32 Grade 8	20 to 30 in-lb	654 to 981 lb
#6 – 40 Grade 8	22 to 33 in-lb	730 to 1,095 lb
#8 – 32 Grade 8	36 to 55 in-lb	1,009 to 1,513 lb
#8 – 36 Grade 8	38 to 57 in-lb	1,060 to 1,591 lb
#10 – 24 Grade 8	53 to 79 in-lb	1,262 to 1,893 lb
#10 – 32 Grade 8	60 to 90 in-lb	1,440 to 2,159 lb
¼ - 20 Grade 8	126 to 189 in-lb	2,291 to 3,437 lb
¼ - 28 Grade 8	144 to 216 in-lb	2,619 to 3,928 lb
5/16 – 18 Grade 8	22 to 32 ft-lb	3,775 to 5,662 lb
5/16 – 24 Grade 8	24 to 36 ft-lb	4,181 to 6,271 lb
3/8 – 16 Grade 8	38 to 58 ft-lb	5,579 to 8,369 lb
3/8 – 24 Grade 8	43 to 65 ft-lb	6,324 to 9,485 lb
7/16 – 14 Grade 8	61 to 92 ft-lb	7,654 to 11,481 lb
7/16 – 20 Grade 8	69 to 103 ft-lb	8,548 to 12,821 lb
½ - 13 Grade 8	94 to 140 ft-lb	10,217 to 15,325 lb
½ - 20 Grade 8	106 to 158 ft-lb	11,517 to 17,275 lb
5/8 – 11 Grade 8	186 to 280 ft-lb	16,272 to 24,408 lb
5/8 – 18 Grade 8	211 to 317 ft-lb	18,429 to 27,643 lb
¾ - 10 Grade 8	331 to 497 ft-lb	24,081 to 36,122 lb
¾ - 16 Grade 8	369 to 554 ft-lb	26,853 to 40,280 lb
7/8 – 9 Grade 8	533 to 800 ft-lb	33,245 to 49,867 lb
7/8 – 14 Grade 8	588 to 883 ft-lb	36,682 to 55,023 lb
1 – 8 Grade 8	800 to 1,199 ft-lb	43,614 to 65,421 lb
1 – 12 Grade 8	875 to 1,313 ft-lb	47,739 to 71,608 lb

The above table is for SAE Grade 8 fasteners, K = .22 (Zinc electroplated bolt or nut)

Fastener Size	Recommended tightening torque	Clamp load
#6 – 32 Grade 5	16 to 24 in-lb	589 to 883 lb
#6 – 40 Grade 5	18 to 27 in-lb	657 to 986 lb
#8 – 32 Grade 5	30 to 45 in-lb	908 to 1,362 lb
#8 – 36 Grade 5	31 to 47 in-lb	954 to 1,432 lb
#10 – 24 Grade 5	43 to 65 in-lb	1,136 to 1,704 lb
#10 – 32 Grade 5	49 to 74 in-lb	1,296 to 1,943 lb
¼ - 20 Grade 5	81 to 122 in-lb	1,623 to 2,434 lb
¼ - 28 Grade 5	93 to 139 in-lb	1,855 to 2,783 lb
5/16 – 18 Grade 5	14 to 21 ft-lb	2,674 to 4,011 lb
5/16 – 24 Grade 5	15 to 23 ft-lb	2,961 to 4,442 lb
3/8 – 16 Grade 5	25 to 37 ft-lb	3,952 to 5,928 lb
3/8 – 24 Grade 5	28 to 42 ft-lb	4,479 to 6,719 lb
7/16 – 14 Grade 5	40 to 59 ft-lb	5,422 to 8,133 lb
7/16 – 20 Grade 5	44 to 66 ft-lb	6,055 to 9,082 lb
½ - 13 Grade 5	60 to 90 ft-lb	7,237 to 10,855 lb
½ - 20 Grade 5	68 to 102 ft-lb	8,158 to 12,236 lb
5/8 – 11 Grade 5	120 to 180 ft-lb	11,526 to 17,289 lb
5/8 – 18 Grade 5	136 to 204 ft-lb	13,054 to 19,581 lb
¾ - 10 Grade 5	213 to 320 ft-lb	17,057 to 25,586 lb
¾ - 16 Grade 5	238 to 357 ft-lb	19,021 to 28,532 lb
7/8 – 9 Grade 5	343 to 515 ft-lb	23,548 to 35,323 lb
7/8 – 14 Grade 5	379 to 568 ft-lb	25,983 to 38,975 lb
1 – 8 Grade 5	515 to 772 ft-lb	30,893 to 46,340 lb
1 – 12 Grade 5	564 to 845 ft-lb	33,815 to 50,723 lb

The above table is for SAE Grade 5 fasteners, K = .20 (Clean non-plated fasteners or Loctited zinc electroplated fasteners)

Fastener Size	Recommended tightening torque	Clamp load
#6 – 32 Grade 5	18 to 27 in-lb	589 to 883 lb
#6 – 40 Grade 5	20 to 30 in-lb	657 to 986 lb
#8 – 32 Grade 5	33 to 49 in-lb	908 to 1,362 lb
#8 – 36 Grade 5	34 to 52 in-lb	954 to 1,432 lb
#10 – 24 Grade 5	47 to 71 in-lb	1,136 to 1,704 lb
#10 – 32 Grade 5	54 to 81 in-lb	1,296 to 1,943 lb
¼ - 20 Grade 5	89 to 134 in-lb	1,623 to 2,434 lb
¼ - 28 Grade 5	102 to 153 in-lb	1,855 to 2,783 lb
5/16 – 18 Grade 5	15 to 23 ft-lb	2,674 to 4,011 lb
5/16 – 24 Grade 5	17 to 25 ft-lb	2,961 to 4,442 lb
3/8 – 16 Grade 5	27 to 41 ft-lb	3,952 to 5,928 lb
3/8 – 24 Grade 5	31 to 46 ft-lb	4,479 to 6,719 lb
7/16 – 14 Grade 5	43 to 65 ft-lb	5,422 to 8,133 lb
7/16 – 20 Grade 5	49 to 73 ft-lb	6,055 to 9,082 lb
½ - 13 Grade 5	66 to 100 ft-lb	7,237 to 10,855 lb
½ - 20 Grade 5	75 to 112 ft-lb	8,158 to 12,236 lb
5/8 – 11 Grade 5	132 to 198 ft-lb	11,526 to 17,289 lb
5/8 – 18 Grade 5	150 to 224 ft-lb	13,054 to 19,581 lb
¾ - 10 Grade 5	235 to 352 ft-lb	17,057 to 25,586 lb
¾ - 16 Grade 5	262 to 392 ft-lb	19,021 to 28,532 lb
7/8 – 9 Grade 5	378 to 567 ft-lb	23,548 to 35,323 lb
7/8 – 14 Grade 5	417 to 625 ft-lb	25,983 to 38,975 lb
1 – 8 Grade 5	566 to 850 ft-lb	30,893 to 46,340 lb
1 – 12 Grade 5	620 to 930 ft-lb	33,815 to 50,723 lb

The above table is for SAE Grade 5 fasteners, K = .22 (Zinc electroplated bolt or nut)

Fastener Size	Recommended tightening torque	Clamp load
#6 – 32 Grade 2	8 to 12 in-lb	300 to 450 lb
#6 – 40 Grade 2	9 to 14 in-lb	335 to 502 lb
#8 – 32 Grade 2	15 to 23 in-lb	462 to 693 lb
#8 – 36 Grade 2	16 to 24 in-lb	486 to 729 lb
#10 – 24 Grade 2	22 to 33 in-lb	579 to 868 lb
#10 – 32 Grade 2	25 to 38 in-lb	660 to 990 lb
¼ - 20 Grade 2	53 to 79 in-lb	1,050 to 1,575 lb
¼ - 28 Grade 2	60 to 90 in-lb	1,200 to 1,801 lb
5/16 – 18 Grade 2	108 to 162 in-lb	1,730 to 2,595 lb
5/16 – 24 Grade 2	120 to 180 in-lb	1,916 to 2,874 lb
3/8 – 16 Grade 2	16 to 24 ft-lb	2,557 to 3,836 lb
3/8 – 24 Grade 2	18 to 27 ft-lb	2,898 to 4,347 lb
7/16 – 14 Grade 2	26 to 38 ft-lb	3,508 to 5,262 lb
7/16 – 20 Grade 2	29 to 43 ft-lb	3,918 to 5,876 lb
½ - 13 Grade 2	39 to 59 ft-lb	4,683 to 7,024 lb
½ - 20 Grade 2	44 to 66 ft-lb	5,278 to 7,918 lb
5/8 – 11 Grade 2	78 to 117 ft-lb	7,458 to 11,187 lb
5/8 – 18 Grade 2	88 to 132 ft-lb	8,447 to 12,670 lb
¾ - 10 Grade 2	138 to 207 ft-lb	11,037 to 16,556 lb
¾ - 16 Grade 2	154 to 231 ft-lb	12,308 to 18,462 lb
7/8 – 9 Grade 2	133 to 200 ft-lb	9,142 to 13,714 lb
7/8 – 14 Grade 2	147 to 221 ft-lb	10,088 to 15,131 lb
1 – 8 Grade 2	200 to 300 ft-lb	11,994 to 17,991 lb
1 – 12 Grade 2	219 to 328 ft-lb	13,128 to 19,692 lb

The above table is for SAE Grade 2 fasteners, K = .20 (Clean non-plated fasteners or Loctited zinc electroplated fasteners)

Fastener Size	Recommended tightening torque	Clamp load
#6 – 32 Grade 2	9 to 14 in-lb	300 to 450 lb
#6 – 40 Grade 2	10 to 15 in-lb	335 to 502 lb
#8 – 32 Grade 2	17 to 25 in-lb	462 to 693 lb
#8 – 36 Grade 2	18 to 26 in-lb	486 to 729 lb
#10 – 24 Grade 2	24 to 36 in-lb	579 to 868 lb
#10 – 32 Grade 2	28 to 41 in-lb	660 to 990 lb
¼ - 20 Grade 2	58 to 87 in-lb	1,050 to 1,575 lb
¼ - 28 Grade 2	66 to 99 in-lb	1,200 to 1,801 lb
5/16 – 18 Grade 2	119 to 178 in-lb	1,730 to 2,595 lb
5/16 – 24 Grade 2	132 to 198 in-lb	1,916 to 2,874 lb
3/8 – 16 Grade 2	18 to 26 ft-lb	2,557 to 3,836 lb
3/8 – 24 Grade 2	20 to 30 ft-lb	2,898 to 4,347 lb
7/16 – 14 Grade 2	28 to 42 ft-lb	3,508 to 5,262 lb
7/16 – 20 Grade 2	31 to 47 ft-lb	3,918 to 5,876 lb
½ - 13 Grade 2	43 to 64 ft-lb	4,683 to 7,024 lb
½ - 20 Grade 2	48 to 73 ft-lb	5,278 to 7,918 lb
5/8 – 11 Grade 2	85 to 128 ft-lb	7,458 to 11,187 lb
5/8 – 18 Grade 2	97 to 145 ft-lb	8,447 to 12,670 lb
¾ - 10 Grade 2	152 to 228 ft-lb	11,037 to 16,556 lb
¾ - 16 Grade 2	169 to 254 ft-lb	12,308 to 18,462 lb
7/8 – 9 Grade 2	147 to 220 ft-lb	9,142 to 13,714 lb
7/8 – 14 Grade 2	162 to 243 ft-lb	10,088 to 15,131 lb
1 – 8 Grade 2	220 to 330 ft-lb	11,994 to 17,991 lb
1 – 12 Grade 2	241 to 361 ft-lb	13,128 to 19,692 lb

The above table is for SAE Grade 2 fasteners, K = .22 (Zinc electroplated nut or bolt)

Fastener Size	Recommended tightening torque	Clamp load
#6 – 32	3 to 5 in-lb	125 to 188 lb
#6 – 40	4 to 6 in-lb	140 to 210 lb
#8 – 32	6 to 10 in-lb	193 to 290 lb
#8 – 36	7 to 10 in-lb	203 to 305 lb
#10 – 24	9 to 14 in-lb	242 to 363 lb
#10 – 32	10 to 16 in-lb	276 to 414 lb
¼ - 20	22 to 33 in-lb	439 to 659 lb
¼ - 28	25 to 38 in-lb	502 to 753 lb
5/16 – 18	45 to 68 in-lb	724 to 1,085 lb
5/16 – 24	50 to 75 in-lb	801 to 1,202 lb
3/8 – 16	80 to 120 in-lb	1,069 to 1,604 lb
3/8 – 24	91 to 136 in-lb	1,212 to 1,818 lb
7/16 – 14	128 to 193 in-lb	1,467 to 2,201 lb
7/16 – 20	143 to 215 in-lb	1,638 to 2,457 lb
½ - 13	16 to 24 ft-lb	1,958 to 2,937 lb
½ - 20	18 to 28 ft-lb	2,207 to 3,311 lb
5/8 – 11	32 to 49 ft-lb	3,119 to 4,678 lb
5/8 – 18	37 to 55 ft-lb	3,532 to 5,298 lb
¾ - 10	58 to 87 ft-lb	4,616 to 6,923 lb
¾ - 16	64 to 97 ft-lb	5,147 to 7,720 lb
7/8 – 9	93 to 139 ft-lb	6,372 to 9,558 lb
7/8 – 14	103 to 154 ft-lb	7,031 to 10,546 lb
1 – 8	139 to 209 ft-lb	8,359 to 12,539 lb
1 – 12	152 to 229 ft-lb	9,150 to 13,725 lb

The above table is for Stainless Steel, Bronze or Aluminum fasteners. By fasteners we are implying nuts or bolts – not stationary components in the clamped joint. K = .20 (Clean non-plated fasteners with or without a Loctite type product)

Socket set screw size	Minimum tightening torque for alloy steel socket set screws	Minimum tightening torque for stainless socket set screws
#6	10 in-lb	7 in-lb
#8	19 in-lb	16 in-lb
#10	34 in-lb	26 in-lb
¼	78 in-lb	70 in-lb
5/16	156 in-lb	130 in-lb
3/8	23 ft-lb	230 in-lb
7/16	36 ft-lb	28 ft-lb
1/2	51 ft-lb	42 ft-lb
5/8	110 ft-lb	82 ft-lb
3/4	179 ft-lb	142 ft-lb
7/8	428 ft-lb	333 ft-lb
1	584 ft-lb	467 ft-lb

The above table is the recommended minimum tightening torque for alloy steel and stainless socket set screws. Please note the recommended tightening torque is the same for both fine threaded and coarse threaded set screws

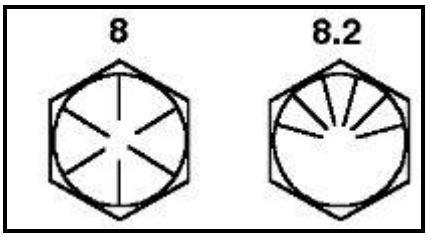
For reference, Recommended tightening torque is found by the following equation;

T = KDP

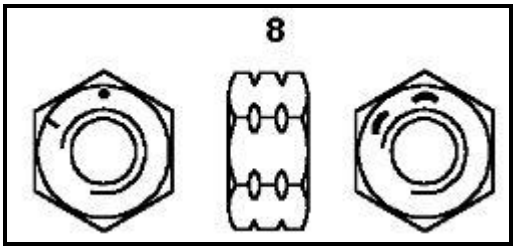
T = Tightening torque in units of inch-pound.
K = Nut factor and it is unit less.
D = Nominal bolt diameter in units of inch.
P = Clamp load in units of pounds.

Nut factor = K = .20 or .22 in these tables. K = .20 for clean non-plated bolts. K = .25 for zinc electroplated bolts. See IFI handbook 6th edition on page M-64 for more details.
Our recommended tightening torques is intended to maintain a clamp load of 60% to 90% of the bolt's proof load. See Mechanical Engineering Design ISBN 0-07-056888-X page 382 for more details.
We assumed a Grade 8 proof load of 120,000 psi for all fasteners sizes.
We assumed a Grade 5 proof load of 85,000 psi for fasteners ¼" in bolt diameter up to 1" in bolt diameter. We assumed a Grade 5 proof load of 108,000 psi for fasteners #6 up to #10 in bolt diameter.
We assumed a Grade 2 proof load of 33,000 psi for fasteners larger than 3/4" in bolt diameter up to 1-1/2" in bolt diameter. We assumed a Grade 2 proof load of 55,000 psi for fasteners #6 in bolt diameter up to 5/8" in bolt diameter.
We assumed a proof load of 23,000 psi for all Stainless Steel, Bronze and Aluminum material fasteners. Sand cast 356.0-T6 aluminum has a yield strength of 24,000 psi listed in the ASM Specialty Handbook Aluminum and Aluminum Alloys on page 720.

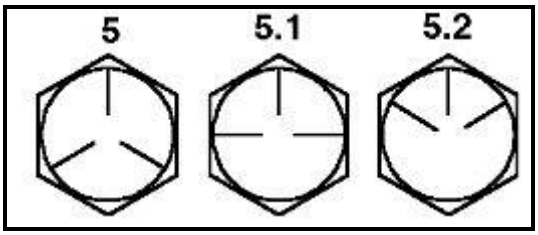
Fastener Size	Nominal bolt diameter (in)	Tensile stress area (square inch)	Stainless, Brass, Bronze or Aluminum proof load (lb)	SAE Grade 2 proof load (lb)	SAE Grade 5 proof load (lb)	SAE Grade 8 proof load (lb)
#6 – 32	.1380	.00909	209	500	981	1,090
#6 – 40	.1380	.01015	233	558	1,095	1,217
#8 – 32	.1640	.0140	322	770	1,513	1,681
#8 – 36	.1640	.01474	339	810	1,591	1,767
#10 – 24	.1900	.0175	403	964	1,893	2,104
#10 – 32	.1900	.0200	460	1,100	2,159	2,399
¼ - 20	.250	.0318	732	1,750	2,705	3,819
¼ - 28	.250	.0364	837	2,001	3,092	4,365
5/16 – 18	.3125	.0524	1,206	2,884	4,457	6,292
5/16 – 24	.3125	.0580	1,336	3,194	4,936	6,968
3/8 – 16	.375	.0775	1,782	4,262	6,587	9,299
3/8 – 24	.375	.0878	2,020	4,831	7,465	10,539
7/16 – 14	.4375	.1063	2,445	5,847	9,036	12,757
7/16 – 20	.4375	.1187	2,730	6,529	10,091	14,246
½ - 13	.500	.1419	3,264	7,804	12,061	17,028
½ - 20	.500	.1599	3,679	8,797	13,596	19,194
5/8 – 11	.625	.226	5,198	12,430	19,210	27,120
5/8 – 18	.625	.256	5,887	14,078	21,759	30,715
¾ - 10	.750	.334	7,693	18,395	28,429	40,135
¾ - 16	.750	.373	8,578	20,513	31,702	44,755
7/8 – 9	.875	.462	10,620	15,237	39,247	55,408
7/8 – 14	.875	.509	11,718	16,813	43,305	61,137
1 – 8	1.000	.606	13,932	19,990	51,488	72,689
1 – 12	1.000	.663	15,250	21,880	56,359	79,565



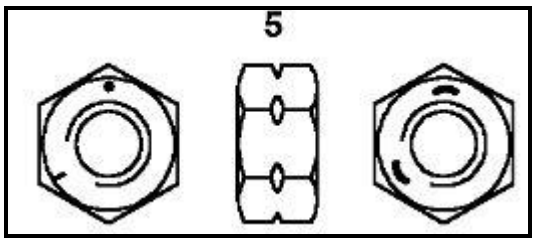
The above image shows how SAE Grade 8 hex head bolts can be identified.



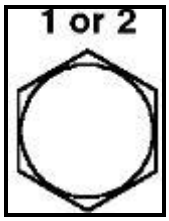
The above image shows how SAE Grade 8 hex nuts can be identified.



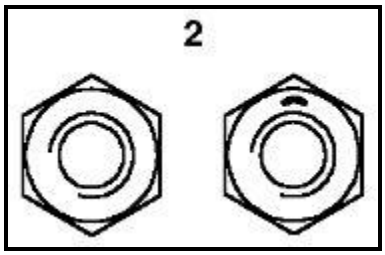
The above image shows how SAE Grade 5 hex head bolts can be identified.



The above image shows how SAE Grade 5 hex nuts can be identified.



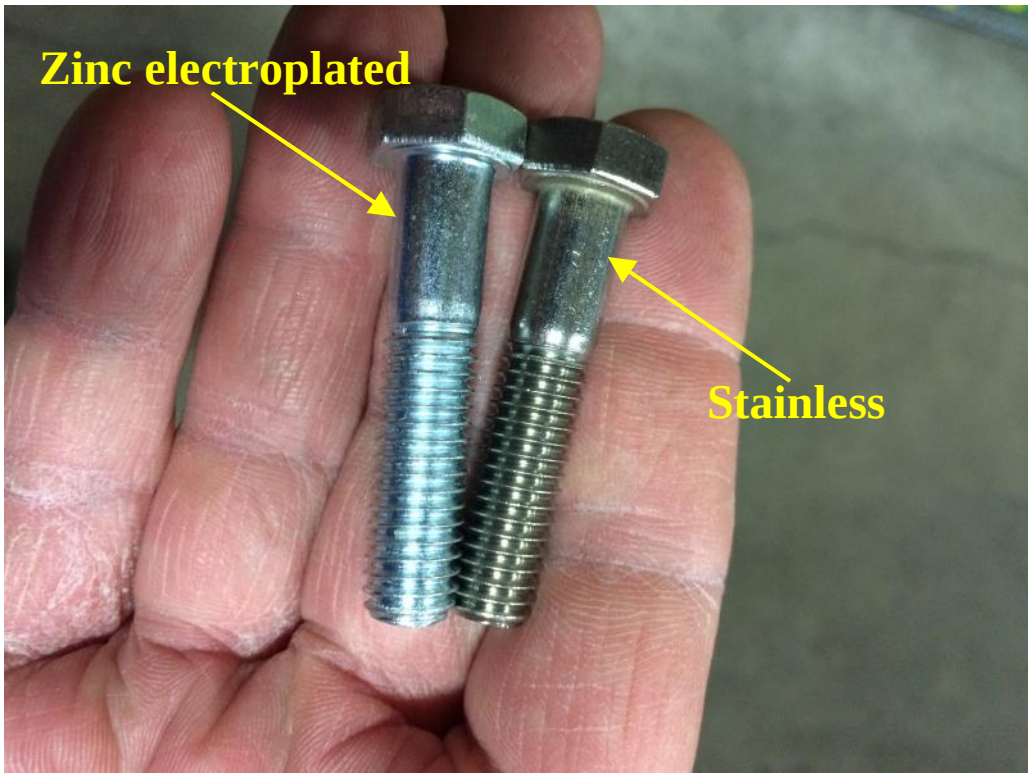
The above image shows how SAE Grade 2 hex head bolts can be identified.



The above image shows how SAE Grade 2 hex nuts can be identified.

The above images show different types of zinc electroplated fasteners.

The above images show different types of clean non-plated fasteners.



The bolt on the left is zinc electroplated.
The bolt on the right is stainless steel.

The above image is a brass machine screw and brass hex nut.

All alloy steel socket head cap screws are have an 180,000 psi tensile strength for ½" and smaller bolts and 170,000 psi tensile strength for 5/8" and larger bolts. Use the SAE Grade 8 recommended tightening torque tables for socket head cap screws.

All alloy steel socket flat countersunk head cap screws have a 150,000 psi minimum tensile strength. Use the SAE Grade 8 recommended tightening torque tables for alloy steel socket flat countersunk head cap screws.

All alloy steel socket button head cap screws have a 137,000 psi minimum tensile strength. Use the SAE Grade 5 recommended tightening torque tables for alloy steel socket button head cap screws.

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The fasteners on the left are alloy steel socket set screws. The fasteners on the right are stainless socket set screws.

If further information is needed, call **Darley** at
Chippewa Falls, WI. - 800-634-7812 or 715-726-2650