12. HF

12. HF

W. S DARLEY & CO.
REPAIR SERVICE INSTRUCTIONS
TYPE HF FRONT MOUNT FIRE PUMP

TO REMOVE HF PUMP AND TRANSMISSION ASSEMBLY FROM TRUCK
Refer to Drawing DHC0100

1. Remove the following items from the pump:
   - Gage Line Tubing
   - Primer Tubing
   - Tachometer Drive Cable
   - Heater Line Tubing
   - Drive Shaft

2. Remove all accessories that will prevent removal of the pump and transmission.

3. Drain oil from gear case.

4. Remove cap screws holding pump support bracket (34) at front of pump to truck frame.

5. Provide an overhead hoist to support the weight of the pump.

6. Remove four 3/8" NC cap screw holding clutch housing (59) to truck frame.

7. Remove the pump from the truck frame.

TYPE HF DISASSEMBLY FOR OVERHAUL
Refer to Drawing DHC0100

1. Remove four 3/8" NC nuts from studs and remove discharge head (13) assembly from top of pump casing (8). Discard discharge head gasket (9).

2. Remove twelve 3/8" NC nuts from studs and remove pump support bracket (34) and suction head (20) from pump casing (8). Discard pump casing gasket (21) and suction head o-ring (94).

3. If necessary to replace seal ring (22), remove seal ring from suction head (20).

4. Remove twelve 3/8" NC nuts and remove pump casing (8) from inboard head (7). Discard casing gasket.

5. Remove cotter key (29) from impeller shaft (3).

6. Remove impeller nut (30) and impeller washer (31) from impeller shaft (3).

7. Slide impeller (24) off of impeller shaft (3).

8. Remove four 5/16" NC cap screws and slide inboard head (7) assembly off of impeller shaft (3). Keep impeller shaft with gear case.

9. Remove oil seal (6) from inboard head (7).

10. If necessary to replace, press stuffing box (25) out of inboard head (7).

11. If necessary to replace, remove seal ring (22) from inboard head (7).

12. Remove three 5/16” NC cap screws and remove bearing cap (86) from gear case cover (91). Discard gasket.

13. Remove impeller shaft (3) assembly from gear case (1).

14. Remove bearing (85) from impeller shaft (3) with a suitable puller. Slide spacer (84) off of shaft.

15. Pry tab of lock washer (88) out of slot in lock nut (87). Remove lock nut and lock washer from impeller shaft (3).

16. Press pinion gear (90), spacer (92), and bearing (4) off of impeller shaft (3).

17. Remove four 1/4” NC cap screws and remove clutch lever (48) from clutch throw screw (51).

18. Pry tab of lock washer (43) out of locknut slot (42). Remove lock nut and lock washer from driveshaft (41).

19. Turn clutch throw screw (51) out of clutch throw nut (52), which will remove thrust bearing (53) from drive shaft (41).

20. Press thrust bearing (53) out of clutch throw screw (51).

21. Remove v-ring (57) from drive shaft (41).

22. Remove four 3/8” NC cap screws and remove clutch housing (59) from gear case cover (91).

23. Slide drive shaft (41) assembly out of drive gear shaft (81).

24. Remove retaining nut and washer (72) from drive shaft (41).

25. Press drive shaft (41) out of clutch drive cup hub (71).

26. Remove twelve clutch springs (68) from clutch cup (66).

27. Remove bearing (70) from clutch drive cup hub (71).

28. Press clutch drive cup hub (65) out of clutch cup (66).

29. Slide clutch pressure ring (65) and clutch cup retainer (69) off of drive shaft (41).

30. Remove two 1/4” NC flat head machine screws, and remove clutch plate retainer (74) from clutch cup (67).

31. Remove fiber clutch drive plates (63), steel clutch driven plates (78), and floating clutch plate (62) off clutch hub (67).

GEAR CASE DISASSEMBLY

32. Remove three 5/16” NC cap screws, and remove clutch throw nut (52) from gear case (1).

33. Drive two #6 tapered dowel pins out of gear case (1) flange from gear case side to gear case cover (91) side.

34. Remove seven 5/16” NC cap screws, and separate gear case cover (91) from gear case (1). Drive shaft gear assembly will retain with gear case.

35. Tap drive shaft gear assembly out of gear case.

36. Remove clutch hub retaining screw.

37. Press drive shaft (81) out of drive gear (56), oil slinger (60), bearing (79), and clutch hub (67) all at once.

38. Press bearing (82) off of drive gear shaft (81).

39. Slide oil slinger (58) off of drive gear shaft (81).

40. Remove four 5/16" NC cap screws, and remove bearing retainer (61) from gear case cover (91). Discard gasket.

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 and seal rings for wear. Use the following table for comparison.

Impeller Seal Ring O.D.	3.862 - 3.864"
Impeller Seal Ring I. D.	3.629 - 3-631"
Seal Ring O.D.	3.875 - 3.877"
Seal Ring I.D.	3.616 - 3.618"
Clearance O.D. - original	0.011 - 0.015"
Clearance I.D. - 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.

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

Impeller Shaft diameter at packing area	1.245 - 1.246"
Stuffing Box bore - new	1.2525 - 1.2535"
Stuffing box bore - max.	1.2585"
Clearance - original	0.0085 - 0.0105"
Clearance - max. allowable	0.0155"

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.

PART	REP. NO.	ORIGINAL BORE DIA.
Gear Case	63	2.8345 - 2.8355"
Gear Case Cover	64	2.8345 - 2.8355"
Clutch Housing	59	2.8355 - 2.8365"
Bearing Retainer	61	2.8345 - 2.8355"
Inboard Head	7	3.1496 - 3.1503"
Bearing Cap	92	2.4410 - 2.4415"
Clutch Throw Screw	51	2.0472 - 2.0479"

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.

PART	REP. NO.		ORIGINAL BORE DIA.
Impeller Shaft	3	small	0.9844 - 0.9848”
		large	1.3781 - 1.3785”
Drive Shaft	41		0.7865 - 0.7870”
Drive Gear Shaft	81	both	1.3779 - 1.3782”
Clutch Drive Cup Hub	71		1.3775 - 1.3779”

7. The original impeller shaft diameter under the pinion gear is 1.1875 to 1.1880”. The original pinion gear bore is 1.1870 to 1.1875” providing 0.0010” to 0.00000” press fit. The parts are still serviceable up to 0.0005” 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 1.3779 to 1.3782”. The original drive gear bore is 1.3780 to 1.3785” providing 0.0002” press fit to 0.0006” clearance. The drive gear may be reversed to work other side of gear teeth.

9. The original drive shaft diameter under the clutch drive cup hub is 1.1235 to 1.1245”. The original drive gear bore is 1.1245 to 1.1255” providing 0.0000” to 0.0020” clearance. The parts are still serviceable up to 0.0025” clearance.

10. The original drive shaft diameter under the clutch hub is 1.3745 to 1.3750”. The original clutch hub bore is 1.3745 to 1.3750” providing 0.0005” press fit to .0005” clearance. The parts are still serviceable up to 0.0010” clearance.

ASSEMBLY OF HF PUMP AND TRANSMISSION
REFER TO DRAWING DHC0100

1. Apply Loctite 243 or equivalent to the threads of four 5/16” NC x 3/4” cap screws and attach bearing retainer (61) and gasket (96) to gear case cover (91) with these cap screws and lock washers. Leave cap screws loose.

2. Apply Loctite 243 or equivalent to the threads of three 5/16” NC x 7/8” cap screws attach bearing cap (86) and gasket (83) to gear case cover (91) with these cap screws and lock washers. Tighten cap screws.

3. Apply a light coating of grease to drive shaft (81). Place drive gear key (80) in drive gear shaft keyway, align with key slot in drive gear (56), and press shaft evenly into drive gear until shaft shoulder is tight against side of gear.

4. Slide oil slinger (58) onto drive shaft (81) with center dish of slinger next to shaft shoulder.

5. Press sealed bearing (79) evenly onto drive shaft (82) until bearing, oil slinger, and shaft shoulder are tight together.

6. Slide oil slinger (60) onto drive shaft (81) with center dish of slinger next to drive gear (56). Slide spacer (100) onto shaft.

7. Press sealed bearing (82) evenly onto drive shaft (81) until spacer, bearing , oil slinger, drive gear, and shaft shoulder are tight together. Slide spacer (100) onto shaft.

8. Apply a light coating of grease to bore of bearing (4), and press bearing evenly onto impeller shaft (3) until bearing is tight against shaft shoulder.

9. Slider spacer bushing (92) onto impeller shaft (3).

10. Place pinion key (89) into impeller shaft keyway, align with key slot in pinion gear (90), and press shaft evenly into pinion gear bore until pinion gear , spacer bushing, and bearing are tight together.

11. Insert lock washer (88) onto impeller shaft (3) and install lock nut (87). Tighten lock nut until one tab of lock washer aligns with a slot in lock nut. Pry tab of lock washer into slot of lock nut.

12. Slide spacer (84) onto impeller shaft (3).

13. Apply a light coating of grease to bore of bearing (85), and press bearing evenly onto impeller shaft (3) until bearing, spacer and shaft shoulder are tight together.

14. Apply grease to bearing bore of bearing cap (86).

15. Insert impeller shaft (3) assembly into bearing cap (85). Do not seat shaft assembly completely into bearing cap.

16. Insert drive gear shaft (81) into gear case cover (91) until bearing (78) is seated in its bore. NOTE: tip impeller shaft into place and work the two shaft assemblies into the bearing pockets at the same time.

17. Insert two #6 tapered dowel pins into gear case cover. Place gear case gasket (93) into position on gear case cover (91).

18. Place gear case (1) over impeller shaft (3) and tap on until drive shaft bearing (82) is seated in its bore.

19. Attach gear case (1) to gear case cover (91) with seven 5/16” NC x 7/8” cap screws.

20. Apply Loctite 290 between the I.D. of the bearings (79,82) and drive shaft and O.D. of bearings (79, 82) and the gear case bearing bore. The Loctite will prevent oil leaking from gear case into the clutch.

21. Tighten cap screws holding bearing retainer (61) to gear cover case (91).

22. Apply Loctite 243 or equivalent to the threads of three 5/16” NC x 7/8” cap screws and lock washers, attach clutch throw nut (52) and gasket (83) to gear case.

23. Apply a light coating of grease to drive gear shaft (81). Place clutch hub key (77) in drive gear shaft keyway. Align key slot in clutch hub (67) with clutch hub key, and press clutch hub onto drive gear shaft until clutch hub is tight against bearing.

24. Secure clutch hub (67) to drive gear shaft (81) with a 1/4” NC x 3/8” socket head cap screw.

25. Attach three clutch plate keys (64) to clutch hub (67) with 6/32 x 1/2” flat head machine screws using Loctite 243 or equivalent. Long side of key goes toward bearing.

26. Wash eight steel clutch driven plates (78) and floating clutch plate (62) in solvent to remove rust preventative. Clean any fiber clutch drive plates (63) that need cleaning with brake cleaner.

27. Place floating clutch plate (62) on clutch hub (67) with flat side out.

28. Place a fiber clutch drive plate (63) on clutch hub, followed by a steel clutch driven plate (78). Alternate drive and driven plates, ending with a steel driven plate. One fiber plate should be left over at this point.

29. Attach clutch plate retainer (74) to clutch hub (67) with two 1/4" NC x 1/2" flat head machine screws with Loctite 243 or equivalent. Stake screws.

30. Place remaining fiber clutch drive plate (63) on clutch hub (67).

31. Place clutch cup key (75) into clutch drive cup hub keyway, align with keyslot in clutch drive cup(66), and press hub into cup until shoulder of hub is tight against the side of cup.

32. Apply a light coating of grease to bore of bearing (70), and press bearing evenly onto clutch drive cup hub (71) until bearing is tight against shoulder of hub.

33. Place twelve clutch springs (68) into clutch drive cup (66).

34. Place clutch cup pressure ring (65) in clutch drive cup (66) with smaller bore next to springs (68).

35. Slide cup retainer plate (69) into drive shaft (41) until retainer plate is seated on shaft shoulder.

36. Place key (73) into drive shaft keyway, align with key slot in clutch drive cup hub (71), and press shaft evenly into hub bore until shaft shoulder, cup retainer plate, and clutch drive hub are tight together. Make sure that cup retainer plate (69) engages clutch cup pressure ring (65) properly.

37. Slide internal lock washer onto drive shaft (41) and tighten on retaining nut (72).

38. Slide drive shaft (41) into drive gear shaft (81). Rotate clutch drive cup (66) back and forth to allow cup to engage driving clutch plates (63).

39. Apply grease to bearing bore of clutch housing (59).

40. Apply a thin layer of Loctite 518 Gasket Eliminator or equivalent to the flange surface. Slide clutch housing (59) over drive shaft (41) and attach gear case cover (91) to clutch housing with four 3/8" NC x 1" cap screws and lock washers.

41. Place v-ring (57) into groove on drive shaft (41) with lip of v-ring facing outward.

42. Press bearing closure (55) into clutch throw nut (52).

43. Screw the clutch throw screw (51) into clutch throw nut (52).

44. Apply grease to bore of clutch throw screw (51) and to bore thrust bearing (53). Tap thrust bearing into clutch throw screw with thrust side of inner bearing race facing outward. Thrust marking on side of outer race will face toward clutch plates.

45. Slide lock washer (43) onto drive shaft (41) and install lock nut (42). Tighten lock nut until a tab of lock washer aligns with a slot of lock nut. Press tab of lock washer into slot of lock nut.

46. Attach clutch lever (48) to clutch throw screw (51) with four 1/4" NC x 3/4" cap screws and lock washers.

NOTE: Twelve 1/4" NC tapped holes are provided in clutch throw screw for adjusting the clutch lever to provide proper operation. When clutch lever is properly adjusted, clutch is beginning to engage when the lever is in to vertical position, and clutch lever should offer greater resistance to engagement during the last quarter turn to its fully engaged position. Clutch must be fully released when the clutch lever is in the "OUT" position.

Adjust clutch lever as often as necessary to maintain proper clutch operation. Clutch will wear rapidly if it is adjusted too loose.

PUMP ASSEMBLY

47. Apply Loctite 609 or equivalent to the outer surface of the stuffing box (25). Align packing holes in stuffing box with packing holes in inboard head (7), and press stuffing box into inboard head until seated.

48. Apply Loctite 609 or equivalent to OD of seal ring (22) press into inboard head (7) until seated.

49. Press oil seal (6) into inboard head (7)) with lip spring of seal facing bearing. Lubricate oil seal lip.

50. Place water slinger (95) into position in inboard head (7) between stuffing box (25) and oil seal (6).

51. Apply a thin layer of Loctite 518 Gasket Eliminator or equivalent to the flange surface of the inboard head (7).

52. Slide inboard head (7) assembly over impeller shaft (3), making sure that water slinger (95) is in the proper position.

53. Attach inboard head (7) to gear case (1) with four 5/16" NC x 7/8" cap screws and lock washers.

54. Move water slinger (95) into its groove on impeller shaft (3).

55. Slide impeller (24) and impeller washer (31) onto impeller shaft (3).

56. Apply Loctite 243 or equivalent to impeller shaft thread.

57. Tighten the impeller nut (30) until it contacts the impeller washer (31), then turn to the next cotter key hole. (DO NOT OVER TIGHTEN).

58. Install a 1/8" x 1" STAINLESS STEEL cotter key (29) in impeller shaft cotter key hole.

59. Place pump casing gasket (21) into position on inboard head (7). Slide pump casing (8) into position on inboard head and attach with twelve 3/8" NC nuts.

60. Apply Loctite 609 or equivalent to OD of seal ring (22) press into suction head (20) until seated.

61. Apply a silicon lubricant, such as Dow Corning Compound 111, (or equivalent) to suction head o-ring (94), and place o-ring in groove of suction head.

62. Place pump casing gasket (21) into position on suction head (20). Tap suction head into position on pump casing (8) and attach with twelve 3/8" NC nuts. Attach pump support bracket (34) on bottom two studs.
63. Place discharge head gasket (9) into position on top of pump casing (8). Place discharge head (13) assembly into position on top of pump casing and attach with four 3/8" NC nuts.

INSTALLING PUMP IN TRUCK CHASSIS

Reverse the procedures outlined under removal instructions.

Lubricate universal joint slip yoke on pump drive shaft.

Fill gear case with 80W/90 Gear Lube oil to the bottom of the 1/8" NPT oil level plug located on the front of the gear case.

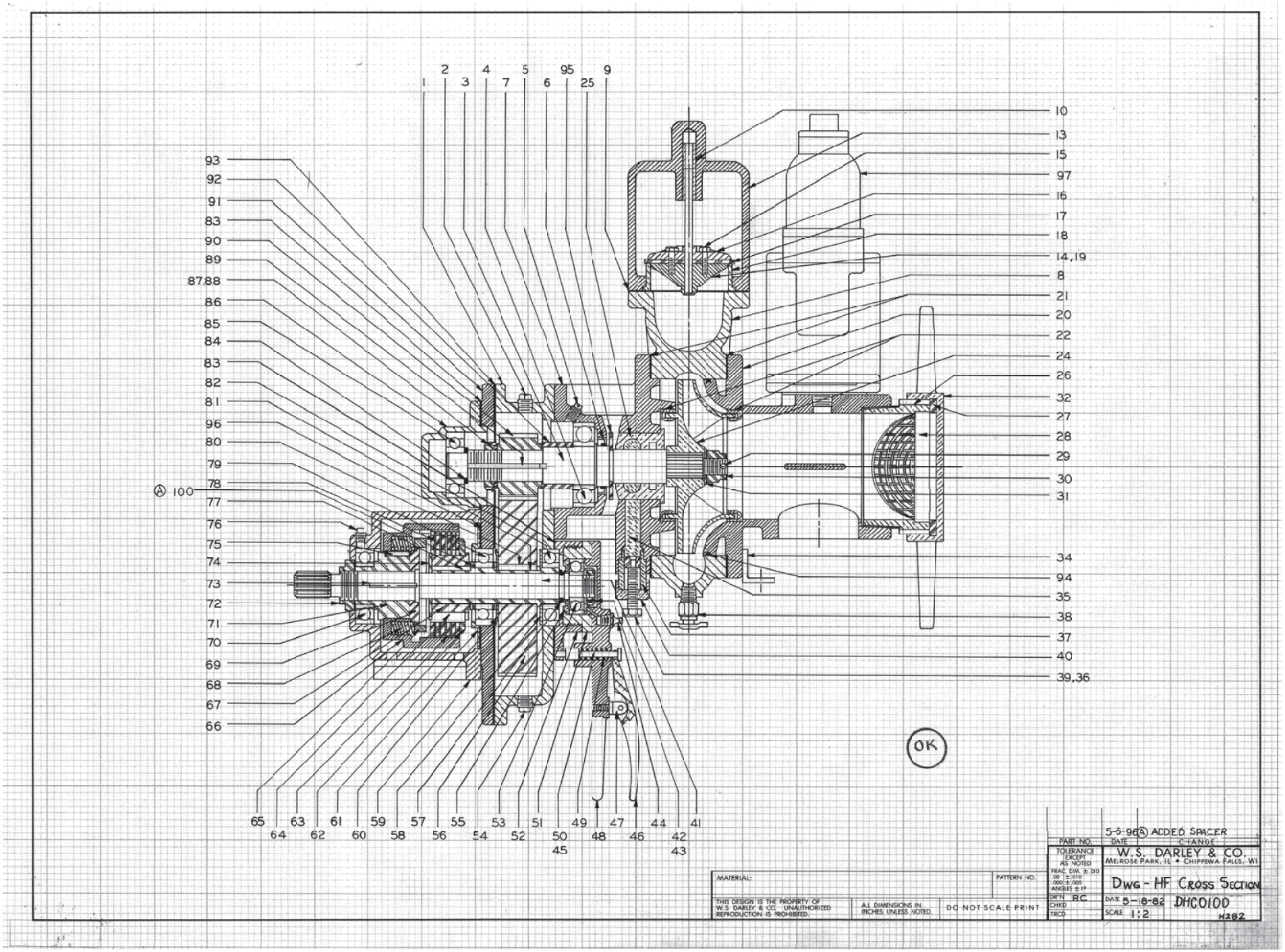
Fill and maintain oil level even with bottom of the oil level plug every 25 hours or 3 months. Use SAE 80W/90 Gear Lube oil in the pump transmission.

CAUTION: Do not overfill

INITIAL CLUTCH BURNISHING

After rebuilding a clutch and before commencing with pump operations, the clutch operation can be improved by burnishing the dry friction disc clutch. To burnish the dry friction disc clutch, set up the apparatus for normal pumping operation. Once the engine is at an idle, the pump has been primed and the pump lever is in the disengaged position – shift the pump lever back and forth from the disengaged position into the engaged position. After six shifts from the disengaged and engaged positions, the clutch's dry friction disc surfaces should be suitably worn in.

IF FURTHER INFORMATION IS NEEDED, CALL **W.S. DARLEY & CO.** AT CHIPPEWA FALLS, WI. AT 800-634-7812 or 715-726-2650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DR'N RC
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W.S. DARLEY & CO.
MELROSE PARK, IL • CHIPPEWA FALLS, WI
DWG - HF CROSS SECTION
DATE 5-8-82
DHC0100
SCALE 1:2
H282
MATERIAL:
PATTERN NO.
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ALL DIMENSIONS IN INCHES UNLESS NOTED.
DO NOT SCALE PRINT

PARTS LIST - TYPE HF500 FIRE PUMP
DRAWING DHC0100

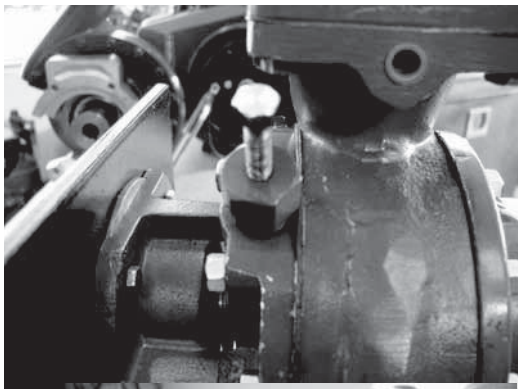
Rep No.	Name of Part
1	Gear Case
2	Pipe Plug
3	Impeller Shaft
4	Bearing
5	Vent Plug
6	Oil Seal - Impeller Shaft
7	Inboard Had
8	Pump Casing
9	Discharge Head Gasket
10	Check Valve Bushing
13	Discharge Head
14	Check Valve Stem
15	Cap Screw
16	Check Valve Plate
17	Check Valve Rubber
18	Check Valve Seat
19	Check Valve Diffuser
20	Suction Head
21	Pump Casing Gasket
22	Impeller Seal Ring
24	Impeller
25	Stuffing Box
26	Suction Nipple
27	Suction Cap Gasket
28	Suction Strainer
29	Cotter Key
30	Impeller Nut
31	Impeller Washer
32	Suction Cap
34	Pump Support Bracket
35	Packing
36	Packing Plunger
37	Packing Plunger Guide
38	Drain Cock
39	Packing Plunger Stud
40	Gland Nut
41	Drive Shaft

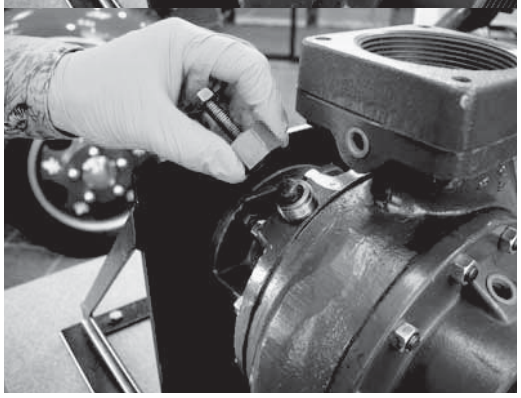
Rep. No.	Name of Part
42	Bearing Locknut
43	Bearing Lockwasher
44	Grease Zerk
45	Lever Latch Washer
46	Lever
47	Clutch Pivot Screw
48	Clutch Lever
49	Clutch Latch Spring
50	Lever Latch
51	Clutch Throw Screw
52	Clutch Throw Nut
53	Bearing
54	Magnetic Pipe Plug
55	Bearing Closure
56	Drive Gear
57	Oil Seal
58	Oil Slinger
59	Clutch Housing
60	Oil Slinger
61	Bearing Retainer
62	Floating Clutch Plate
63	Driving Clutch Plate
64	Clutch Plate Key
65	Clutch Cup Pressure Ring
66	Clutch Drive Cup
67	Clutch Hub
68	Clutch Load Spring
69	Cup Retainer Plate
70	Bearing
71	Clutch Drive Cup Hub
72	Retaining Nut & Washer
73	Key
74	Clutch Plate Retainer
75	Clutch Cup Key
76	Pipe Plug
77	Clutch Hub Key
78	Driven Clutch Plate

Rep No.	Name of part
79	Bearing
80	Drive Gear Key
81	Drive Gear Shaft
82	Bearing
83	Gasket
84	Spacer
85	Bearing
86	Bearing Cap
87	Bearing Locknut
88	Bearing Lockwasher
89	Pinion Key
90	Driven Gear
91	Gear Case Cover
92	Spacer Bushing
93	Gear Case Cover
94	O'Ring Suction Head
95	Water Slinger
96	Bearing Cover Gasket
97	Dbl. Float Primer Assembly

W. S. DARLEY & CO.

DARLEY INJECTION TYPE STUFFING BOX ADJUSTMENT





Prop 65 Warning: This product contains lead, a chemical known to the State of California to cause cancer, birth defects, and other reproductive harm. Wash hands after handling.

Caution: Do not attempt to use anything but Darley injection packing. Using the wrong packing material in your pump may cause catastrophic failure of the pump shaft sealing components.

Only use W.S. Darley & Co.'s plastallic injection packing material. It is made of a special composition of shredded fibers, and a special bonding and lubricating compound.

It is important that the stuffing box is completely filled solid with packing and compressed firm during adjustment to prevent formation of voids and excessive leakage.

To pack the stuffing box when empty and assembled in the pump, remove the packing screw and nut assembly, and insert pellet form packing into the packing plunger guide. Replace the packing screw assembly and use a hand speed wrench to force the pellets into the gland. DO NOT USE A POWER TOOL! Repeat pellet additions while turning the impeller shaft by hand until resistance to turning is felt when the stuffing box is almost full. Continue turning packing screw by hand using a standard 6" long 9/16" end wrench until 4 lb. of force is felt at the end of the wrench. This is equivalent to 2 ft-lb or 24 in-lb torque. Continue turning until a few flakes of packing are extruded out the opening between the impeller shaft and the stuffing box hole. The gland is now ready for pressure testing or pumping.

After priming the pump with water, start the pump and raise the discharge pressure to 50 psi. Tighten the packing screw using a 6" long 9/16" end wrench until 4 lb. force is felt at the end of the wrench (24 in-lb torque). Continue operating the pump at 50 psi for 5 minutes to dissipate packing pressure against the shaft and permit cooling water to flow between the shaft and stuffing box hole. Make sure that water actually does come through before operating pump at any higher pressure. The normal drip rate may vary between 5 and 60 drops per minute.

Operate the pump for 10 minutes at the highest normal operating pressure flowing sufficient water to prevent overheating. Do not run the pump blocked tight. Lower discharge pressure to 50 psi and repeat the packing screw tightening procedure outlined above.

The pump may now be operated for any time period required within its rated capacity. However, the drip rate should be monitored more frequently during the first few hours, and adjusted if necessary to achieve a stable flow rate. Several more adjustments may be required.

For a list of approximate quantity of packing pellets required by model (completely repacked), see below:

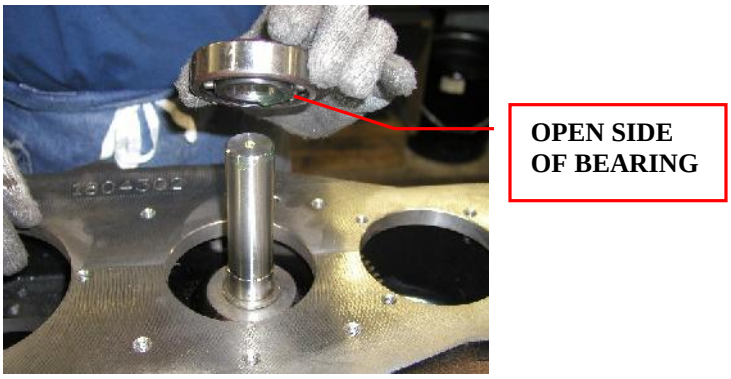
Model	Approximate # Packing Pellets
A	6
2BE	6
EM	15
H	8
JM	8
KD	10
KS	8
LD	15
LS	9
P	10
U2	5
U4	10

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

DARLEY
BASIC ASSEMBLING TECHNIQUES

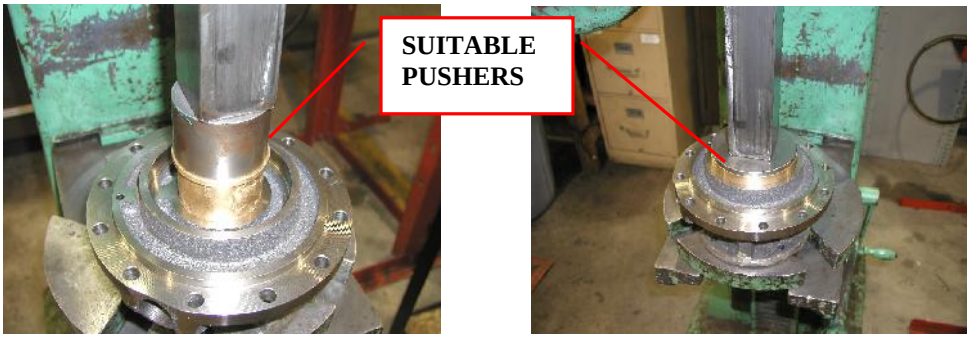
- Work with clean tools in clean surroundings during assembly.
- Clean parts thoroughly and keep free from nicks and abrasions.
- Keep loose parts marked otherwise identified to avoid error in assembly.
- **Bearings:** Keep bearings in original containers until ready to install.
- **Bearings/Press fits:** 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.



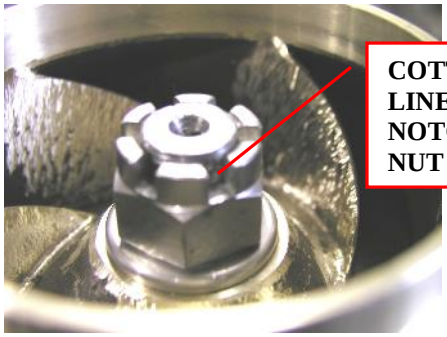
- **Bearings:** When pressing a bearing onto a shaft, lightly lube the bore of the bearing and the shaft journal for the bearing with oil. Also when installing bearings into bearing pockets, lightly lube the OD of the bearing and the bore of the bearing pocket with oil.

- **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.

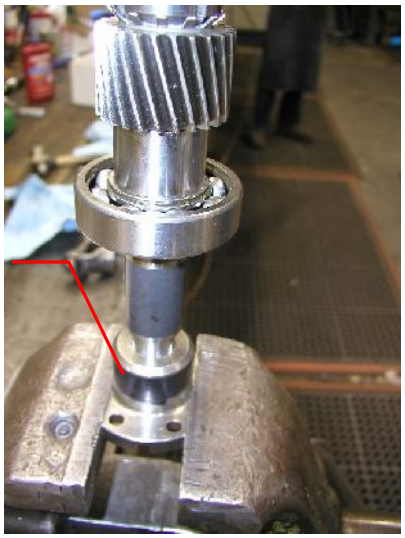


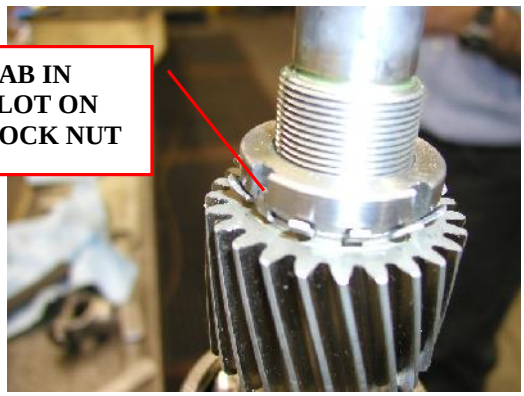
- **Press fits:** When pressing a part into housing (ex. Stuffing box, seal ring, etc.), the part needs to be started perpendicular to the housing.

- **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.



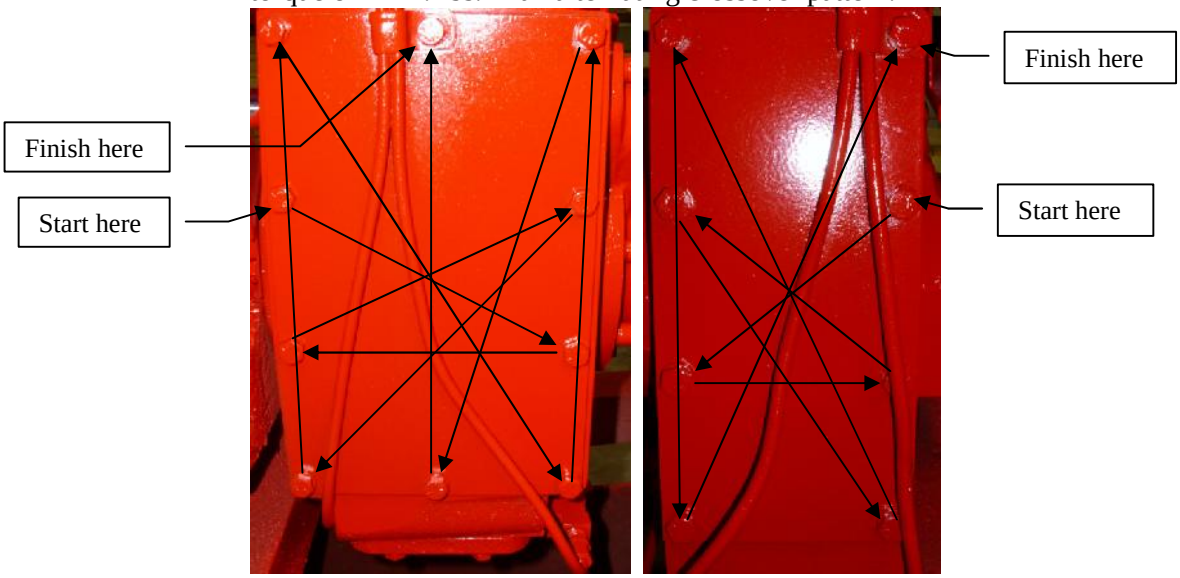
- **Lock Washer/Lock Nut:** Secure shaft so that it doesn't rotate when tightening lock nut. Line up tab on lock washer with keyway slot in shaft and slide washer onto shaft. Screw lock nut onto shaft until snug, then turn until a tab and slot line up. Using a punch, tap tab from lock washer into slot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





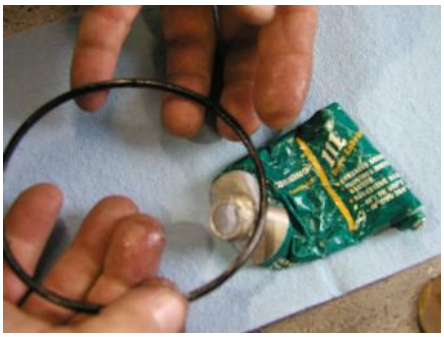
- **Loctite/thread locker:** When applying Loctite/thread lockers, only use one small drop per hole, unless explicitly told differently by engineering, a WI, or assembly/repair instruction or assembly supervisor.
- **Loctite/thread locker:** When applying Loctite/thread lockers to lock fasteners going 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.

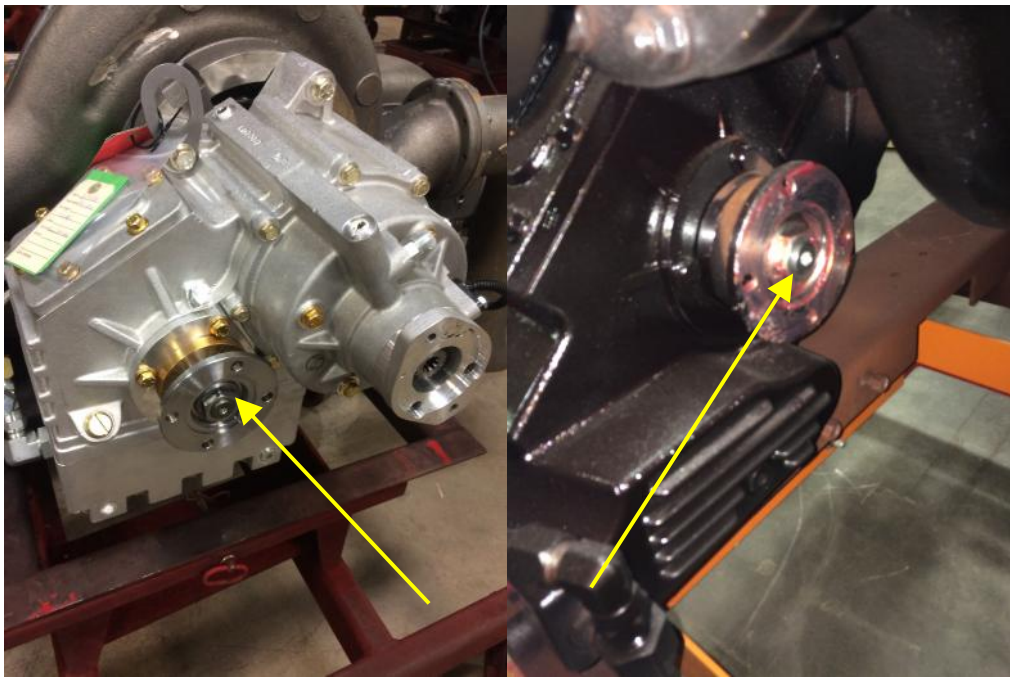
- **O-rings/Quad rings:** When installing o-rings and quad rings LIGHTLY lube with oil or silicon grease (Dow Corning 111). Be careful not to apply too thick of a film of lubricant when using the silicone grease because over application of the grease can cause the o-ring/quad ring to bridge and leak.



- **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.

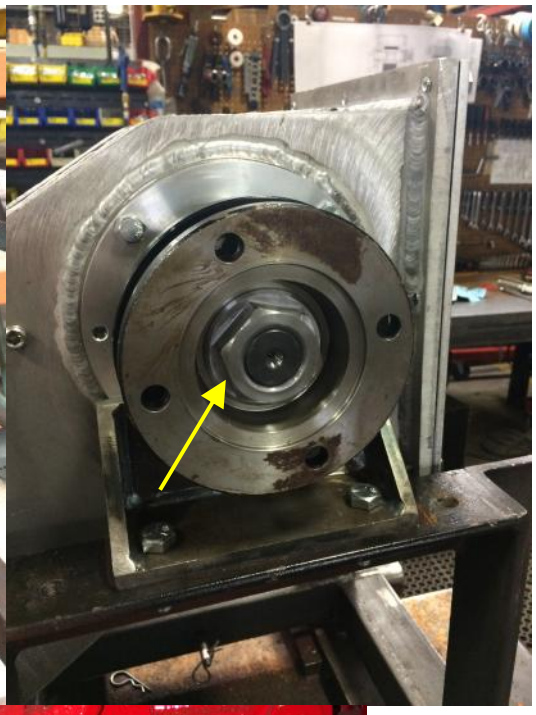


PUC and PUC-3G yoke nuts are tightened to 300-350 lb-ft.

- **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.

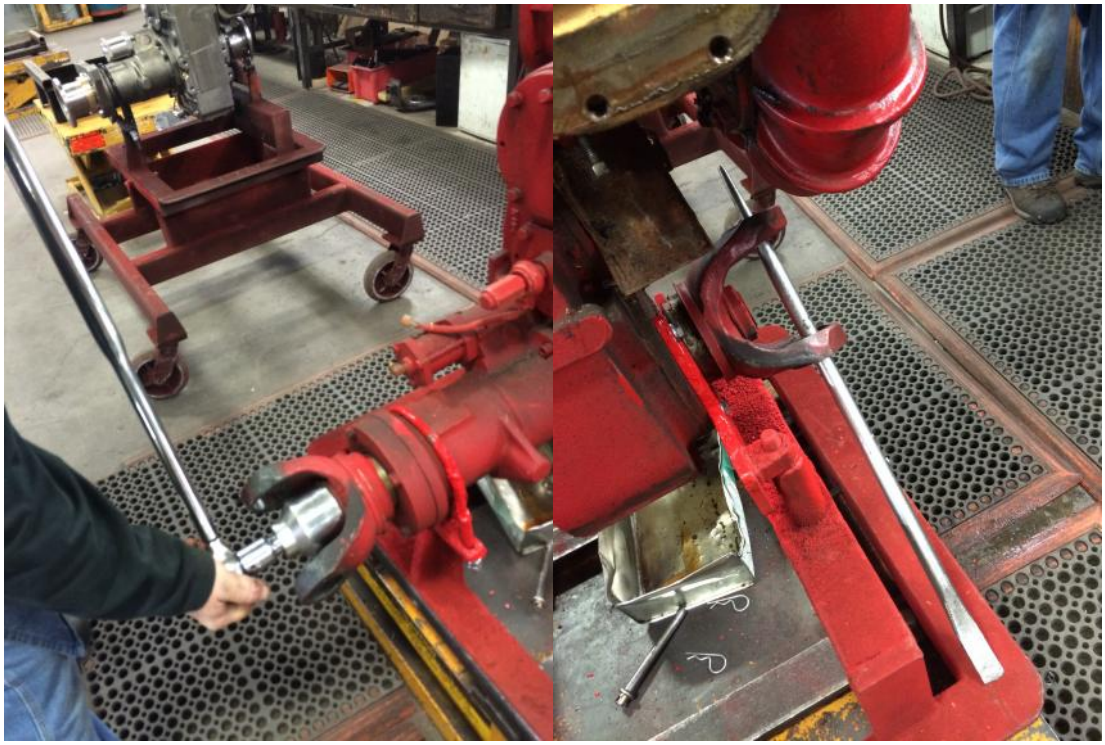
All 1.75-12 interference threaded yoke nuts are torqued to 150-200 ft-lb.



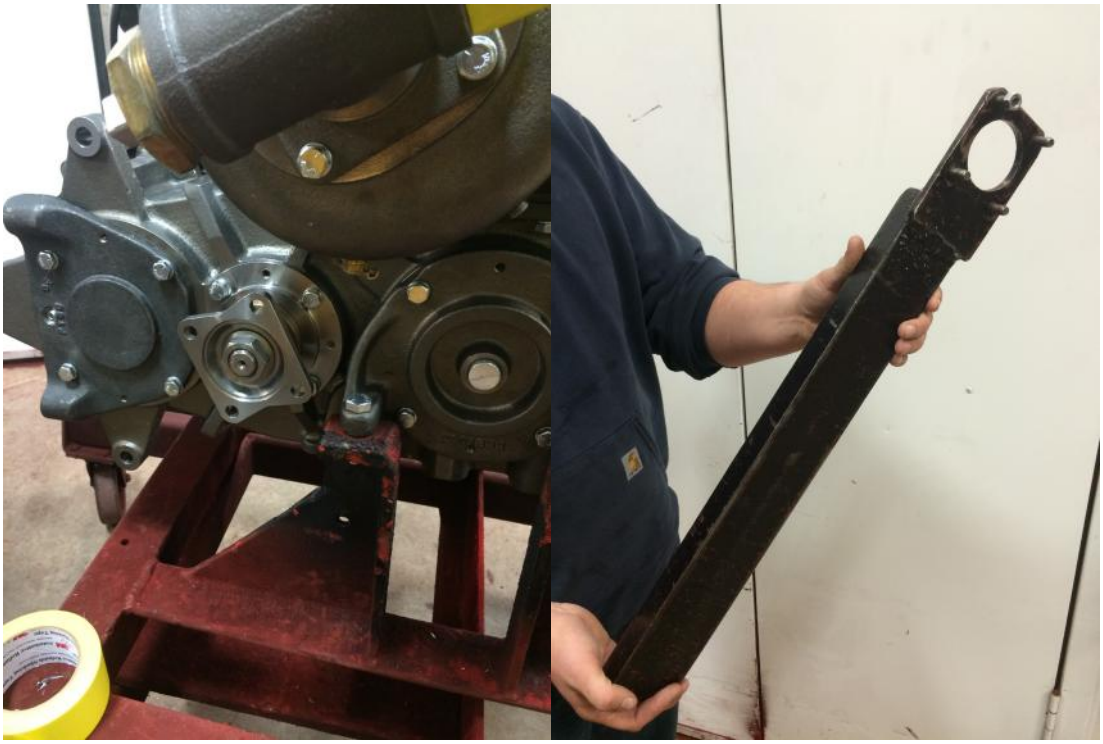
All 1.25-12 threaded yoke nuts are torqued to 150-200 ft-lb.

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

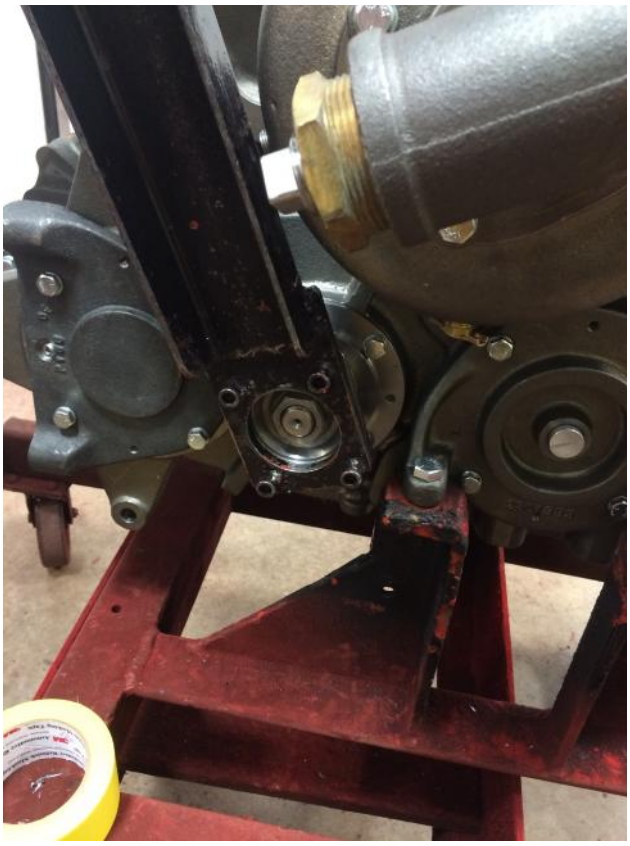
After torqueing the yoke nut down, check to make sure there is not a gap between the yoke nut and the yoke.



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

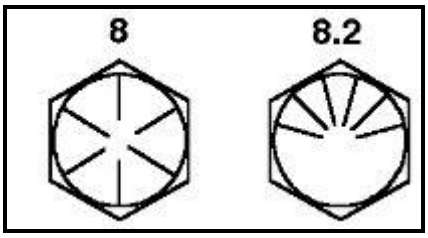
For reference, Recommended tightening torque is found by the following equation;

T = KDP

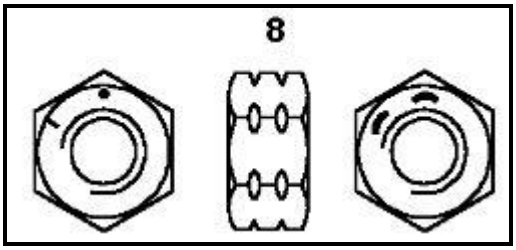
T = Tightening torque in units of inch-pound.
K = Nut factor and it is unit less.
D = Nominal bolt diameter in units of inch.
P = Clamp load in units of pounds.

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.

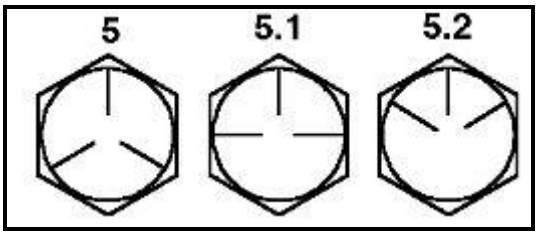
Fastener Size	Nominal bolt diameter (in)	Tensile stress area (square inch)	Stainless, Brass, Bronze or Aluminum proof load (lb)	SAE Grade 2 proof load (lb)	SAE Grade 5 proof load (lb)	SAE Grade 8 proof load (lb)
#6 – 32	.1380	.00909	209	500	981	1,090
#6 – 40	.1380	.01015	233	558	1,095	1,217
#8 – 32	.1640	.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



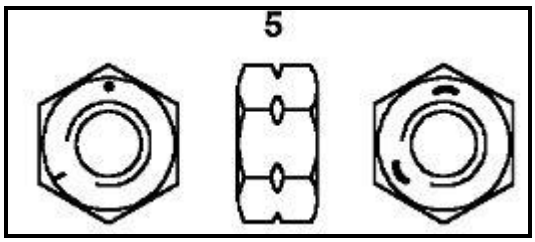
The above image shows how SAE Grade 8 hex head bolts can be identified.



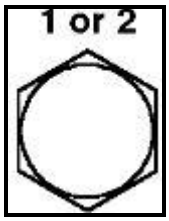
The above image shows how SAE Grade 8 hex nuts can be identified.



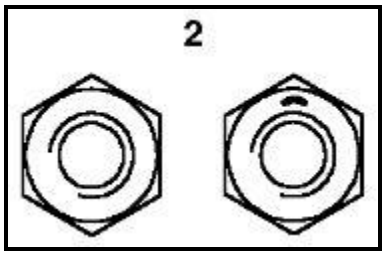
The above image shows how SAE Grade 5 hex head bolts can be identified.



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



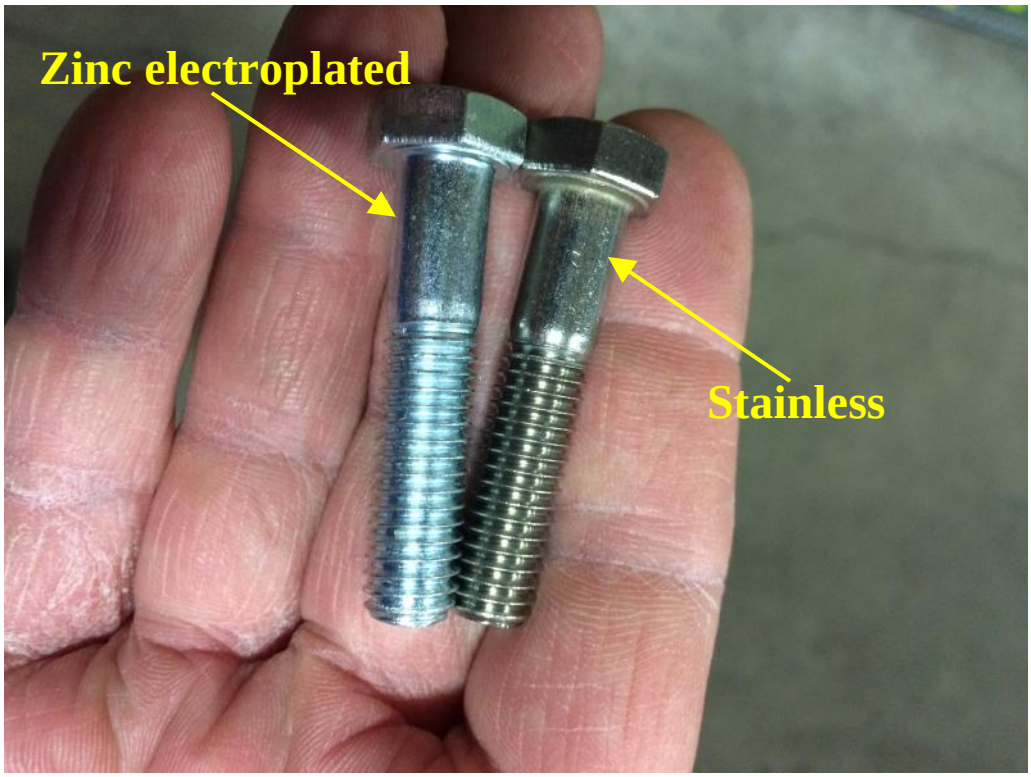
The above image shows how SAE Grade 2 hex head bolts can be identified.



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