HYDRO 15

FLEX WING MOWER

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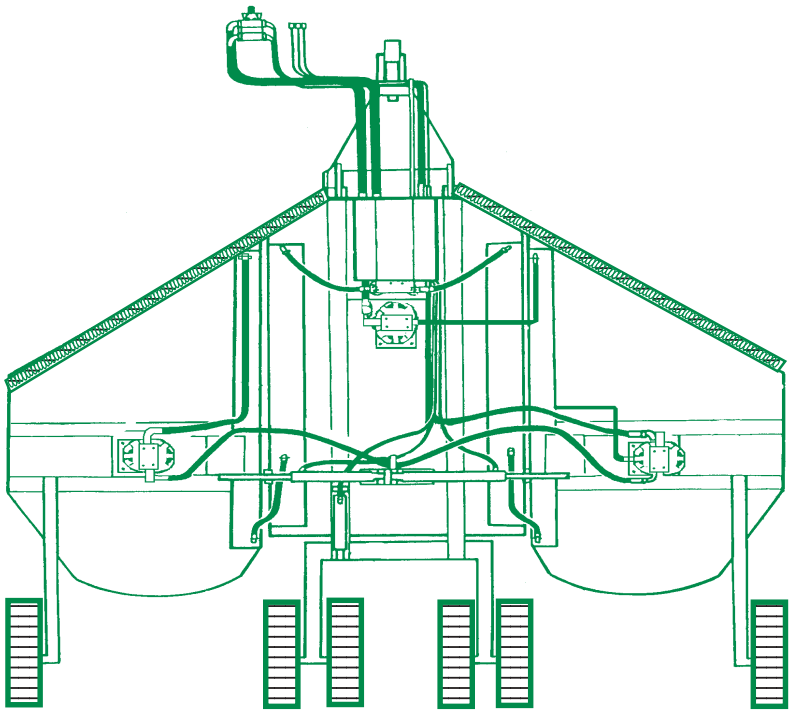
PRODUCT SERVICE MANUAL



An operator's manual, parts manual was shipped with the unit shipped from the factory. There may also be other information on this product available, assembly manual, insert sheets and/or special instruction sheets. This manual is designed to be used in conjunction with these other manuals and/or instruction sheets. This manual is not designed to replace any of the other manual. The information is as of the published date, changes may be made to unit without prior notice and/or changes to the tractors which will affect the mounting. Alamo Industrial will not be responsible for the changes that may affect the unit. If manuals are needed contact your local dealer or Alamo Industrial Inc.

ALAMO INDUSTRIAL
1502 E. Walnut
Seguin, Texas 78155
830-379-1480

MEMBER OF THE ALAMO GROUP
ALWAYS ON THE CUTTING EDGE

TO THE OWNER/OPERATOR/DEALER

All implements with moving parts are potentially hazardous. There is no substitute for a cautious, safe-minded operator who recognizes the potential hazards and follows reasonable safety practices. The manufacturer has designed this implement to be used with all its safety equipment properly attached to minimize the chance of accidents.

BEFORE YOU START!! Read the safety messages on the implement and shown in your manual. Observe the rules of safety and common sense!

WARRANTY INFORMATION:

Read and understand the complete Warranty Statement found in this Manual. Fill out the Warranty Registration Form in full and return it to within 30 Days. Make certain the Serial Number of the Machine is recorded on the Warranty Card and on the Warranty Form that you retain.

INTRODUCTION

ABOUT THIS MANUAL:

The intent of this publications to provide the competent technician with the information necessary to perform the CORRECT repairs to the Alamo Industrial Product. This will, in turn provide for complete customer satisfaction

It is hoped that the information contained in this and other Manuals will provide enough detail to eliminate the need for contact of the Alamo Industrial Technical Service Dept. However, it should be understood that many instances may arrive wherein correspondence with the Manufacturer is necessary.

CONTACTING MANUFACTURER: (Please help us Help You! Before You Call!)

Alamo Industrial Service Staff Members are dedicated to helping you solve yours or your customer's service problem as quickly and efficiently as possible. Unfortunately, we receive entirely to many calls with only a minimum amount of information. In some cases, the correspondent has never gone out to look at the equipment and merely calls inquiring of the problems described to him by the operator or customer.

PART NUMBERS: Part numbers listed in this manual are subject to change without notice as designs are made to adapter to the tractor or for a design improvement. Before ordering parts ALWAYS Measure old part to make certain that is the one you will need. This manual is designed to be used along with the Parts and Operators Manual.

Most calls received by Alamo Industrial Service can be classified into approx. 6 general categories.

1. Hydraulic or Mechanical Trouble Shooting.
2. Request for Technical Information or Specifications.
3. Mounting or Fitting Problem.
4. Special Service Problem.
5. Equipment Application Problems.
6. Tractor Problem Inquiries.

HOW YOU CAN HELP:

Make sure the call is necessary! Most of the calls received may not be necessary if the Dealer Service Technician would do the following.

1. Check the Service Information at your Dealership provided by Alamo Industrial, This would include, Service Bulletins, Information Bulletins, Parts Manuals, Operators Manuals or Service Manuals, many of these are available via the Alamo Industrial Internet site (Alamo - Industrial. Com). Attempt to diagnose or repair problem before calling.

2. If a call to Alamo Industrial is needed, Certain Information should be available and ready for the Alamo Industrial Service Staff. Such information as, Machine Model, Serial Number, Your Dealer Name, Your Account Number and Any other information that will be useful. This information is vital for the development of a prompt and correct solution to the problem. This will also help to develop a database of problems and related solutions, which will expedite a solution to future problems of a similar nature.

3. The technician may be asked to provide detailed information about the problem including the results of any required trouble shooting techniques. If the information is not available, The technician may be asked to get the information and call back. Most recommendations for repairs will be based on the procedures listed in the Service Manual / Trouble Shooting Guide.

CONTACT ALAMO INDUSTRIAL:

Alamo Industrial, 1502 E. Walnut St. Seguin TX. 78155,
Technical Service Dept. PH: 830-379-1480

INDEX

INDEX

INDEX

Section 1

HYDRO 15

Model Specifications

SPECIFICATIONS - HYDRO 15 FLEX WING

READ THIS BEFORE BEGINNING ASSEMBLY, REPAIRS OR TESTING:

The Hydro 15 has electric components:. The electric components can be damaged if care is not taken when performing repairs, testing, dis-assembly or re-assembly. Mower must be maintained in a safe position at all times. The hydraulic system must be protected from contamination at all times.

DO NOT

1. DO NOT start any repairs, testing or dis-assembly before the mower is secured with the wings in the lowered position and the mower hydraulic axle system released to lower the mower completely. If the Hydraulic axle cylinders or turnbuckles are to be removed or serviced make certain mower decks are securely supported by strong jack stands. Make certain mower is in secure clean environment when working on hydraulic system. If mower is connected to tractor must be secured to prevent someone from starting it and parked in accordance with the tractor manufactures recommendation, See tractor operators manual and/or decals for parking tractor securely.
2. DO NOT open any hydraulic component on mower before the entire exterior of the mower and hydraulic components have been cleaned of all debris or any thing that would contaminate the hydraulic system. When working on the hydraulics always keep the hoses sealed by using temporary caps to plug them, do not just leave them open to the elements
3. DO NOT short any wires across or allow them to be shorted out on the electric components of mower. Do not allow or attempt to jump across any wires or supply them with alternate power source.
4. DO NOT install higher rated fuses than are recommended by manufacturer for any components.
5. DO NOT do any welding on unit unless the electrical components are unplugged first, this is to prevent a power surge going into switch and/or solenoids (THIS IS VERY IMPORTANT). This could also apply to the tractor components. Check Tractors repair guide for specific instruction about tractor model and type.It is recommended that mower be disconnected from tractor when being repaired.
6. DO NOT attempt to repair or adjust a component that is not intended to be repaired, example sealed components as there are no serviceable components inside.
7. DO NOT let anyone attempt any testing or repairs unless they are an experienced and qualified technician. Technicians must have proper tools, gauges, meters etc. to perform proper diagnosis and/or repairs.
8. DO NOT perform any repairs with dirty tools or in dirty area. When working on hydraulic components, keeping system clean and free of contamination is important.
9. DO NOT re-use old oil if it is contaminated, re-install dirty components or not completely clean the system after a repair if there is a possibility of oil contamination. Example: If the right wing motor has metal in it from a failure the left wing motor is most likely also contaminated. The center motor, and possibly the pump, the hoses, the tank, the filter housings as well as the filters will most likely need cleaning and or replacing.
10. DO NOT start or engage system if the oil level is not at the proper level or condition. Never start or run unit low or out of oil.
11. DO NOT install / add any oil unless you know it is the correct type and the container is clean. Make certain the oil is not contaminated with dirt or any liquid. It is recommended that any oil installed be done using a commercial oil buggy with a filtered system, a buggy system can also be used to clean the oil.

SPECIFICATIONS - HYDRO 15 FLEX WING

General Specifications for Mower:

Tractor Horse Power Required	70 - 90 HP
Tractor PTO RPM	540 RPM required
Mower Paint Colors	Alamo Yellow Std / Other Colors Optional
Mower Gross Weight	4200 lbs. w/ Chain Guards (this can vary w/ wheel type)
Mower Tongue Weight	Approx 2200 lbs w/ Wings lowered
Cutting Capacity	Grass & Up To 1-1/2" dia Brush (Max)
Mower Overall Length	199" Front To Back
Mower Overall Width	186.5" w/Wings Down & 96" w/ Wings Folded (this can be affected by tire size, type, & wing axle adjustment)
Number Blade Carriers	3 on 15 ft Model & 2 on 10 Ft Model
Cutting Width Options	15 Ft or 10 Ft Model
Over All Cutting Width... (15 Ft Model)	180" Center & Wings Overall Cutting Width
(10 Ft. Model)	124-1/2" Center & Wing Overall Cutting Width
Cutting Height	2" Down to 15" Up w/ 700:15 Pneumatic Tires (Cutting Height will vary with tire & Wheel sizes) 2" Down to 12" Up w/ 12" Tires (Cutting Height will vary with tire & Wheel sizes)
Blade Carrier Cutting Width	Center & Wing
Center Section	69" (Carrier Cutting Width - Overlap)
Left Wing	63-1/2" (Carrier Cutting Width - Overlap)
Right Wing	63-1/2" (Carrier Cutting Width - Overlap)
Blade Over Lap Between Wing and Center	8" total overlap (4" center overlap & 4" Wing overlap)
Blade Carrier Options	Pan or Bar Carrier
Bar Carrier Size	Bar Carrier - 1-1/4" X 6" Bar Size
Pan Carrier Size	Pan Carrier - 3/16" thick X 2-1/2" high X 37-1/4" dia. pan w/ 1-1/4" X 6" steel bar w/ cross bar brace.
Blade Carrier Mounting	Bolts Direct to Blade Spindle f/ Under Side
Bolts	Qty 4
Type	Allen Head Bolts
Torque	400 ft lbs
Installation	Use Thread Lock Compound
Lockwasher	Qty 4
Blade Options	Fan
Blade Size	1/2" thick X 3.5" wide X 22-1/4" long (measure blade length from center of bolt hole to end of blade)
Blade Rotation	CCW rotation Center & LH Wing, CW RH Wing
Blade Bolt Type	Bolt On W/ Locknut
Construction	Cold Forged and Hardened, w/ 1-1/8" square Shank,
Shoulder	1/2" High X 1-1/2" dia Shoulder, w/ 1" RH Thread,
Bolt Head	2-7/16" Round Flat Head
Bushing	2" OD X 1-1/2" ID X 1-1/2" Long Welded into Blade Bar
Washer & Nut	1" Structural Steel Flat Washer & Toplock Locknut
Torque	300 ft lbs
Blade Tip Speed	Blade Tip Speed Based on Max Pressure & RPM
Center Section Blade Tip Speed	18,262 FPM (Operating Speed)
Wing Section Blade Tip Speed	13,194 FPM (Operating Speed)
Blade Spindle	1 On Center Section & 1 On Each Wing
Spindle Bearing Type	Adjustable Roller Bearing Cup & Cone)
Spindle Seal	Replaceble Round Seal Bottom & Gasket Seal Top
Spindle Lubrication	NLGI EP #2 Grease / Grease w/ Grease Gun
Spindle Bearing Preload (Required)	Adjustable (12 to 15 in. lbs. of rolling resistance)

SPECIFICATIONS - HYDRO 15 FLEX WING

Blade Spindle Speed			Measured RPM at Spindle Shaft
Center Section Spindle Tip Speed			731 RPM (Operating Speed)
Wing Section Spindle Speed			881 RPM (Operating Speed)
Spindle to Deck Mounting Bolts			3/4" Grade 8 Toque to 350 ft. lbs.
Hydraulic Pump, Tandem			Front1/2 of Pump f/ Wing & Rear 1/2 pump of f/ Center
Pump Type			Tandem Gear Type - PTO Driven Via Speed Changer
Pump Displacement			Center = 2.95 C.I.D. Wing = 3.6 C.I.D.
Pump HP			145 HP Dual Stage Gear Type
Speed Changer Gear Ratio			1 RPM Input X 4 RPM Output (Increase)
Tractor PTO Speed			540 RPM Required
Pump RPM			2160 RPM Operating (2750 RPM Max)
Pump Pressure			3000 PSI Operating (3600 PSI Max at Max RPM)
Pump GPM	Front 1/2 (Wing Motors)		28 GPM Operating (35 GPM at Max RPM)
	Rear 1/2 (Center Motor)		24 GPM Operating (35 GPM at Max RPM)
Hydraulic Motor, Center & Wing			1 & 2 on 15 ft Model / 1 & 1 on 10 ft Model
Motor Type			Gear Type
Motor HP Rating	Center		75 HP @ 3000 PSI
	Wing		70 HP @ 2000 PSI
Motor Displacement			Center = 6.300 C.I.D. Wing = 6.375 C.I.D.
Motor Relief Valve Setting			Center = 3000 PSI Wing = 2000 PSI
Motor Max Pressure			Center = 3600 PSI Wing = 3000 PSI
Motor HP Rating at Operating RPM			Center = 37.8 HP Wing = 27.2 HP
Motor Tip Speed at Operating RPM			Center = 731 RPM Wing = 881 RPM
Motor Cut Off ... Wing Decks			Electric Cut Off Standard on Wings
	Center Deck		Tractor PTO Shut Off For Center Deck Standard
Motor Mounting Type			Bolts Direct to Blade Spindle Asy.
Motor To Spindle Mounting Bolt Size			1/2" Grade 8 Torque to 95 ft. lbs
Hydraulic Oil Type			100AW or Equivalent SAE 30 Weight Hyd Oil
Hydraulic Oil Capacity			Tank & Cooling Tubes = 35 Gals
Hydraulic Tank			Weldment, Bolted to Center Section
Hydraulic Filter			2 Micron Filter / Replaceable
Hydraulic Cooling Tube Type			3" X 8" Deck Length Weldments (2 each wing & Center)
Hydraulic Reservoir Pressure			11 PSI (Return Pressure)
Mower Deck Leveling Adjustment			Mechanical f/ Front to Rear (at Assembly Setup & Self Leveling While Operating)
Mower Center Deck Control Rods			Dual Control Rods.
Mower Hitch			Self Leveling
Axle Lifting	Standard		Hydraulic Cylinder Center Axle & Lift Screws on Wings
	Optional		Hydraulic Cylinder on Center Axle and Wing Axle
Axle Lowering Height Stop	Center Axle		Clip on Spacers Set Center Cylinder
Axle Shock Absorber	Center		Rubber Bump Pads (Standard)
	Wing		Coil Springs each Wing Axle (Standard)
Mower Wing Leveling	Standard		Wing Axle mechanical Screw Lift Adjustment
	Optional		Wing Axle & Center Axle Hydraulic Lift Adjustment
Mower Wing Lift and Fold	Standard		Hydraulic Cylinder, 1 each Wing
	Optional		Cable Winch and Stand
Wing Lift & Fold			Hydraulic Standard
Wing Lift Range			22° Down & 90° Up
Wing Winch Stand	Standard		Bolt on Weldment
Wing Winch	Optional		Manual Operated Cable Lift Winch
Mower Wing Transport	Standard		Welded Bracket and Pin Assembly
Hydraulic Control Valve	Option		Remote 3 Spool (15 ft) or 2 spool (10 ft) w/ Detent
Hydraulic Control Valve Type	Option		Open or Closed Center
Wing Deck Side Skirts	Standard		10-3/8" High - 1/4" thick

SPECIFICATIONS - HYDRO 15 FLEX WING

Skid Shoes	Standard	Standard Center & Wings, Replaceable Bolt on.
Deck Material Thickness		10 ga. Steel with formed channel reinforcement
Deck Reinforcement	Standard	Hydraulic Oil Cooling Tubes welded to deck
Wheels		6 Standard or 4 Optional
Wheel Type Standard		6:00 X 9 Std (Qty 6)
Wheel Type Option		15" Wheel less tire 15" Wheel & Pneumatic Tire Asy Used or Recapped Airplane Tire & wheel Asy Foam Filled Airplane Tire Asy
Wheel Spacing (Center Axle)		56" Center Inner Wheel to Center Inner Wheel
Chain Guards		5/16" Double Row Standard, Front & Rear
Tractor Drawbar Setting		14 " to 16" f/ end PTO Shaft to Clevis Pivot Bolt.
Drawbar Safety Chain		Standard

TORQUE VALUES - BOLTS:

Maximum Torque per Bolt Size and Grade, Ft lbs & (Nm)

IMPORTANT ! Listed below IS BOLT TORQUE and NOT APPLICATION TORQUE, Component Application Torque will vary dependimg on what is bolted down and the type material (Metal) that is being bolted together. Thread condition and lubrication will vary Torque settings.

Inche Sizes

Bolt Dia. inch	2 (B) Plain Head	5 (D) 3 Dashes	8 (F) 6 Dashes
1/4	Not Used	10 (14)	14 (19)
5/16	Not Used	20 (27)	30 (41)
3/8	Not Used	35 (47)	50 (68)
7/16	35 (47)	55 (75)	80 (108)
1/2	55 (75)	85 (115)	120 (163)
9/16	75 (102)	130 (176)	175 (230)
5/8	105 (142)	170 (230)	240 (325)
3/4	185 (251)	300 (407)	425 (576)
7/8	160 (217)	445 (603)	685 (929)
1	250 (339)	670 (908)	1030 (1396)
1-1/8	330 (447)	910 (1234)	1460 (1979)
1-1/4	480 (651)	1250 (1695)	2060 (2793)

ALWAYS CHECK MARKINGS ON TOP OF BOLT HEAD OR OTHER BOLT DESCRIP-TIONS

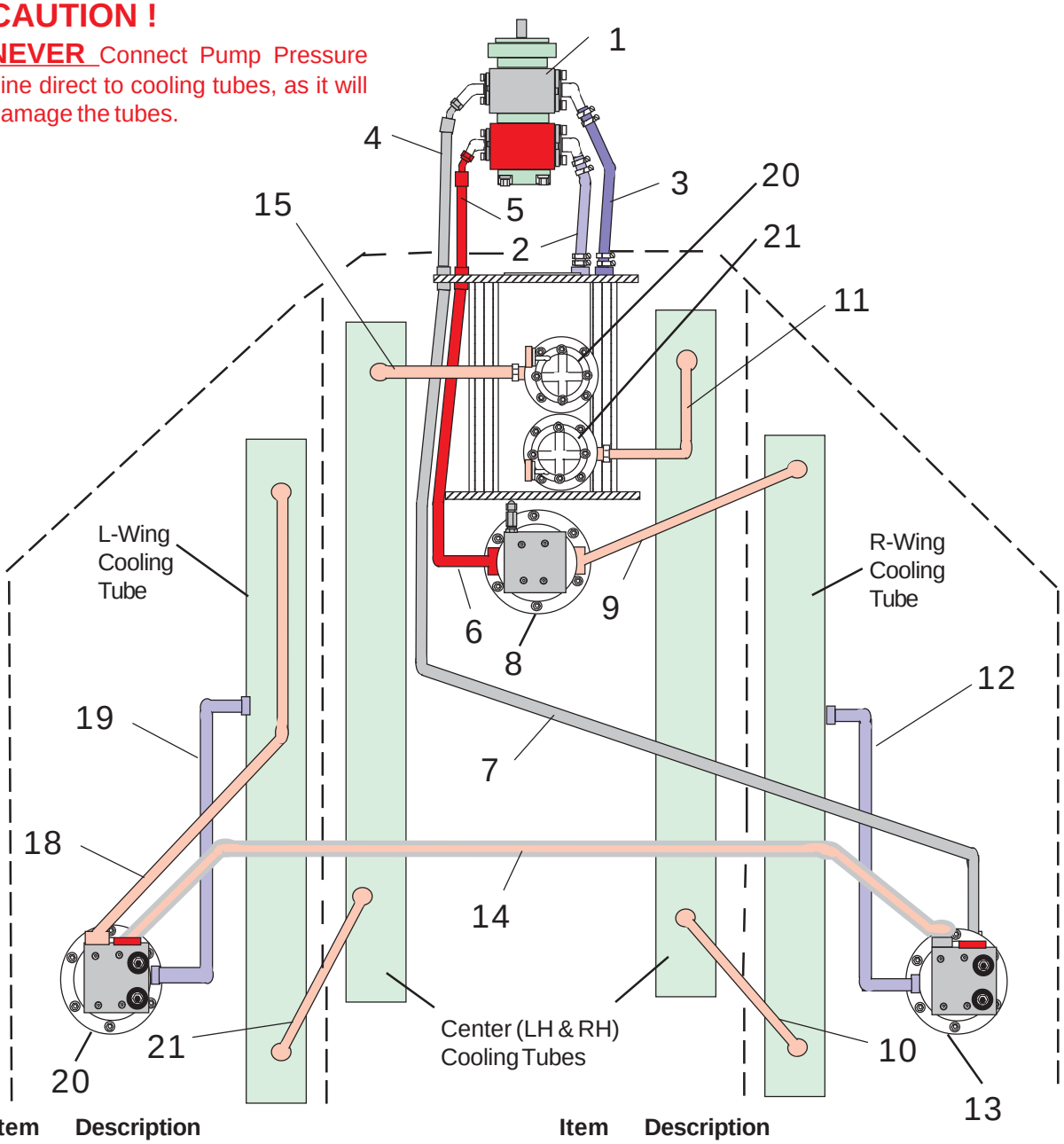
Metric Sizes

Bolt Dia. mm	4.8	8.8	10.8
6	5	7	12
8	11	20	25
10	20	40	58
12	37	70	105
14	60	100	140
16	92	155	200
18	118	216	280
20	160	270	355
22	215	330	430
24	285	500	700
27	450	875	1000
30	600	1200	1700
33	800	1600	2300
36	900	2100	3000

15 FT - PUMP & MOTOR HYDRAULIC SCHEMATIC

CAUTION !

NEVER Connect Pump Pressure Line direct to cooling tubes, as it will damage the tubes.



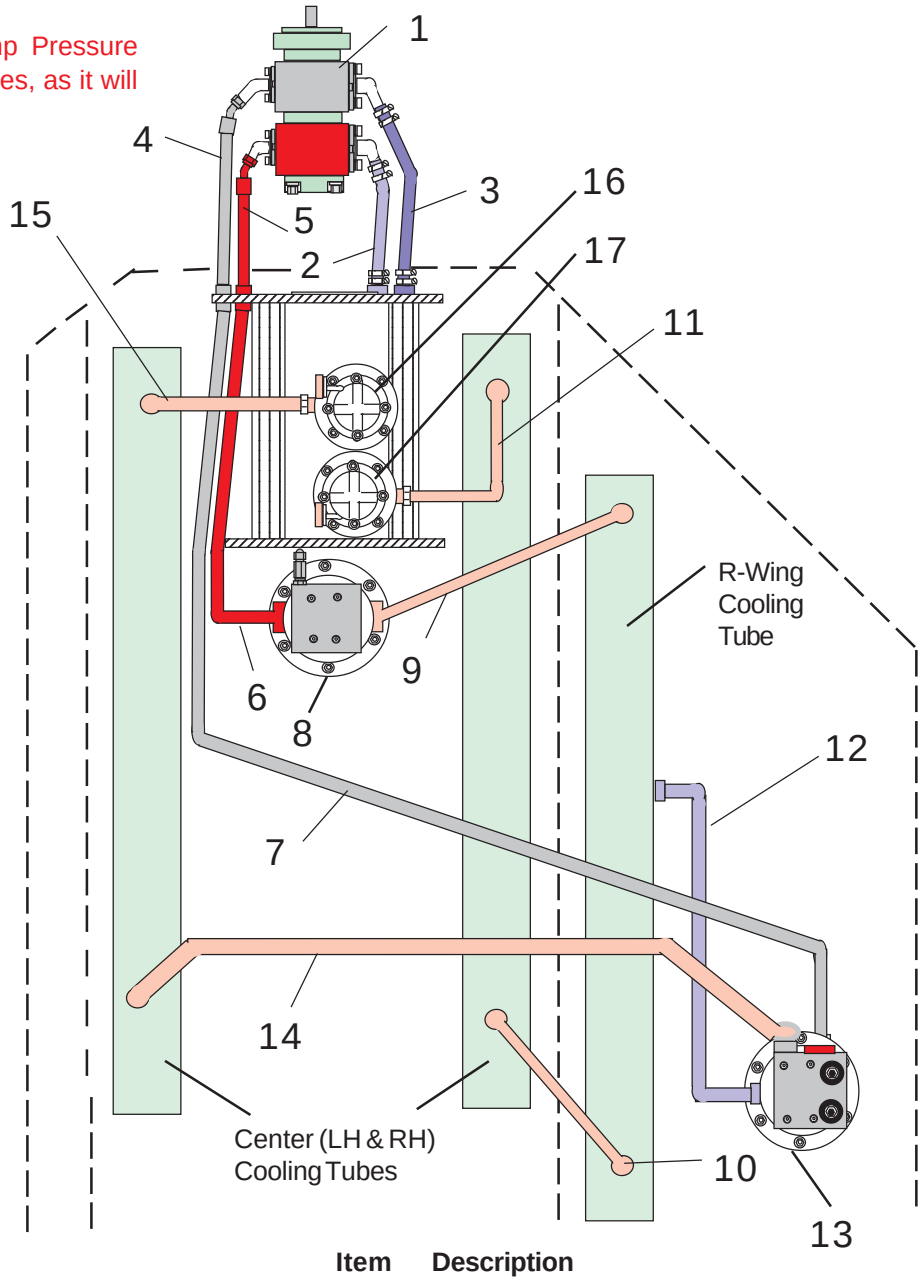
Item	Description
1	Tandem Pump Asy
2	Suction (Tank to Wing Pump)
3	Suction (Tank to Center Pump)
4	Pressure (Pump to Bulk Head Fitting)
5	Pressure (Pump to Bulk Head Fitting)
6	Pressure (Bulk Head Fititng to Center Motor)
7	Pressure (Bulk Head Fitting to Wing Motors)
8	Motor Asy (Center Sction Motor)
9	Return (Center Motor to Wing CoolingTube)
10	Return (Wing Tube to Center Cooling Tube)
11	Return (Center Coolingg Tube to Fiter / Tank)

Item	Description
12	Case Drain (R- Wing Motor to Cooling Tube)
13	Wing Motor Asy (R- Wing)
14	Return / Pressure (f/ R-Wing to L-Wing Motor)
15	Return (Center Cooling Tube to Filter / Tank)
16	Return Filter & Gauge (Wing Motors Return)
17	Return Filter & Gauge (Center Motor Return)
18	Return (L-Wing Motor to Cooling Tube)
19	Case Drain (L-Wing Motor to Cooling Tube)
20	Wing Motor Asy (L-Wing)
21	Return (L-Wing Tube to Center Cooling Tube)

10 FT - PUMP & MOTOR HYDRAULIC SCHEMATIC

CAUTION !

NEVER Connect Pump Pressure Line direct to cooling tubes, as it will damage the tubes.



Item	Description
1	Tandem Pump Asy
2	Suction (Tank to Wing Pump)
3	Suction (Tank to Center Pump)
4	Pressure (Wing Pump to Bulk Head Fitting)
5	Pressure (Center Pump to Bulk Head Fitting)
6	Pressure (Bulk Head Fititng to Center Motor)
7	Pressure (Bulk Head Fitting to Wing Motor)
8	Motor Asy (Center Sction Motor)
9	Return (Center Motor to Wing CoolingTube)
10	Return (Wing Tube to Center Cooling Tube)
11	Return (Center Coolingg Tube to Fiter / Tank)

Item	Description
12	Case Drain (R- Wing Motor to Cooling Tube)
13	Wing Motor Asy (R- Wing)
14	Return (R-Wing Motor to Cooling Tube)
15	Return (Center Cooling Tube to Filter / Tank)
16	Return Filter & Gauge (Wing Motor Return)
17	Return Filter & Gauge (Center Motor Return)

NOTES

Section 2

HYDRO 15

Pump Service & Repair

PUMP SERVICE & REPAIR

Recommended Reading Before any Service Work Begins:

1. Read this section completely before starting inspection or repair to the mower hydraulic system to become familiar with its components.

2. Identify the model of the mower model number, serial number and other information that may be needed to identify which components or options that may be on the mower.

3. Make certain the mower and tractor are secured in a safe and proper parked position, hydraulic (axle and wings) lowered. Tractor safely parked according to tractor manufacturers recommendations.

4. Clean the complete hydraulic system in the area of the repairs. Dirt is the enemy of all hydraulic systems and all steps must be taken to keep hydraulic system from being contaminated.

5. Make certain the hydraulic oil is not hot from being operated or tested. All hydraulic components (including hydraulic oil) temperature should not exceed ambient temperatures. If temperature is high it must be allowed top cool before attempting any repairs of the hydraulic system. Caution should be taken, if mower is sitting in hot sun on a very hot day the temperature of the metal and oil can be hot, test the temperature.

6. The drawing and illustrations in this section are to help understand the components of the pump. This section is not intended to be a parts manual or operators manual although it is intended to be used with the other manuals.

7. Use caution if clamping any pump components in a vise or gripping them with any type of tools. The jaws of a vise can damage the surface or it the shape of a component, tools can scratch or damage the surface to render the component un-serviceable

8. These pumps are designed to be assembled to be turned in the direction for which they were built, clockwise or counter clockwise. When the pump is dis-assembled it is very important that you take notice of which components are where and which way they are installed in pump (example Item 5). If these pumps are installed with component in the wrong place and then turned in the wrong direction the pressure will usually blow the input seal out and may damage other components.

9. When making repairs always make certain that the cause of the failure is identified and repaired. Sometimes the cause of the failure is not corrected and another failure occurs rapidly because the cause of the failure is still there.

10. Make certain to use drain pans to catch all oil that may leak out during the testing and/or repair steps. Make certain to keep all hydraulic opening plugged or capped during repairs.

11. Never start the tractor and engage PTO to turn pump, if any hydraulic components have been removed or disconnected, line blockage or oil diverted to the wrong place could to extreme damage to the hydraulic system and/or to the mower deck cooling tubes.

12. The pressure side of the pump hydraulic flow MUST NEVER be sent directly to the deck cooling tubes as the excess pressure will damage them. The hydraulic oil flow can only be sent through the deck cooling tubes when it is being returned to the tank with little or no resistance.

13. Some components of hydraulic system are not meant the be repaired, only replaced. Do Not dis-assemble a component if it is a part intended for replacement only.

14. When storing a pump or its components for any reason it is recommended they be stored in a clean area and covered to protect from any dust, components that have been washed be coated which oil if they are made of material that may rust.

Recommended To Test Old Hydraulic Pump before it is Removed:

(Before Installing a New or Rebuilt Pump).

A. Connect your Flow Meter in Line to test Pressure as unit is started; this is in case the Relief Valve is malfunctioning or has been tampered with. If this is not done you could damage the replacement Pump because you would not Know it until Pump failed from excessive pressure.

B. Before connecting any lines to Pump, fill all Ports with clean Oil to provide initial Lubrication. This is especially important is Pump is located at a higher level than Oil Reservoir.

C. Check Oil level in reservoir, fill to full level if needed, Reservoir must have more Oil than the Pump GPM capacity.

D. After connecting the Lines and mounting the replacement Pump, make sure that Oil is not warmer than Pump temperature. If Oil is warmer than pump run Pump at short intervals till Pump and Oil temperature is equalized. Hot Oil must not be fed into cold Pump.

E. Operate the Pump for at least two minutes at no load and at low RPM (400 RPM min and 1400 RPM max.). Watch Flow Meter Pressure (or Pressure Gauge). During this break-in period, the unit should run free and not develop an excessive amount of heat. Heat should not exceed 100 deg F. above ambient Temperature. If the unit operates properly, speed and pressure can then be increased to normal operating settings. Increase Pressure in 500 Lbs. PSI increments from start, this should take 4 to 5 minutes to max. PSI allowing 1 minute between increases to check Oil Pressure and Temperature.

F. If normal Pressure and Heat readings are seen then the New or Rebuilt Pump installation should be done, remove Flow Meter (Pressure Gauge) from line, reconnect Line and check all connections.

Test Equipment Needed:

1. Flow Meter, The Flow meter should have components to measure:
   - A. Guage to Measure the Oil Temperature.
   - B. Gauge to Measure Oil Pressure PSI (Load and No Load).
   - C. Gauge to Measure Oil Flow in G.P.M.
   - D. A Valve to load system to check operating Pressure (PSI).
   - E. Assortment of Connections to connect to Hydraulic System.
2. Electrical Volt Meter with variable settings and Ohm Meter.
3. Electrical Test Light.
4. Wrenches, (Socket Wrenches, Open and Boxed End Wrenches).

Flow Testing the Pump: (figure 1)

1. Use a Flow Meter that is rated to 6000 PSI and 60 GPM Minimum. This applies to the gear type pump and motor type only
2. the area around the hoses, motor, flow meter must be clean of all debris and dirt. NO contamination can be allowed to enter the system or its components. Make certain there is nothing in flow meter from previous use that will contaminate the hydraulic system, dirty and contamination in test equipment hoses and valves can cause a failure to occur.
3. Disconnect the hydraulic return hose from the motor. Connect the hoses to the flow meter as shown above, recheck all connections to make certain they are connected correctly and fittings have been check for tightness.
4. Completely open the pressure valve on the flow meter.

5. Record all the readings during the test. Start the system, run at 540 PTO speed (which will run pump at required speed) until the Oil temperature reaches at least 110° F. before starting test. Check the flow (GPM) at 0 psi. (or no load). Slowly close the pressure control valve (valve on flow meter) until the gauge pressure reaches 500 psi. and record the readings pressure, temperature and flow (GPM). Continues this at 500 psi increments until a maximum of 2000 psi.
6. If the flow rate is 85 % or greater of beginning flow rate at no load, the pump is serviceable and functioning within specifications.

CAUTION ! Stop tractor engine and discontinue testing if hydraoulic oil temperature exceeds 220° F. as temperatures above this could cause damage to components.

Example: Recorded test results

PSI.	GPM	TEMP ° F.
0	____	_____
1000	____	_____
2000	____	_____
3000	____	_____

PSI.	GPM	TEMP ° F.
500	____	_____
1500	____	_____
2500	____	_____

Shown Below is a Gear Pump Schematic

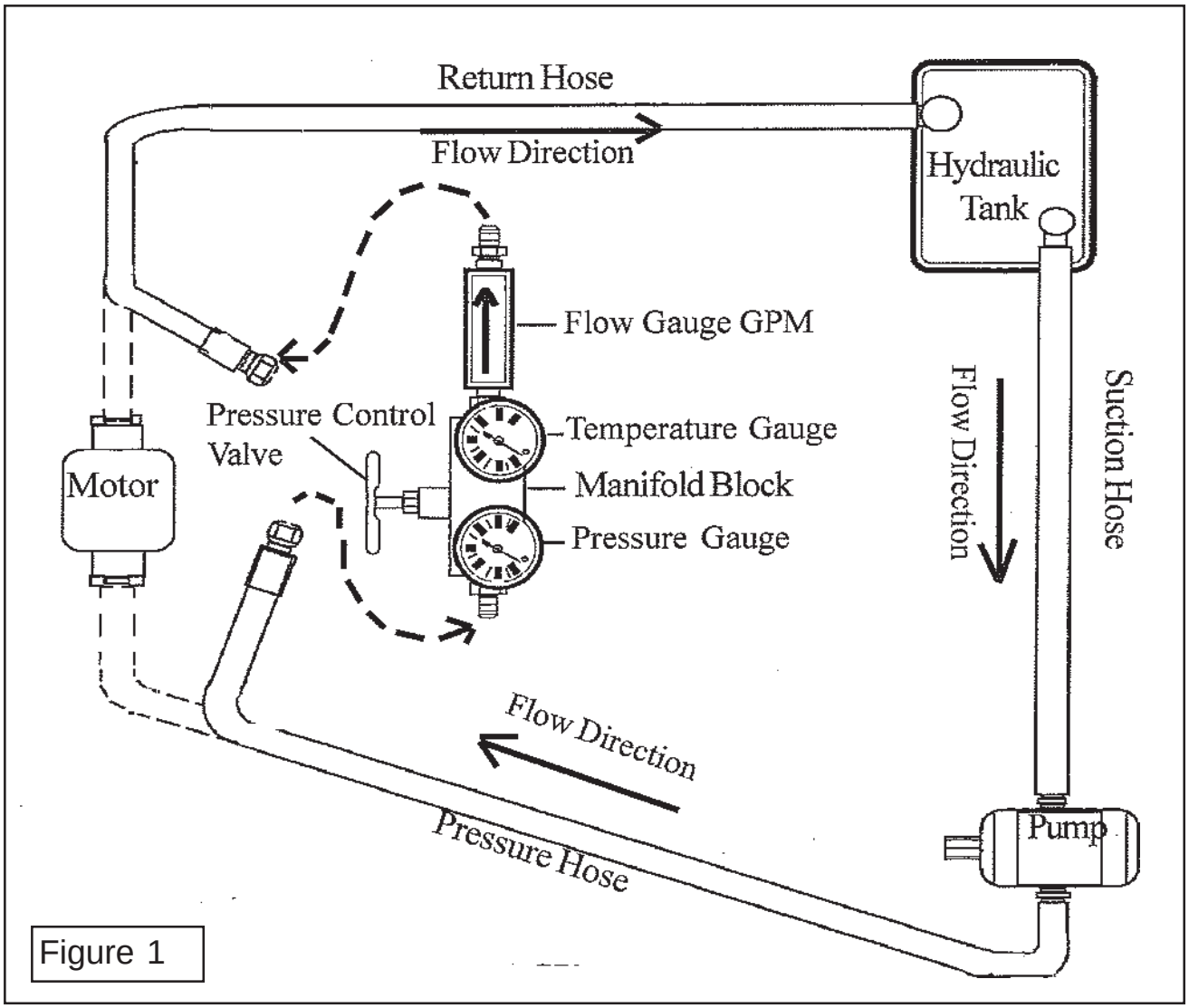


Figure 1

15 FT - PUMP & MOTOR HYDRAULIC SCHEMATIC

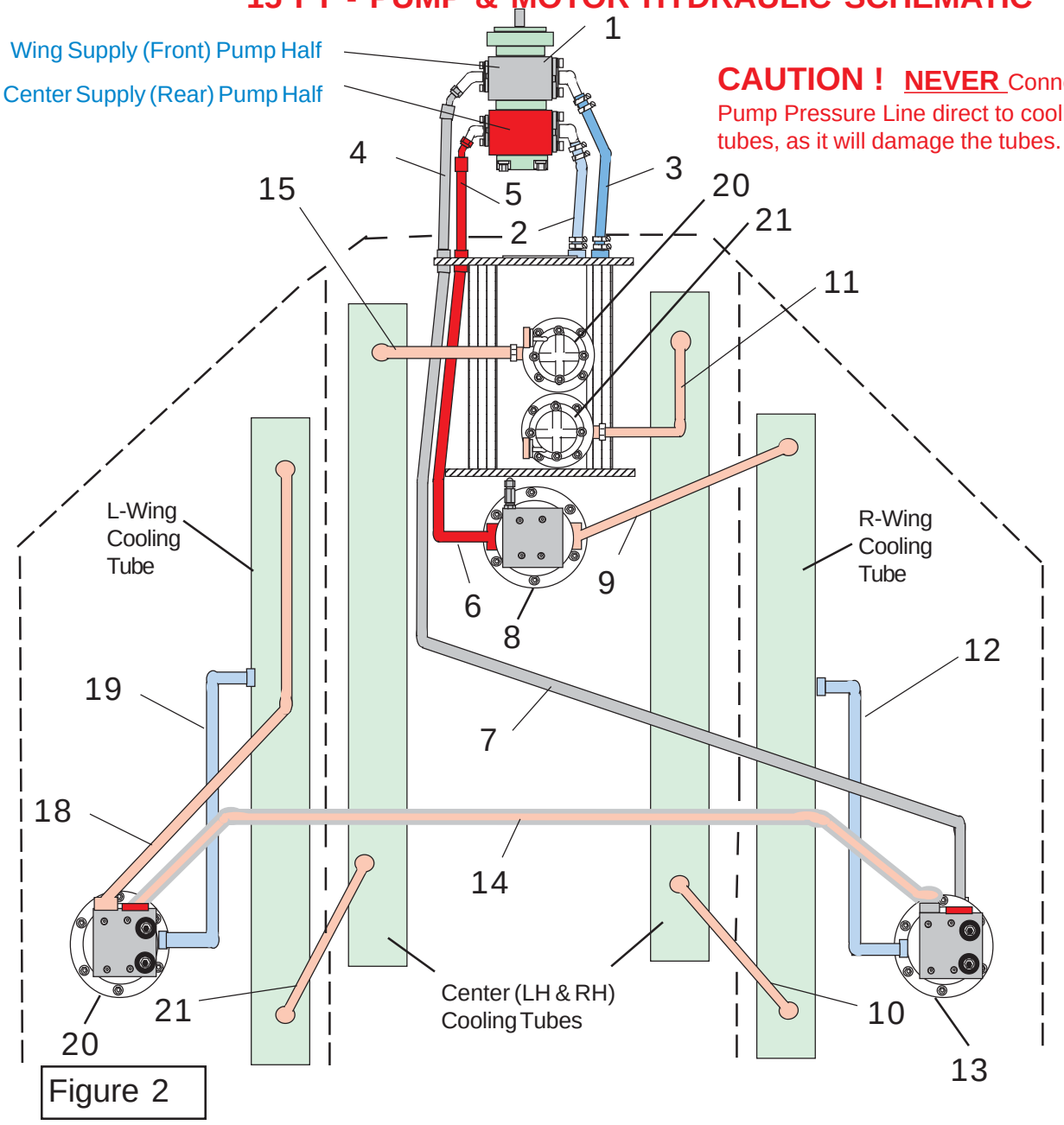


Figure 2

Item	Description
1	Tandem Pump Asy
2	Suction (Tank to Wing Pump)
3	Suction (Tank to Center Pump)
4	Pressure (Pump to Bulk Head Fitting)
5	Pressure (Pump to Bulk Head Fitting)
6	Pressure (Bulk Head Fititng to Center Motor)
7	Pressure (Bulk Head Fitting to Wing Motors)
8	Motor Asy (Center Sction Motor)
9	Return (Center Motor to Wing CoolingTube)
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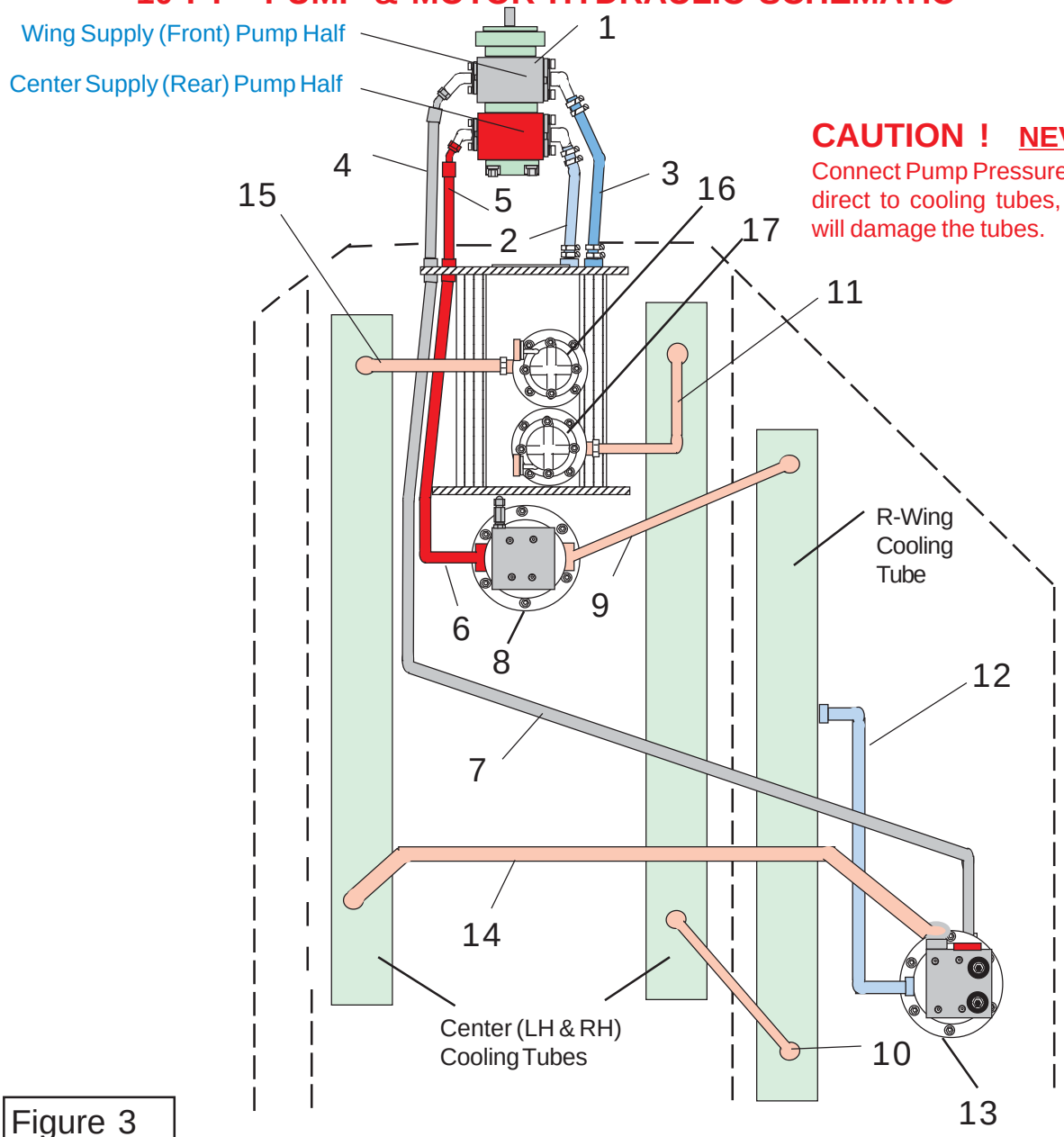
15	Return (Center Cooling Tube to Filter / Tank)
16	Return Filter & Gauge (Wing Motors Return)
17	Return Filter & Gauge (Center Motor Return)
18	Return (L-Wing Motor to Cooling Tube)
19	Case Drain (L-Wing Motor to Cooling Tube)
20	Wing Motor Asy (L-Wing)
21	Return (L-Wing Tube to Center Cooling Tube)

10 FT - PUMP & MOTOR HYDRAULIC SCHEMATIC



CAUTION ! NEVER
Connect Pump Pressure Line direct to cooling tubes, as it will damage the tubes.

Figure 3

Item	Description
1	Tandem Pump Asy
2	Suction (Tank to Wing Pump)
3	Suction (Tank to Center Pump)
4	Pressure (Wing Pump to Bulk Head Fitting)
5	Pressure (Center Pump to Bulk Head Fitting)
6	Pressure (Bulk Head Fititng to Center Motor)
7	Pressure (Bulk Head Fitting to Wing Motor)
8	Motor Asy (Center Sction Motor)
9	Return (Center Motor to Wing CoolingTube)
10	Return (Wing Tube to Center Cooling Tube)
11	Return (Center Coolingg Tube to Fiter / Tank)

Item	Description
12	Case Drain (R- Wing Motor to Cooling Tube)
13	Wing Motor Asy (R- Wing)
14	Return (R-Wing Motor to Cooling Tube)
15	Return (Center Cooling Tube to Filter / Tank)
16	Return Filter & Gauge (Wing Motor Return)
17	Return Filter & Gauge (Center Motor Return)

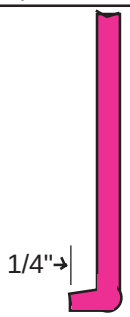
Recommended Tools:

Listed below are some of the toolds that are recommended for the dis-assembly and re-assembly of the pump for the HYDRO 15 Mower.

1. Arbor Press
2. Awl
3. 1-1/2" Dia steel ball
4. Bearing Puller (Owaonna Tool Co. MD-956 or equivalent)
5. Bushing Remover Tool (figure 4)
6. Clean lintless Cloth
7. Deburing Tool (an old file with cutting teeth ground off)
8. Machinest Hammer
9. Soft Hammer
10. Permatex Aviation Form-A-Gasket.™ (No. 3 non hardening sealant or equal)
11. Medium Grit Carborundurn Stone.
12. Seal removal Tool (figure 6)
13. Oil and Grease
14. Snap Ring Pliers
15. Prick Punch
16. Bushing Installation Tool (figure 5).
17. Scale (1/32" or 1/64" graduations)
18. Small Screw Driver
19. Torque Wrench (in. lbs & ft lbs)
20. Vise with 6" minimum opening
21. Bar for Lip Seal Installation
    For Front (Wing Supply) Pump use 1-3/4" dia X 2" Bar
    For Rear (Center Supply) Pump use 2-1/2" dia X 2" Bar
22. Special Steel Sleeve (figure 7)

Seal Removal Tool: Easily made from old screw driver. Heat the tip and bend as shown. Grind the tip to fit the notch behind the shaft seal.

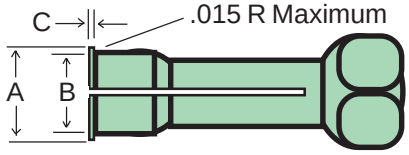
Figure 6



Bushing Puller: The bushings in the pump may be removed from tier bores, using blind hole collet-type bushing pullers similar to those manufactured by Owatonna Tool Co. The Table below illustrates the modification necessary to adapt the OTC collets to this task. Equivalent pullers from other suppliers may be modified in a similar fashion.

Pump	A	B	C	Make f/ OTC Collet No.
Wing Supply Pump	.980 / .970	.875 Ref	.100 / .090	33863
Center Supply Pump	1.382 / 1.372	1.260 / 1.250	.100 / .120	33865

Figure 4



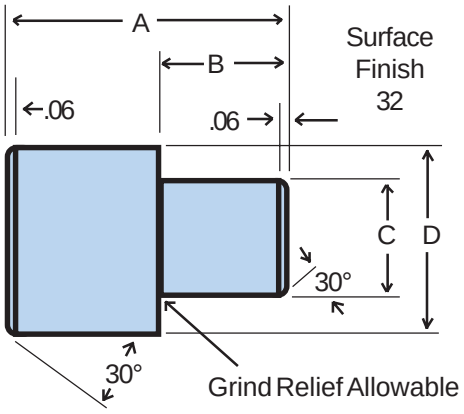
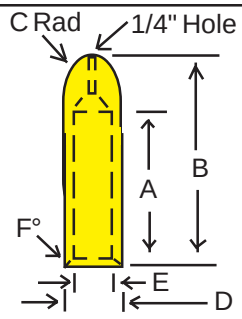


Figure 5

Pump	A	B	C dia.	D dia.
Wing Supply Pump	3.00	1.47	1.054 + .000 - .002	1.250
Center Supply Pump	3.00	1.73	1.492 + .000 - .002	1.750

Special Steel Sleeve: The special steel sleeve is used to insert the drive shaft through the lip seal without damage and can be made from bar stock. For the center supply pump use a 1-1/8" to 1-1/4" dia X 4-5/8" bar. For wing supply pump use a 1-1/2" dia X 4-5/8" bar. The drawing and cgart give details for making this special tool.



Pump	A	B	C Rad	D Rad	E dia.	F° Chamfer
Wing Supply Pump	3-3/8"	4-1/2"	9/16"	1.065 + .000 - .002	1.002 + .002 - .000	.015" X 45°
Center Supply Pump	3-3/8"	4-1/2"	9/16"	1.377 + .000 - .002	1.250 + .002 - .000	.015" X 60°

Figure 7

All external surfaces MUST be free of scratches and burrs

Pump Cleaning & Removal:

1. Clean Pump, Hoses and all connections before disconnecting any components from the pump. This will keep contamination from getting into system. Figure 8 shows the pump and hoses connected to the mower (this mower is new, clean and un-used) with the pump sitting on the ground, if the hoses are to be dis-connected, the pump should mounted up and above the hydraulic tank (on work bench, hoist, etc.). What ever the technician decides to mount pump on. Some type of drain pan will be required to catch the oil that will drain out when hoses are dis-connected. The hoses will need to be capped (plugged) after removal being disconnected. If cap is not leak proof then hoses must remain elevated above hydraulic tank to prevent oil leakage from hose fittings. Figure 9 shows how the hoses are connected. Hoses are connected with 4 bolt split flange kits (1-1/2" on suction side &1" on pressure side)

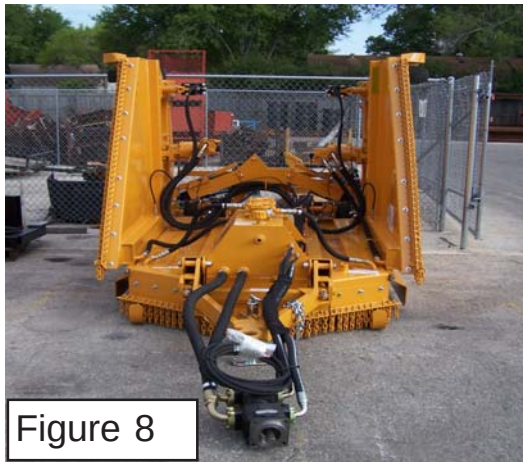
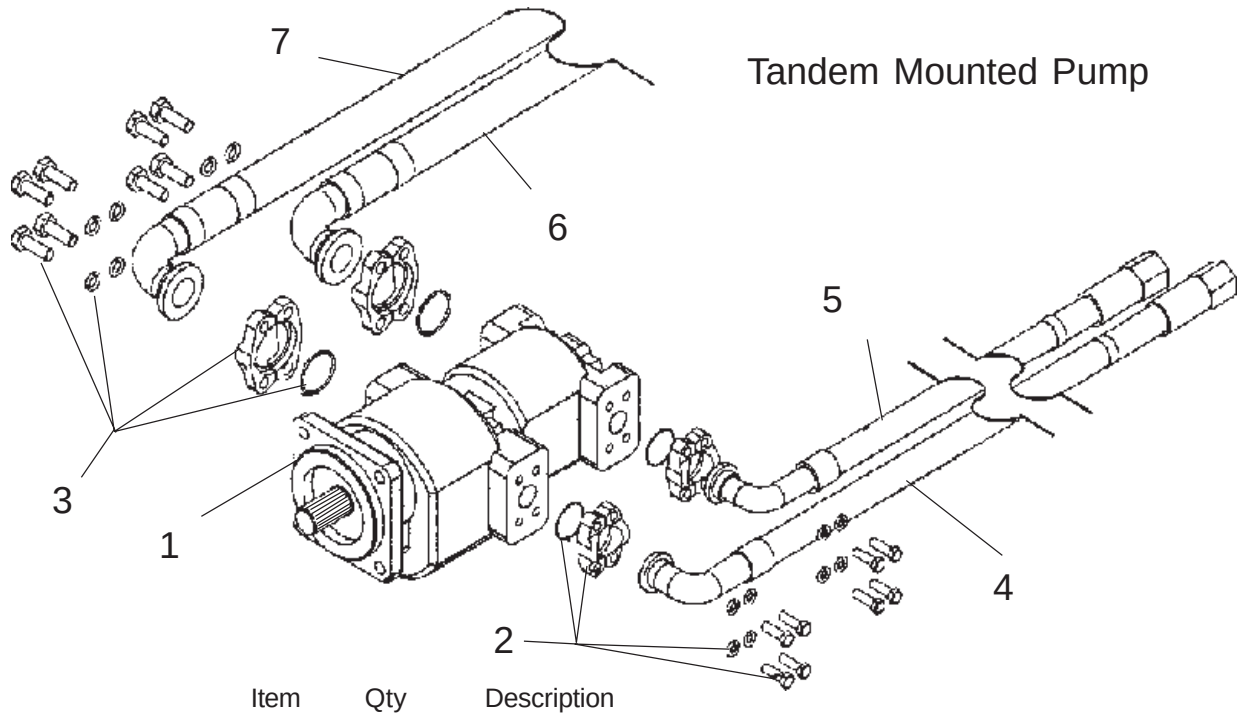


Figure 8

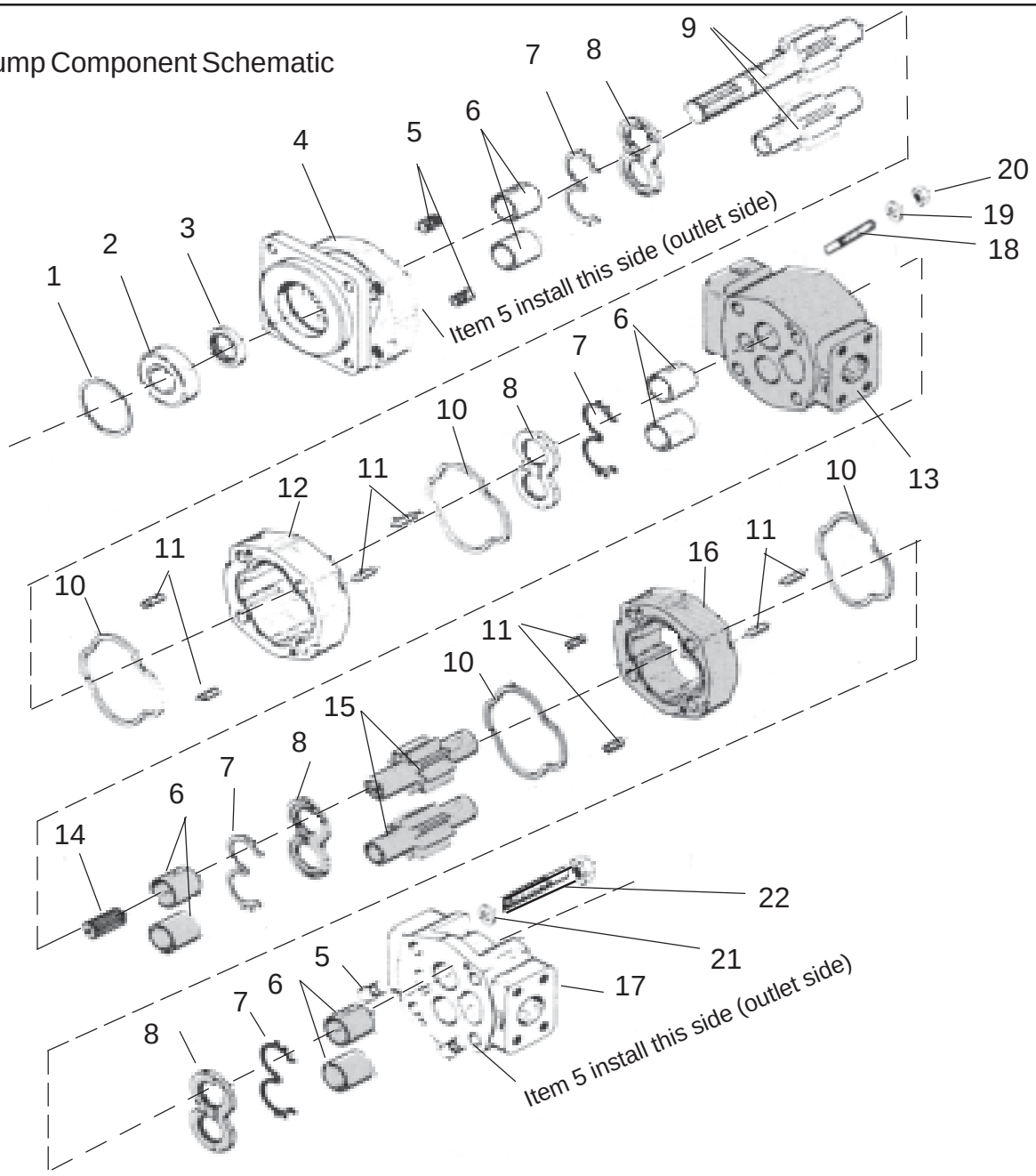
Tandem Mounted Pump



Item	Qty	Description
1	1	Pump Assembly (Tandem Pump)
2	2	Split Flance Kit, (1" Flange)
	1	O-Ring (for 1" Flange) (Qty Each Kit)
	4	Bolt, Hex Head, (Qty Each Kit)
	4	Lockwasher (Qty Each Kit)
3	2	Split Flance Kit, (1-1/2" Flange)
	1	O-Ring (for 1" Flange) (Qty Each Kit)
	4	Bolt, Hex Head, (Qty Each Kit)
	4	Lockwasher (Qty Each Kit)
4	1	Hose Asy, 1" Hose & Flange (Pressure to Wing Motors)
5	1	Hose Asy, 1" Hose & Flange (Pressure to Center Motor)
6	1	Hose Asy, 1-1/2" Hose & Flange. (Suction Hose for Center Motor
7	1	Hose Asy, 1-1/2" Hose & Flange. (Suction Hose for Wing Motor)

Figure 9

Pump Component Schematic



Item	Qty	Description
1	1	Snap Ring
2	1	Bearing, Outboard
3	1	Seal, Input
4	1	Shaft End Cover
5	1	Plug
6	8	Bushings
7	4	Channel Seal
8	4	Thrust Plate
9	1	Integral Drive Shaft and Gear Set
10	4	Gasket Seal

Item	Qty	Description
11	8	Dowel Pins
12	1	Gear Housing
13	1	Bearing Carrier
14	1	Connecting Shaft
15	1	Gear Set (Matched)
16	1	Gear Housing
17	1	Port End Cover
18	4	Studs
19	4	Lockwasher
20	4	Nuts
21	4	Lockwasher
22	4	Bolt

Figure 10

IMPORTANT!

Mark all Sections of Pump with a Number (or) Symbols that will serve as a guide to all sections being re-installed the same way they were removed. Example: if the numbers (marks) do not line up (1, 2, 3, 4 & 5) as they were marked, the pump is not being assembled correctly. Check this all through the assembly process.

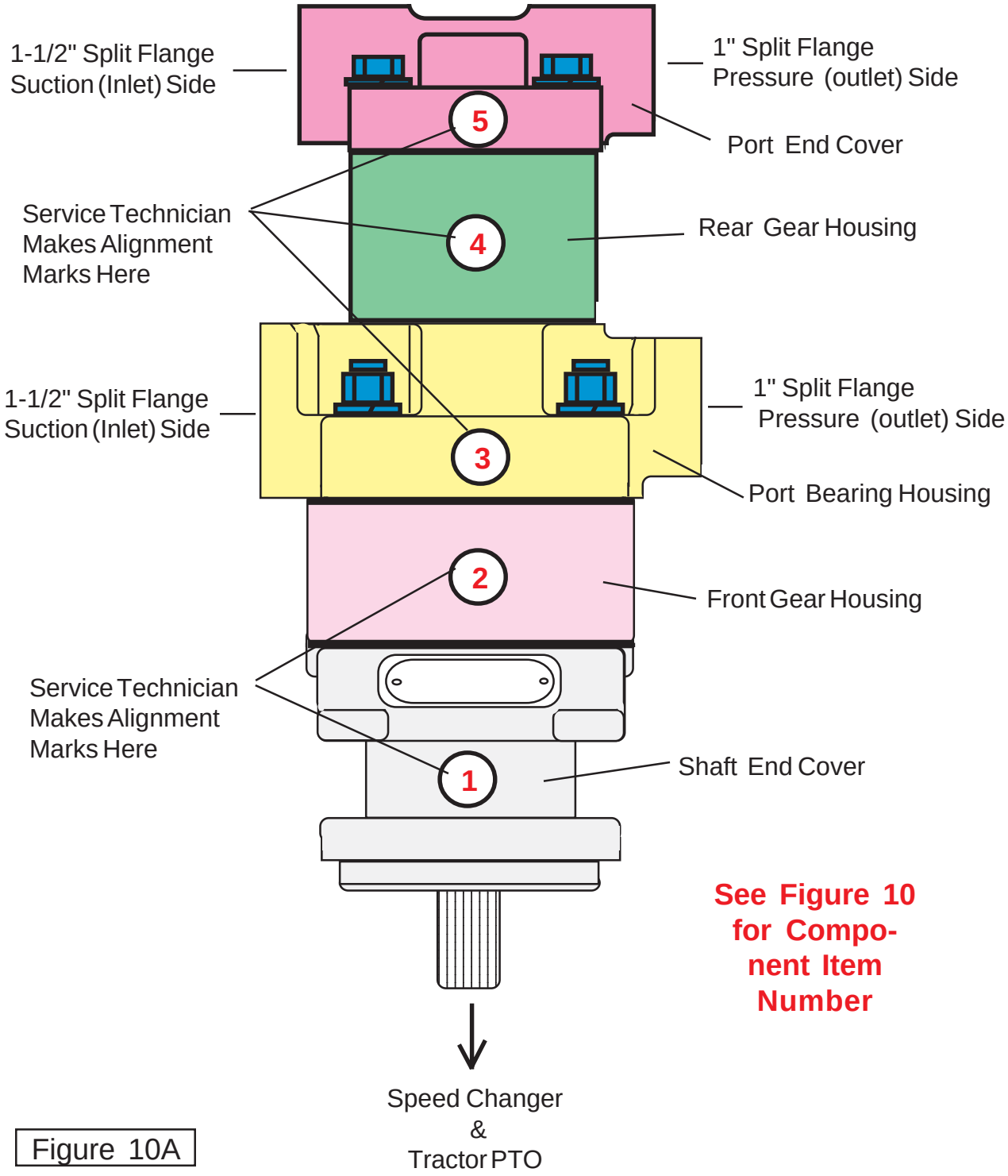


Figure 10A

Pump Dis-Assembly CAUTION! :

Important information - read before dis-assembly:

1. If prying off sections becomes necessary, take extreme care not to mar or damage machined surfaces. Excessive force while prying can result in misalignment and seriously damage parts.
2. If parts are difficult to come apart during dis-assembly, tap gently with a soft hammer (never use an iron hammer).
3. Gears are closely matched, therefore they must be kept together as sets when removed from the pump. Handle gears with care to avoid damage to journals or teeth. Avoid touching gear journals.
4. Never hammer bushing into bores: always use an arbor press.

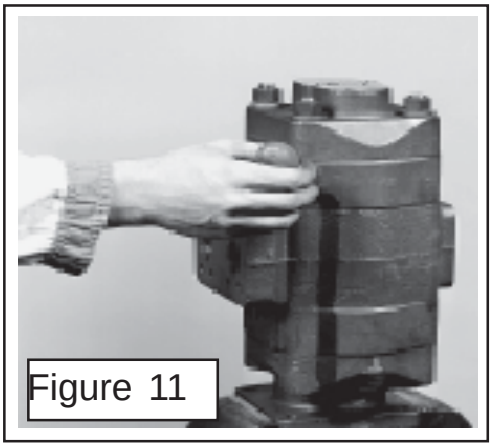


Figure 11

Pump Dis-Assembly:

1. Place the pump in a vise with the drive shaft pointing down. Caution DO NOT grip on or near any machined surfaces of pump during assembly or dis-assembly. Mark all sections of the pump (figure 10A) , these marks must be done in a manner that will not wash off and these marks are to identify the orientation of the component of the pump later for re-assembly. It is recommended that marks be done with metal stamps that will mark components for correct assembly order for & during re-assembly. This is very important as if any of the sections of pump are installed in the wrong direction it could damage pump when re-assembled or when pump is engaged during operation (figure 11).

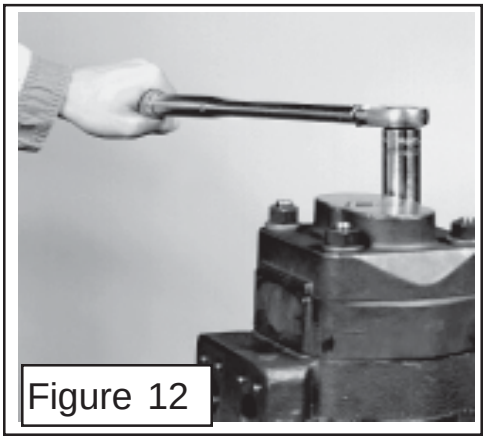


Figure 12

2. Use a socket Wrench or Boxed end wrenches (Air impact wrenches are not recommended for dis-assembly). Remove the four hex bolts and washers (figure 10 item 19 & 20) , This will allow for the removal of the outward half of the pump. The inward section is still connected together with the studs and nuts which will be removed in a later step. Inspect the bolts for thread condition. If bad threads on bolts most likely the threads in that hole are bad, mark the hole so it can be check later.

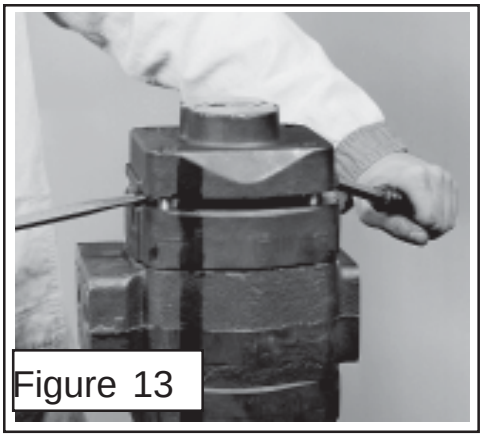


Figure 13

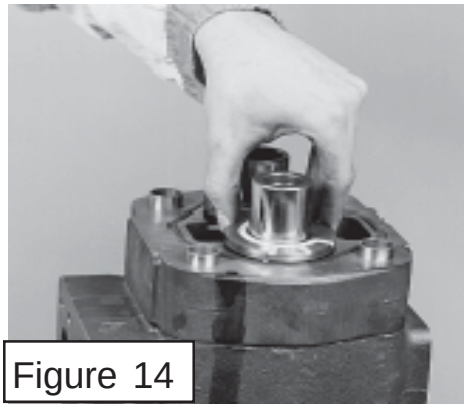


Figure 14

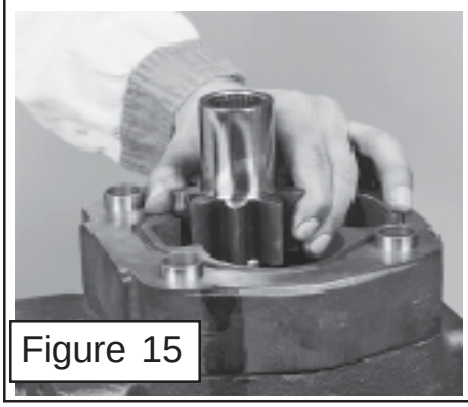


Figure 15

3. Lift the first port end cover (figure 10 item 17), if prying is necessary, be careful not to damage the machined surfaces. Dowel pins (figure 10 item 11) will remain in either the port end cover or gear housing. This will be OK because the components must be re-assembled in the same direction and orientation as removed. If one or more of the components are to be replaced as parts then it may require that the dowel pins be removed (figure 13).

4. Remove the thrust plate (figure 10 item 8). Make a note how this was removed, there is a smooth side and there is a grooved side. The smooth side will always face the gears, the grooved side will be for the channel seal (figure 10 item 7). Inspect the thrust plate for damage or wear at this time (see wear tolerance chart for pump and motors in this section), this will help in looking for other wear or damage to other components and also enable you to start making a list of components that need replacing.

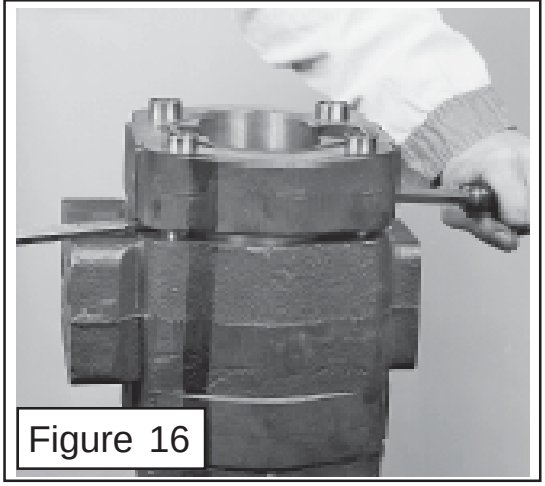


Figure 16

5. Carefully remove the drive gear and the driven gear (figure 10 item 15). Avoid tapping the gear teeth together or against other hardened surfaces (figure 15), Keep these gears together because they are a matched set. Examine the gears for wear and/or damage. Note the dowels (figure 15) that are in the gear housing, sometimes these will come out and be in the end cover or they may stay in the gear housing. It will be OK as long as the same components are to be reassembled, but if some components are to be replaced and some are not then these dowel pins will have to be re-moved and re-inserted.

6. Remove the outer gear housing (figure 10 item 16). Lift the outer gear housing (figure 16) up, if prying is necessary take care not to damage machined surface. Examine gear housing for wear and /or damage. (See wear tolerance chart for pump and motors in this section). When the gear housing is removed there will be another thrust plate and channel seal (figure 10 item 7 & 8) that was under the gears, sometimes this thrust plate will come out with the gears.


Figure 17

7. Carefully lift or pry the bearing carrier (figure 10 item 13) off carefully to avoid damage to carrier (figure 17). The dowel pins will remain in the bearing carrier housing or the gear housing, it will not require that they be removed unless the housing is to be replaced and then only to arrange the dowel pins order so the components will fit together.

8. Remove the connecting shaft (figure 10 item 14) as shown (figure 18) by pulling it up out of the drive gear shaft splines. Inspect the shaft for wear and /or damage. Inspect the end of the drive gear. Remove the thrust plate, note the thrust plate will have the channel seal in it (figure 10 item 7 & 8). Note the smooth side of thrust plate always goes toward the gear. Care fully remove the drive gear and the driven gear (figure 10 item 9). Avoid tapping the gear teeth together or against other hardened surfaces (figure 18), pull the drive gear straight up. The drive gear has the splined shaft on the other end and care must be taken not to hit the splined shaft against sides and damaging them.Keep these gears together because they are a matched set. Examine the gears for wear and / or damage

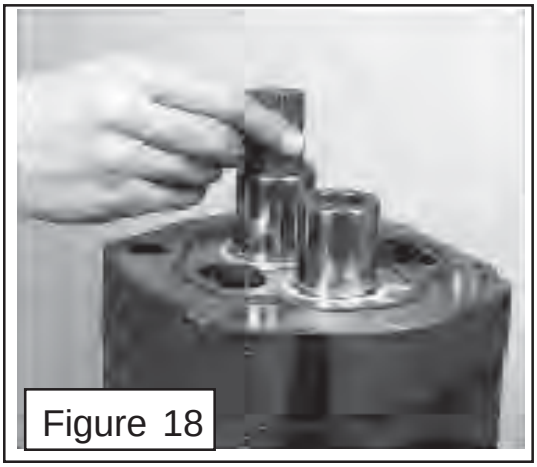


Figure 18

9. Lift or pry off the first section of gear housing (figure 10 item 12). Be careful not to damage machined surfaces (figure 19). Inspect the gear housing (See wear tolerance chart for pump and motors in this section). for wear and / or damage.

10. Inspect all of the bushings for scoring or discoloration (figure 10 item 6 qty 8) in the port end cap, bearing carrier (both sides) and the shaft end cover. If they need to be replaced use a bushing puller as shown (figure 4 recommended tools list). Remove the bushings with care not to damage housings (figure 20).

11. Remove shaft end cover (figure 10 item 4) from vice and turn it 180° over and re-insert it into vice. Using snap ring pliers remove the snap ring (figure 10 item 1) as shown (figure 21).

12. Remove the shaft bearing (figure 10 item 2) using a bearing puller (figure 22). Make certain to use the correct size bearing puller and that puller is inserted straight.

13. Remove shaft end cover (figure 10 item 4) from vice and turn it 180° over and re-insert it into vice. Remove the double lip seal by inserting the special seal removal tool (see figure 6 recommended tools). Make note of which way seal is removed. Inspect the shaft end cover seal seat area (figure 23).

14. Inspect all the components that have been removed (review steps 1 through 13). There are 4 gasket seals (figure 10 item 10) that are installed, one on each side of the gear housing. Make certain the gasket seal have been removed and the gasket grooves are clean. Wash and clean all the components, DO NOT use any material that will leave lint on components, it 's best to air dry the components. Use extreme caution when cleaning gear sets, DO NOT use any abrasive materials at all and DO NOT bang the gears together. Keep the gears in the same sets as they were remove as they are a matched set and must remain as a set. (See next two pages for wear identification).


Figure 19

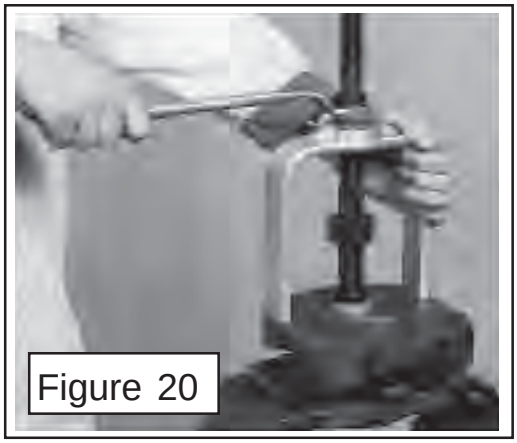


Figure 20

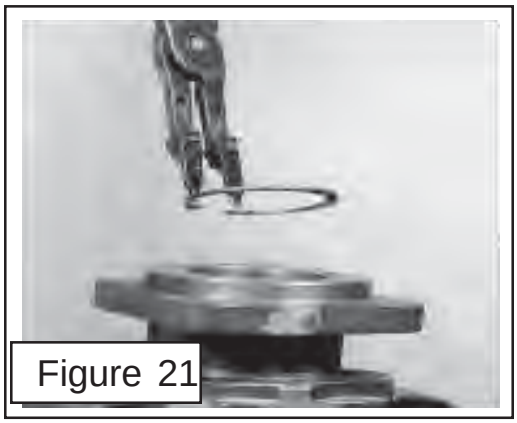


Figure 21

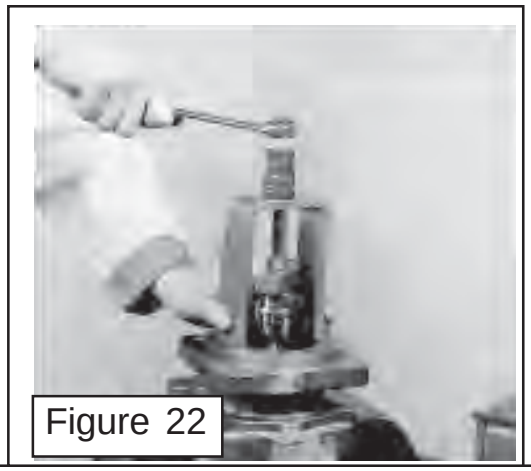
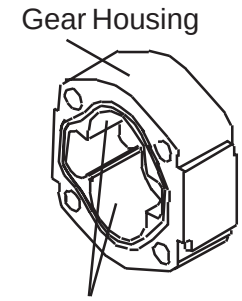


Figure 22


Figure 23

Wear Tolerance for Pump & Motor:

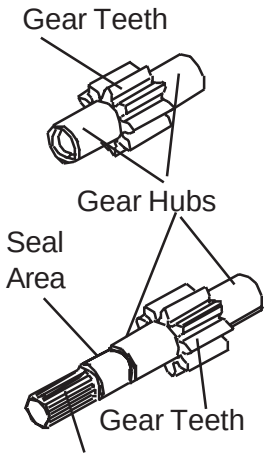
This is suggested Wear Tolerance to Keep Assemblies operating as efficient as possible, Not Complete failure rate. Your Pumps and/or motors may not be exact same as discussed here.



Gear Housing: Gear type Pump and Motor

Wear in excess of .007" cut-out necessitates replacement of the Gear Housing. Place a straight edge across the Bore in the cut out area. If you can slip a .007" feeler gage under the straight edge in the cutout area. Replace the Gear Housing.

Pressure pushes the Gears against the Housing on the Low-Pressure side. As the Hubs and Bushings wear, the cutout becomes more pronounced. Excessive cutout wear in short period of time indicates excessive pressure or Oil contamination. If the relief Valve Settings are within prescribed limits check for shock pressures or tampering. Withdraw Oil Samples and check it and tank for dirt. Where cut-out is moderate, 0.007" or less, gear housing is in good enough condition and may be reused, understand if you are at 0.007" you are at the upper limits and will not be at peak performance. A pump should always produce at least 85% efficiency (Example: if your Pump is rated at 37 GPM it should produce at least 32 GPM).



Gears:

Any scoring on Gear Hubs necessitates Replacement. Scoring, Grooving or Burring of Outside diameter of Teeth requires replacement. Nicking, Grooving or Fretting of Teeth surfaces also necessitates replacement.

Drive Shaft: (with Built on Gear)

If Gear Teeth and Gear Hubs are OK, Inspect Splines on input end (OD) of Shaft and the Splines (ID) Output) Coupler End (Tandem Pump) for condition and Wear.

Inspect Wear or damage to Seal Wear Area. If damage at Seal are check for contamination. Note: Some Pumps and/or Motors may have Keyway or Splines. Either will have to be inspected for condition. If Damage in any of these area the Shaft / Gear will have to be replaced.

Thrust Plate:

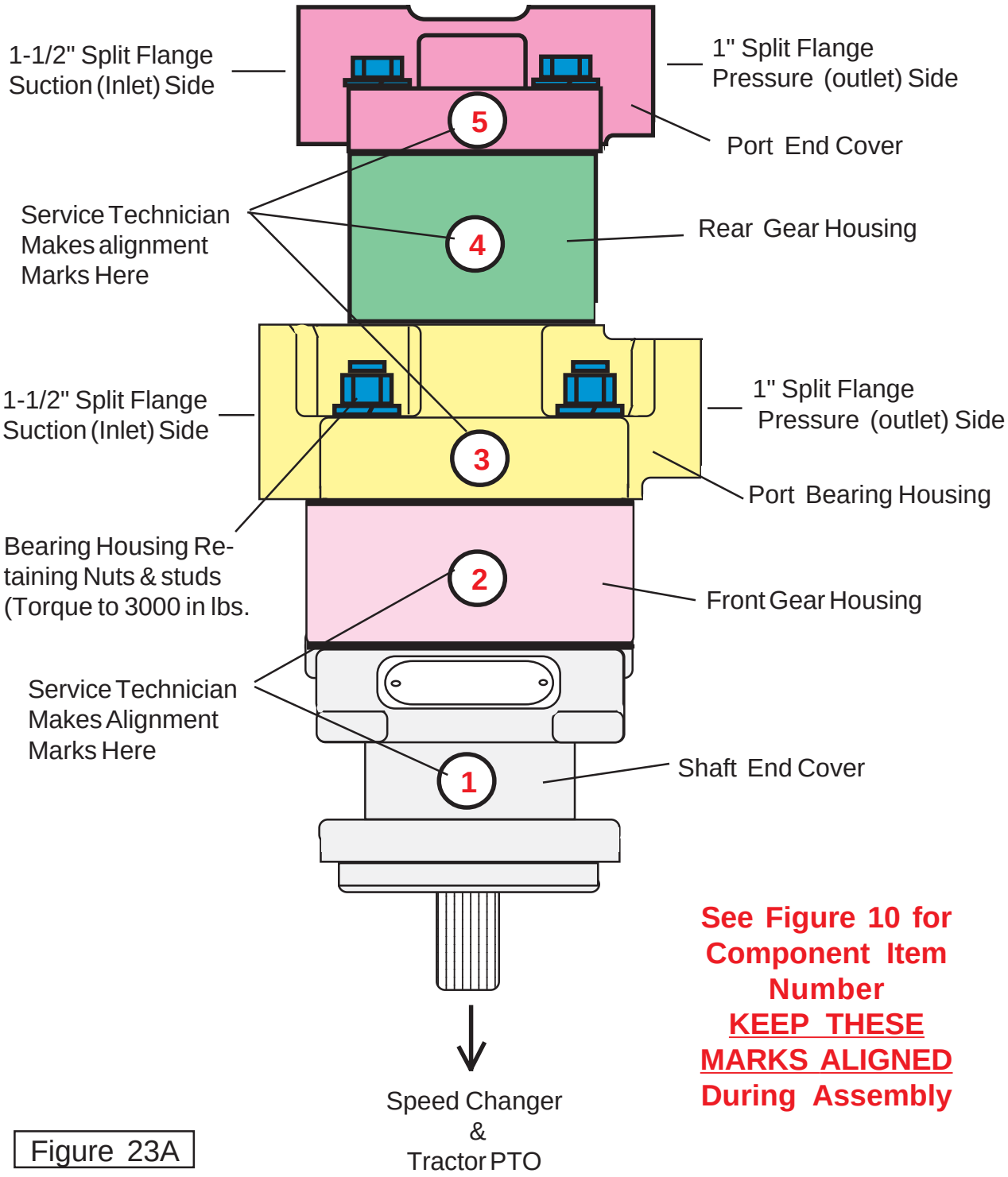
The Thrust Plate Seals the Gear Section at the sides of the Gears. Wear will allow internal slippage, which is Oil bypassing within the pump. The Pump and Motor Thrust Plates are different even though they may look very similar. They are built different. They will not interchange.

A Maximum of 0.002" wear is allowable. Replace Thrust Plates if they are scored, eroded or pitted. Wear can be checked usually by comparing thickness at outer edges with thickness at Gear contact area.

1. Check center of Thrust Plates where the Gears mesh. Erosion here indicates Oil contamination.
2. Pitted Thrust Plates indicate cavitation or Oil aeration.
3. Discolored Thrust Plates indicate overheating, probably insufficient Oil.

IMPORTANT !

Mark all Sections of Pump with a Number (or) Symbols that will serve as a guide to all sections being re-installed the same way they were removed. Example: if the numbers (marks) do not line up (1, 2, 3, 4 & 5) as they were marked, the pump is not being assembled correctly. Check this all through the assembly process.



See Figure 10 for Component Item Number

KEEP THESE MARKS ALIGNED During Assembly

Figure 23A

Pump Assembly CAUTION! :

Important information - read before assembly:

1. All sections have been cleaned and inspected, take extreme care not to allow the marring or damage to machined surfaces to occur. Make certain all components are laid out so as not to damage the machined surfaces.
2. Make certain any replacement parts have been compared to the old parts to make certain they are correct.
3. Gears are closely matched, there fore they must be kept together as sets when removed from the pump. Handle gears with care to avoid damage to journals or teeth. Avoid touching gear journals. DO NOT mix new and old gears when reassembling pump.
4. Never hammer bushing into bores: always use an arbor press, Hammering will damage bushings and possibly the bores in the housing.
5. (NOTE illustrations shown here are for a single pump, the tandem pump is longer with more sections, the disassembly will be basically the same with the exception tandem pump has two pump section instead of one. See figure 9 & 10 for reference to components).

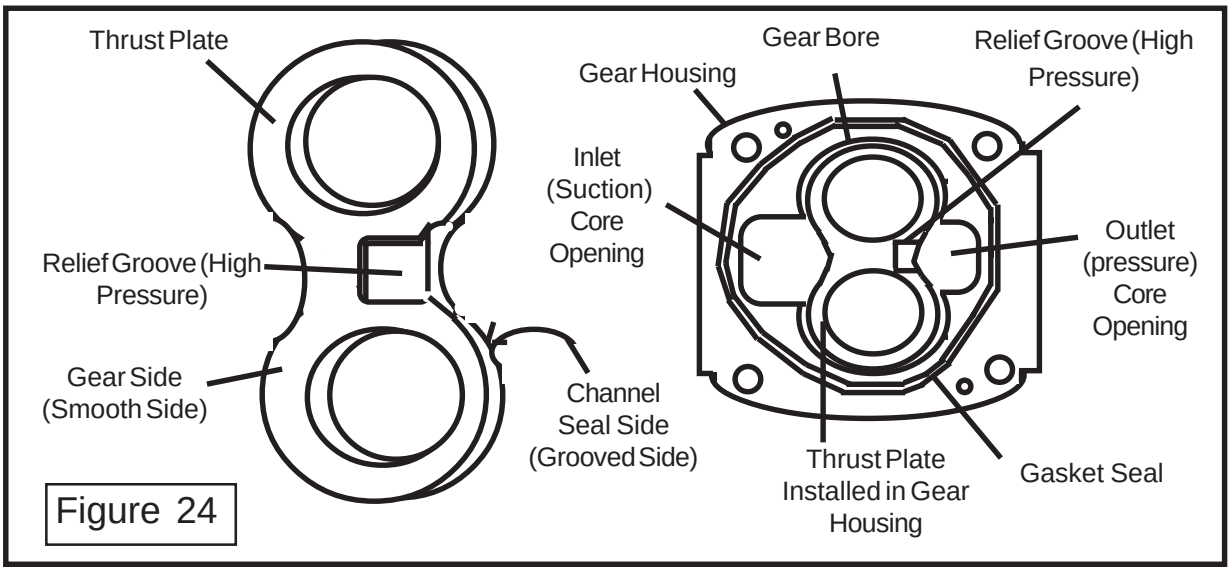


Figure 24

Thrust Plate CAUTION! : (Figure 24)

Important information - read before assembly:

1. Thrust Plates must be in good condition, no scratches or excessive worn places on either side of plate.
2. Thrust plates must be installed correctly, The thrust plate has two surfaces, one surface has a groove for the channel seal and the other surface is smooth with a relief groove (notch) in it.
3. Thrust plate smooth surface with relief notch will always face the gears, the groove side for the channel seal side will always face the gear bearing journal bushings never the gears as the gear would destroy the channel seal.
4. The relief groove will face the High Pressure side or Outlet Side of the gear housing. This is determined by the port (bearing carrier or port end cap) port size. The Inlet (suction Side port will have a bigger opening than the pressure side.
5. These thrust plates are very important to the way they are installed. If they are installed wrong, the pump will not function properly and other components could be damaged if operated with them wrong.

Pump Assembly:

1. Check all the machined surfaces on all pump components to make certain they are level and free of scratches. Minor scratches and slight un-level conditions may be fixed by using a Medium Grit Carborundurn Stone. This must be done equal all the way across the face of the machine surface to keep it level (figure 25). ALL part must be cleaned and dried if stone is used it. If deep scratches or excessively un-level the section will need to be replaced, so make certain this is checked before continuing installation of other components. Replace the parts with machined surfaces if required. Check components for wear or damage now before continuing.

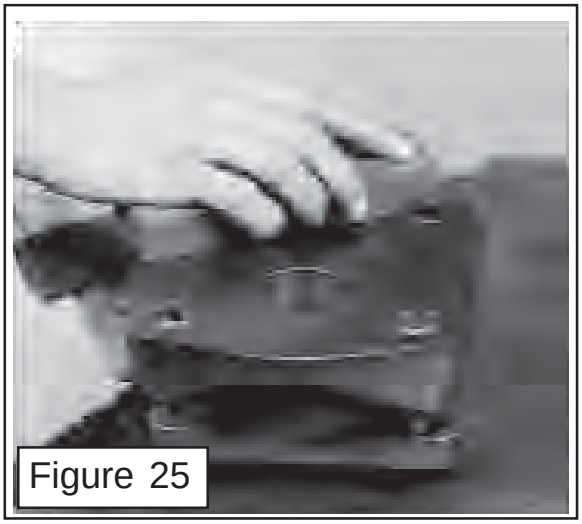


Figure 25

2. If the bushings (figure 10 item 6) were removed and new ones need to be replaced. Inspect the holes where the bushing will be pressed in. If there are burrs or rough edges at the tops of the holes they can be de-burred by using your finger and emory cloth. Keep the emory cloth on an angle and only around the top of the bore (figure 26). Do this to each hole for the bushing that are to be replaced. IMPORTANT ! Bushing must be pressed in with an arbor press DO NOT drive them in with a hammer.

3. Insert the shaft end cover in the vise with the machined surface up (figure 27). Examine the plug in the surfaced area. It is NOT required to remove this plug un-less the shaft end housing is being replaced. This pump (PGP/PGM 365 Series) has one plug and it is installed on determines the direction of travel of the pump, DO NOT change the location of this plug un-less you want to change travel direction. If plug is changed by error the pump will be damaged when engaged, it will most likely blow the shaft seal out of it and it may damage other components in the mowers hydraulic system. This plugged is change by using a screw driver if need be.


Figure 26

4. If new plugs are to be installed, coat the threads of the plug with locktite™ thread sealant. If new plugs have been installed, they need to be screwed in tightly. Stake the plug with a prick punch at both ends of the screw drive slot and around the edges. Peen the edge of the hole 1/32" to 1/16" with a 1-1/2" dia steel ball (a 1-1/2" ball peen ball end of a hammer can be used for this (figure 28), when striking ball peen hammer flat end put a piece of cloth over it to prevent chips from flying off of hammer . DO NOT use hammer direct to hit plugs

5. Note: Steps 5, 6, 7 & 8 apply to Shaft End Cover (figure 10 item 4), Bearing Carrier (figure 10 item 13) and Port End Cover (figure 10 item 17) Any bushing removed from the shaft end cover, port end cover or bearing end cover should be assembled in the drive bores with the grooves to the top of unit (12 O'clock). Assemble the bushings in the driven bores with the groove to the bottom of the unit (6 O'clock). The Grooves refer to the bearing seam (figure 29).

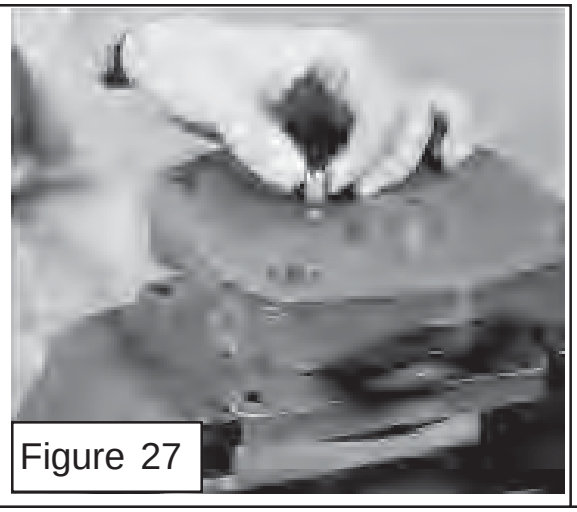


Figure 27

6. Bushings should be pressed into the bores one at a time, Use the special installation tool (figure 5 Tools recommended list) and an arbor pres. Be sure that the groove (or seam) are positioned as stated in step 5 previously. Be sure to support casting so they are square and level to the arbor press and the bushings are straight before attempting to press them in. The bushing must be pressed into the bores flush with the casting face (figure 30).

7. Repeat steps 1 and 2 after busings are installed (See steps 1 & 2). Just as earlier if the stone is used parts it is used on MUST be washed and dried . Make certain bushings are flush with castings and there are NO burrs on the top ID of bushings. (figure 31).

8. Check to make certain that the dowel pins are in place in any new castings and that the location corresponds with the mating casting. Before inserting any dowel pins check to make certain holes are clean, the top of the holes do not have burrs. To insert dowels hold the dowel in alignment with the hole. Gently start the pin into the hole straight, tap lightly with a soft hammer until dowel is seated into hole. (figure 32). Note as shown, dowel pins have holes in the center, this is for the studs to go through.

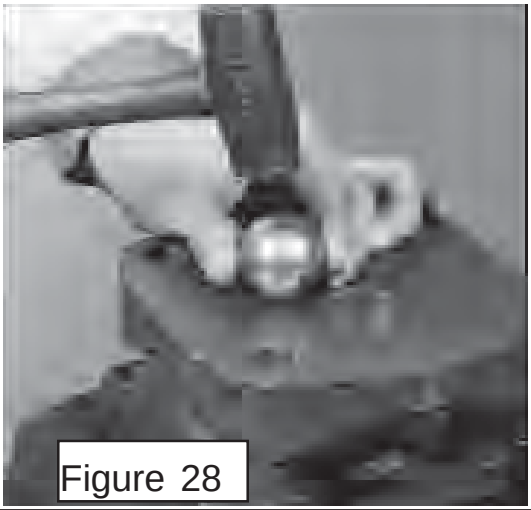


Figure 28

9. Remove the shaft end cover from the vice and turn it over 180° and re-insert it into the vise with the splined side up (figure 34). Before inserting the new lip seal (figure 10 item 3) into the shaft end cover Coat the outer edge of the lip seal with Permatex Aviation Form-A- Gasket™ No. 3 non-hardening sealant or equivalent. With the metal side of the seal up, press it into the mounting flange side of the shaft end cover with an arbor press and bar (see recommended tools list). Be careful not to damage the lip seal. Press the lip seal in until flush with the recess, wipe off excess sealant.

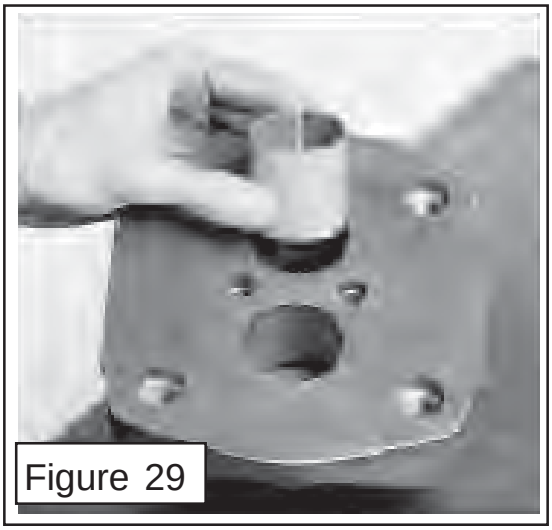


Figure 29

10. Install the outboard bearing (figure 10 item 2), guide the bearing into the recess in the shaft end cover. This is a light press fit and can be pressed in with the arbor press or it can be lightly tapped into the bore. DO NOT use excessive force to insert bearing, if it will not go with light (continued next page)

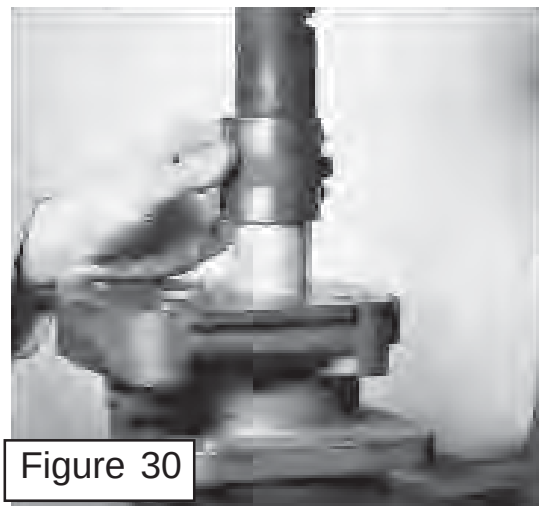


Figure 30

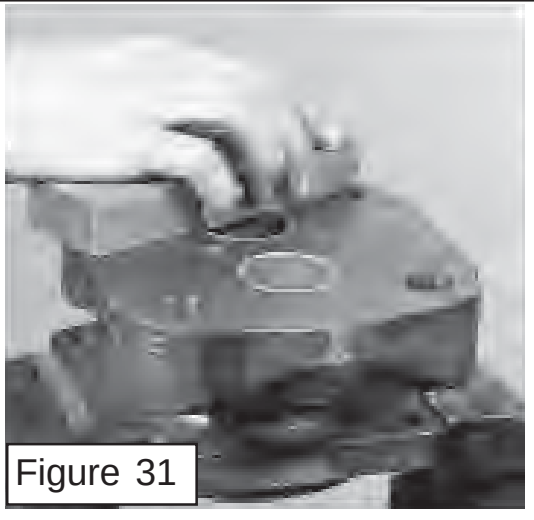


Figure 31

(continued from previous page) force check for size error or other reason. Forcing an over size bearing in will damage bearing and casting (figure 34).

11. Using the snap ring pliers as shown. Install the snap ring into the flange side of the shaft end cover (figure 35). Lightly tap the snap ring with a small punch and hammer to make certain it is seated into the snap ring groove of the shaft end cover.

12 Remove the shaft end cover (figure 10 item 4) from the vice and turn it over 180° and re-insert it into the vise with the splined side down and re-insert it into the vise.

Grease the new Gasket Seals (figure 10 item 10) and insert it in both sides of all gear housings. Position the first gear housing (figure 10 item 12) onto the shaft end housing (figure 10 item 4) aligning it with the holes for the dowel pins. Tap it with a soft hammer until it rest tightly against the shaft end cover. Be careful not to pinch the seal gasket, also be sure that the large rounded core is on the inlet side (figure 36).

13. Assemble the channel seals (figure 10 item 7) into the grooves in the thrust plates (figure 10 item 8) with the flat side of the seal facing away from the thrust plates as shown (figure 37 & 38). IMPORTANT NOTE: Channel seals will always be on side of thrust plate away from gears, only the smooth side of thrust plates are against gears.

14. Gently slip the thrust plate (figure 10 item 7 & 8) through the gear housing and into place on the shaft end cover (figure 39). The channel seal from step 13 should face the shaft end cover. The relief groove in the thrust plate should face the outlet side of the pump (see figure 23A).

15. Coat the driven gear journal with light coat of oil, Slide the driven gear (figure 10 item 9) through the housing and into the bushing in thew shaft end cover (figure 40) Coat the drive gear (figure 10 item 9) splined shaft end with light coat of grease, insert shaft into the special steel sleeve (figure 7 recommended tools list). Lightly coat the steel sleeve with grease. Place the lightly greased drive gear shaft inside the sleeve and slide both through shaft end cover with a twisting motion until the integral gear rest against thrust plate. Avoid damaging double lip seal. Remove steel sleeve, squirt clean oil over gears (figure 40). Note purpose of sleeve is to prevent splines on the shaft from damaging double lip seal.

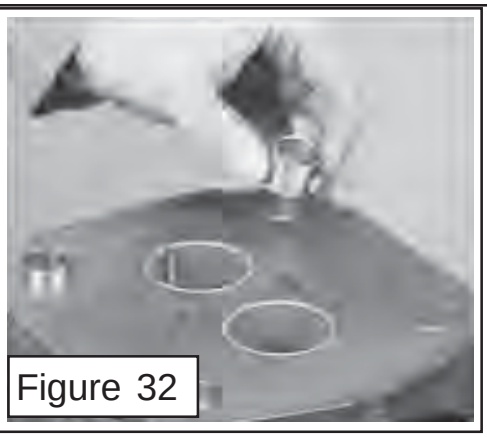


Figure 32

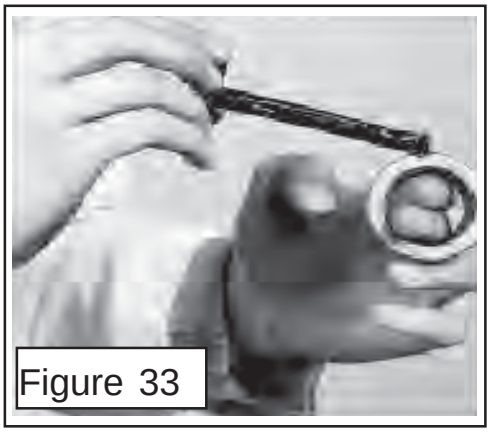


Figure 33

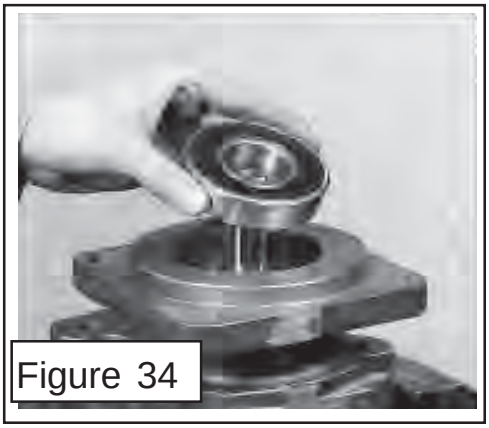


Figure 34

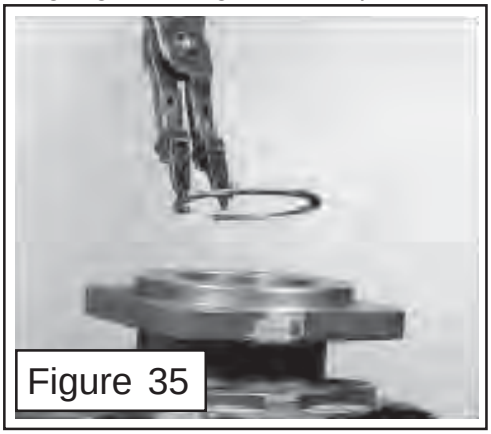


Figure 35

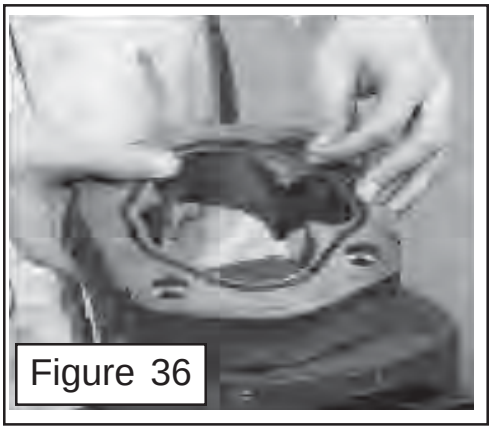


Figure 36

16. Slip the next thrust plate with the channel seal installed (figure 10 item 7 & 8) over the gear journals and into the housing bore. The flat side of the seal should face up with the relief groove of thrust plate facing the outlet side. Check the gear housing gasket seal (figure 10 item 10) is still in place on gear housing (figure 24 & 41).

17. Lightly coat the gear journals with grease. When placing the Bearing housing (figure 10 item 13) over gears, use caution so you don't hit and damage gear shaft journals. Place the bearing carrier onto gear shaft journals of the drive and the driven gears. Be sure to align the dowel pin holes over with dowel pins. When the parts are parallel squeeze them together or alternately tap over each dowel until the parts are together. DO NOT use excessive force to put housing together, if light taping won't do it something is wrong (figure 42).

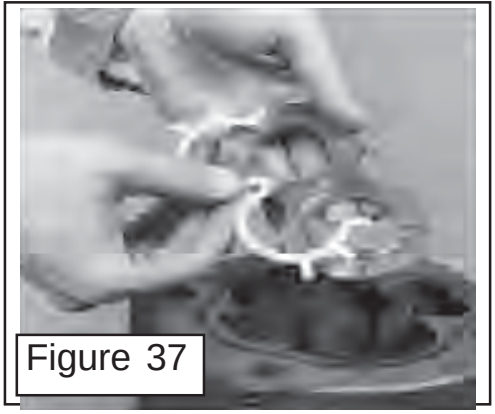


Figure 37

18 Insert the 4 studs, 4 Lockwashers & 4 Nuts (See figure 23A) that connect the previous sections. Tighten the stud nuts in alternating pattern until Torque of the nuts to 3000 in. lbs. (250 ft. lbs.)

19. Coat the connecting shaft (figure 10 item 14) use light coat of grease, insert it into spline of drive gear. Make certain that gasket seals are coated with clean grease and installed into second gear housing as instructed in step 12. Position and place second gear housing (figure 10 item 16) making certain the dowel pins are kept aligned between two castings (figure 43 & 44). Housing should fit flush to bearing housing. MAKING CERTAIN the marks made to keep the components in the same orientation when re-assembled are aligned (figure 23A).

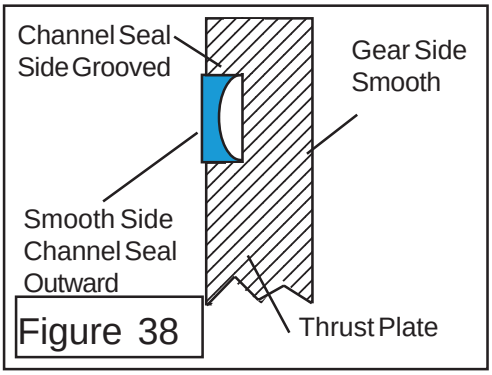


Figure 38

20 Place the thrust plate (figure 10 item 7 & 8) into the gear housing as per step 14. Coat the journal of the drive gear and the driven gear insert the drive gear aligning the splined shaft end over the splined connecting shaft. Insert the driven gear into the gear housing aligning gear teeth with the drive gear. DO NOT force the gears in, they must slide in smoothly and mesh together (figure 44). Make certain the gears are seated completely down and against the thrust plate face.

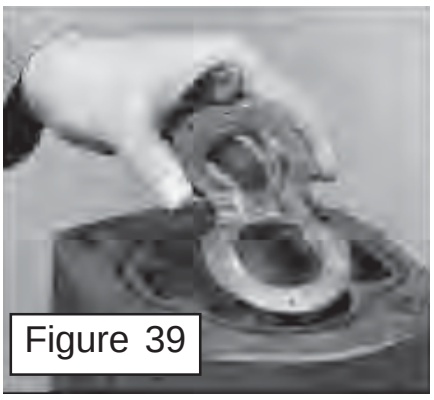


Figure 39

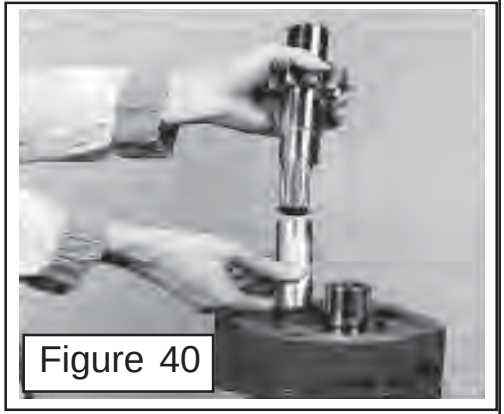


Figure 40

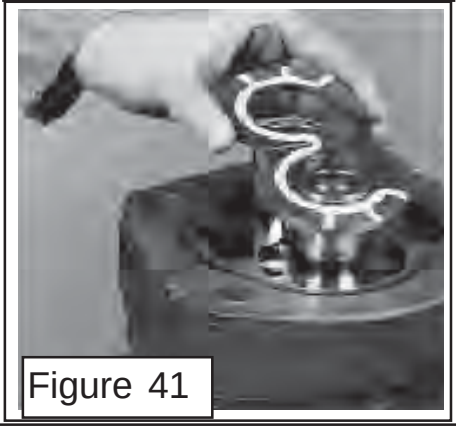


Figure 41

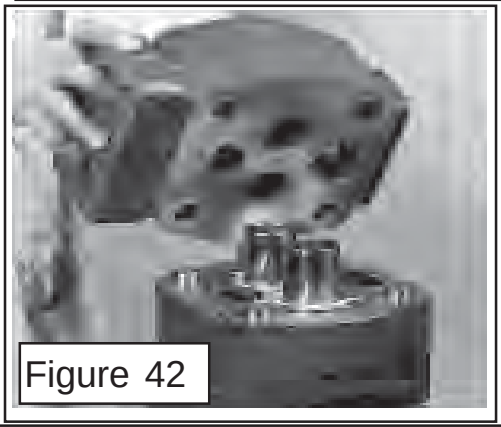


Figure 42

21. Check the plug in the port end housing (figure 10 item 5). These plugs do not have to be removed unless the port end housing (figure 10 item 17) is being replaced or someone has removed the plug. The plug must be installed on the correct side to function properly. If plugs need to be installed, removed or re-installed refer to steps 3 & 4 in the assembly instructions on correct way to install plugs (figure 27, 28 & 45).

22. Gently slip the thrust plate (figure 10 item 7 & 8) into the gear housing and into place on the shaft end (figure 46). The channel seal from should face the port end cover. The relief groove in the thrust plate should face the outlet side of the pump (see figure 23A & 24). The correct installation of the thrust plate and channel seal are very important, DO NOT install them wrong.

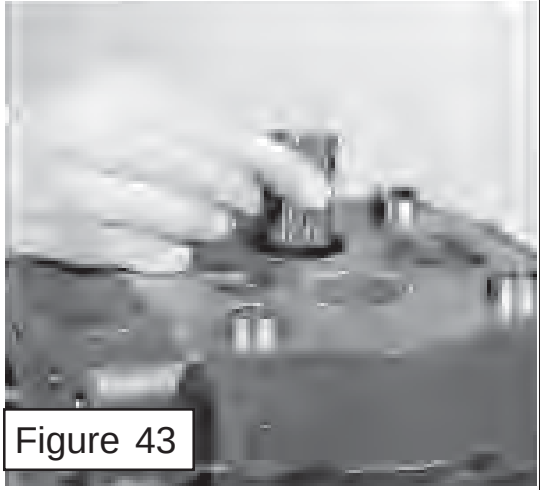


Figure 43

23. Make certain the bushings are OK or have been replaced correctly (see step 5, 6 & 7). Place the port end cover over the gear housing making certain your alignment marks (figure 23A) are aligned and the gear journals of the gear set have a light coat of grease on them Recheck the gasket seal (figure 10 item 10) is still in place. Tap the port end cover lightly in the center, make certain that the dowel pins are aligned, cover should fit flush on gear housing (figure 46).

24. Thread the bolts & lockwashers in through shaft end cover and gear housing until threads are started into bearing housing. Alternately tighten the bolts in increments that will make the three components pull down evenly (figure 47). Torque the bolts in increments until the bolts (qty 4) are torqued to 200 ft. lbs.

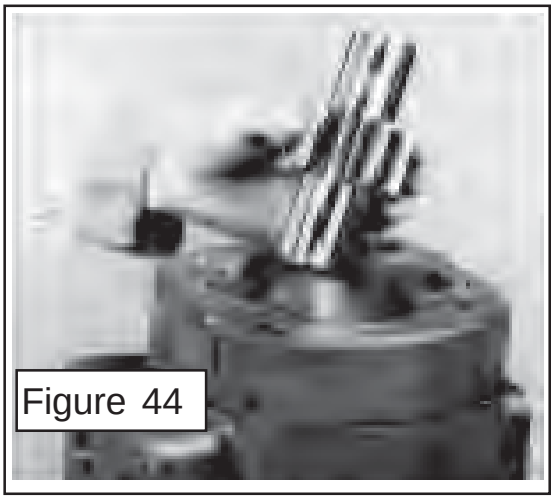


Figure 44

25 Review all assembly steps to make certain the assembly is correct. Wipe and clean any grease that may be on the outside of pump. Reconnect hoses to pump (figure 9).

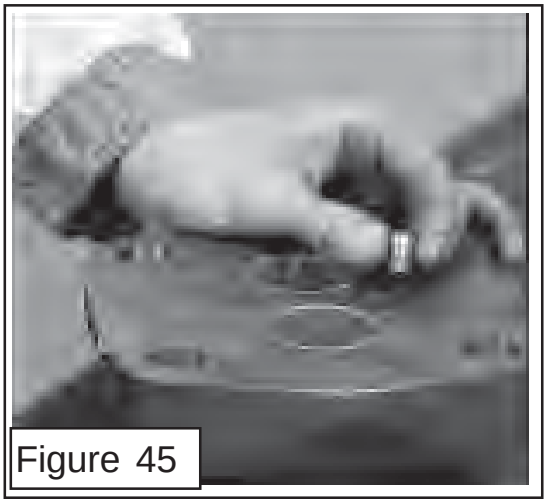


Figure 45

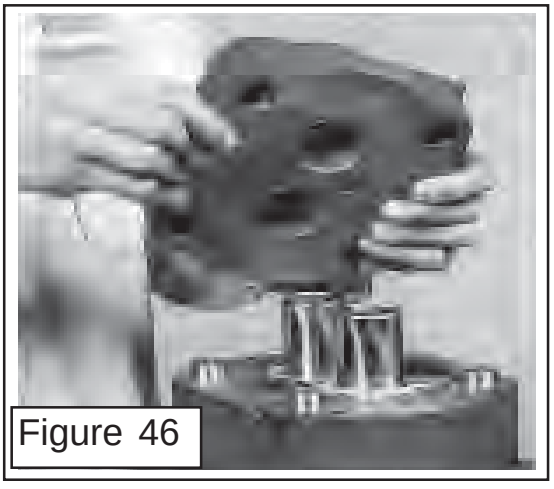


Figure 46

Recommended Start-Up Procedure For New Or Rebuilt Pump:

(Important Steps 26 through 30)

26. Before installing a new or rebuilt pump, back off the main relief valves until the spring tension on the adjusting screw is relieved (See Specification section for relief valve settings). This will avoid the possibility of immediate dam age to the replacement pump in the event the relief valve has been set to high.

27. Before connecting any lines (hoses) to the pump fill all the ports with clean oil to provide initial lubrication on start up, fill the suction hoses with oil. This is particularly important if the pump is located above the reservoir. Use thread sealant on all fittings and hose threads. DO NOT USE TEFLON TAPE.

28. Make certain the oil reservoir is full of clean oil. Test oil before running a replacement pump. Contaminated oil will damage a replacement pump even oil ran a minute or so. Review the type of failure that had occurred and investigate any damage that may have been caused due to that failure. DO NOT run the replacement pump if the cause of the failure has not been corrected. Any oil added to or to fill reservoir must be ran through a 100 micron screen before going into tank. See the tank fill section for available equipment for this purpose.

29. After connecting the lines (hoses) and mounting the replacement pump, operate the pump at least two minutes at no load and at low RPM (400 rpm). During this break-in period, the mower should run free (no load) and not develope an excessive amount of heat. If the unit operates properly, speed and pressure can then be increased to normal operating settings (See Specification Section).

30. Reset the main relief if needed to its proper setting while the pump is running at maximum operating engine (motor) speed for the PTO rating. (See Specification Section)

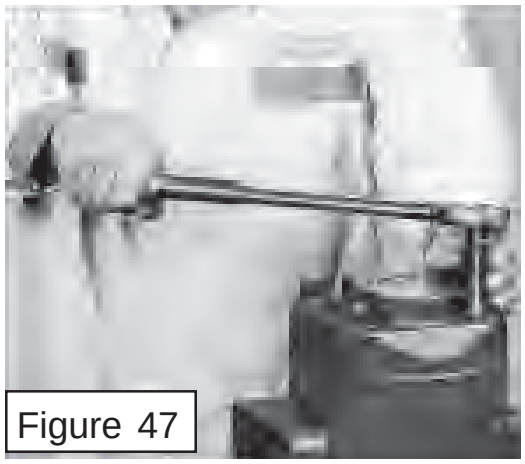


Figure 47

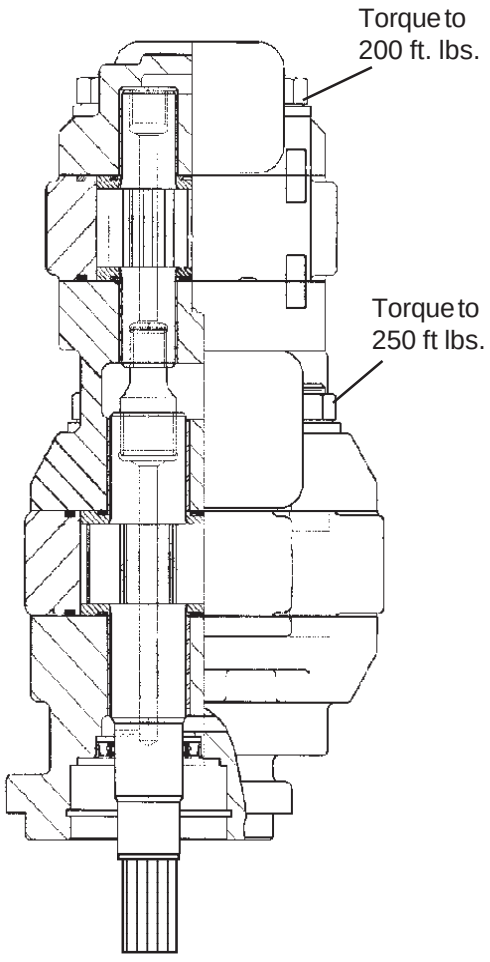


Figure 48

Section 3

HYDRO 15

Motor Service & Repair

Recommended Reading Before any Service Work Begins:

1. Read this section completely before starting inspection or repair to the mower hydraulic system to become familiar with its components.

2. Identify the model of the mower model number, serial number and other information that may be needed to identify which components or options that may be on the mower.

3. Make certain the mower and tractor are secured in a safe and proper parked position, hydraulic (axle and wings) lowered. Tractor safely parked according to tractor manufacturers recommendations.

4. Clean the complete hydraulic system in the area of the repairs. Dirt is the enemy of all hydraulic systems and all steps must be taken to keep hydraulic system from being contaminated.

5. Make certain the hydraulic oil is not hot from being operated or tested. All hydraulic components (including hydraulic oil) temperature should not exceed ambient temperatures. If temperature is high it must be allowed top cool before attempting any repairs of the hydraulic system. Caution should be taken, if mower is sitting in hot sun on a very hot day the temperature of the metal and oil can be hot, test the temperature.

6. The drawing and illustrations in this section are to help understand the components of the pump. This section is not intended to be a parts manual or operators manual although it is intended to be used with the other manuals.

7. Use caution if clamping any pump components in a vise or gripping them with any type of tools. The jaws of a vise can damage the surface or it the shape of a component, tools can scratch or damage the surface to render the component un-serviceable

8. These pumps are designed to be assembled to be turned in the direction for which they were built, clockwise or counter clockwise. When the pump is dis-assembled it is very important that you take notice of which components are where and which way they are installed in pump (example Item 5). If these pumps are installed with component in the wrong place and then turned in the wrong direction the pressure will usually blow the input seal out and may damage other components.

9. When making repairs always make certain that the cause of the failure is identified and repaired. Sometimes the cause of the failure is not corrected and another failure occurs rapidly because the cause of the failure is still there.

10. Make certain to use drain pans to catch all oil that may leak out during the testing and/or repair steps. Make certain to keep all hydraulic opening plugged or capped during repairs.

11. Never start the tractor and engage PTO to turn pump, if any hydraulic components have been removed or disconnected, line blockage or oil diverted to the wrong place could to extreme damage to the hydraulic system and/or to the mower deck cooling tubes.

12. The pressure side of the pump hydraulic flow MUST NEVER be sent directly to the deck cooling tubes as the excess pressure will damage them. The hydraulic oil flow can only be sent through the deck cooling tubes when it is being returned to the tank with little or no resistance.

13. Some components of hydraulic system are not meant the be repaired, only replaced. Do Not dis-assemble a component if it is a part intended for replacement only.

14. When storing a pump or its components for any reason it is recommended they be stored in a clean area and covered to protect from any dust, components that have been washed be coated which oil if they are made of material that may rust.

Recommended To Test Hydraulic Pump before Motor is Removed:

(Before Installing a New or Rebuilt Motor).

A. Connect your Flow Meter in Line to test Pressure as unit is started; this is in case the Relief Valve is malfunctioning or has been tampered with. If this is not done you could damage the replacement Pump because you would not Know it until Pump failed from excessive pressure.

B. Before connecting any lines to Pump, fill all Ports with clean Oil to provide initial Lubrication. This is especially important is Pump is located at a higher level than Oil Reservoir.

C. Check Oil level in reservoir, fill to full level if needed, Reservoir must have more Oil than the Pump GPM capacity.

D. After connecting the Lines and mounting the replacement Pump, make sure that Oil is not warmer than Pump temperature. If Oil is warmer than pump run Pump at short intervals till Pump and Oil temperature is equalized. Hot Oil must not be fed into cold Pump.

E. Operate the Pump for at least two minutes at no load and at low RPM (400 RPM min and 1400 RPM max.). Watch Flow Meter Pressure (or Pressure Gauge). During this break-in period, the unit should run free and not develop an excessive amount of heat. Heat should not exceed 100 deg F. above ambient Temperature. If the unit operates properly, speed and pressure can then be increased to normal operating settings. Increase Pressure in 500 Lbs. PSI increments from start, this should take 4 to 5 minutes to max. PSI allowing 1 minute between increases to check Oil Pressure and Temperature.

F. If normal Pressure and Heat readings are seen then the New or Rebuilt Pump installation should be done, remove Flow Meter (Pressure Gauge) from line, reconnect Line and check all connections.

Test Equipment Needed:

1. Flow Meter, The Flow meter should have components to measure:
   - A. Guage to Measure the Oil Temperature.
   - B. Gauge to Measure Oil Pressure PSI (Load and No Load).
   - C. Gauge to Measure Oil Flow in G.P.M.
   - D. A Valve to load system to check operating Pressure (PSI).
   - E. Assortment of Connections to connect to Hydraulic System.
2. Electrical Volt Meter with variable settings and Ohm Meter.
3. Electrical Test Light.
4. Wrenches, (Socket Wrenches, Open and Boxed End Wrenches).

Flow Testing the Pump: (figure 1)

1. Use a Flow Meter that is rated to 6000 PSI and 60 GPM Minimum. This applies to the gear type pump and motor type only
2. the area around the hoses, motor, flow meter must be clean of all debris and dirt. NO contamination can be allowed to enter the system or its components. Make certain there is nothing in flow meter from previous use that will contaminate the hydraulic system, dirty and contamination in test equipment hoses and valves can cause a failure to occur.
3. Disconnect the hydraulic return hose from the motor. Connect the hoses to the flow meter as shown above, recheck all connections to make certain they are connected correctly and fittings have been check for tightness.
4. Completely open the pressure valve on the flow meter.

5. Record all the readings during the test. Start the system, run at 540 PTO speed (which will run pump at required speed) until the Oil temperature reaches at least 110° F. before starting test. Check the flow (GPM) at 0 psi. (or no load). Slowly close the pressure control valve (valve on flow meter) until the gauge pressure reaches 500 psi. and record the readings pressure, temperature and flow (GPM). Continues this at 500 psi increments until a maximum of 2000 psi.
6. If the flow rate is 85 % or greater of beginning flow rate at no load, the pump is serviceable and functioning within specifications.

CAUTION ! Stop tractor engine and discontinue testing if hydraoulic oil temperature exceeds 220° F. as temperatures above this could cause damage to components.

Example: Recorded test results

PSI.	GPM	TEMP ° F.
0	____	_____
1000	____	_____
2000	____	_____
3000	____	_____

PSI.	GPM	TEMP ° F.
500	____	_____
1500	____	_____
2500	____	_____

Shown Below is a Gear Pump Schematic

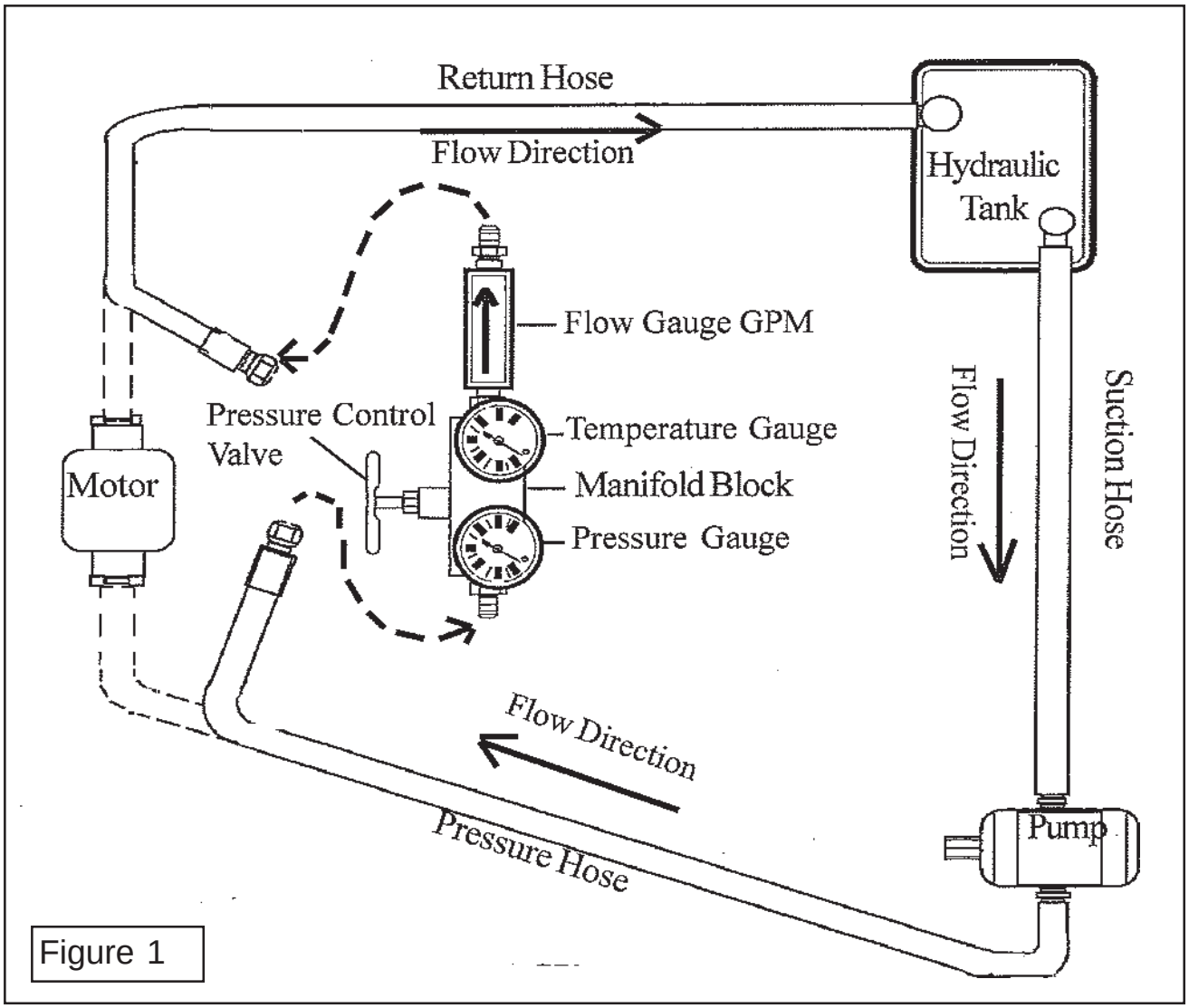


Figure 1

15 FT - PUMP & MOTOR HYDRAULIC SCHEMATIC

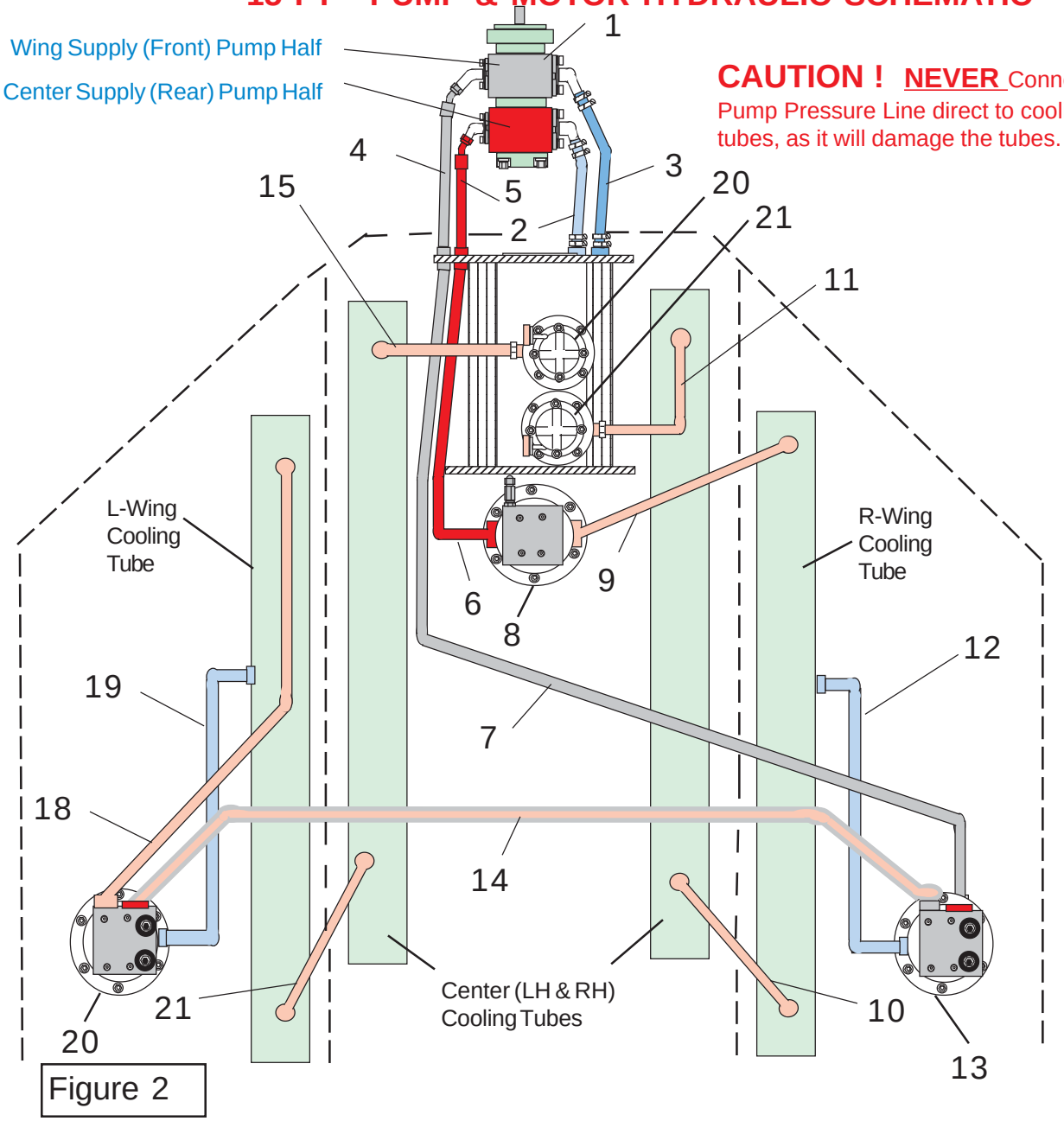
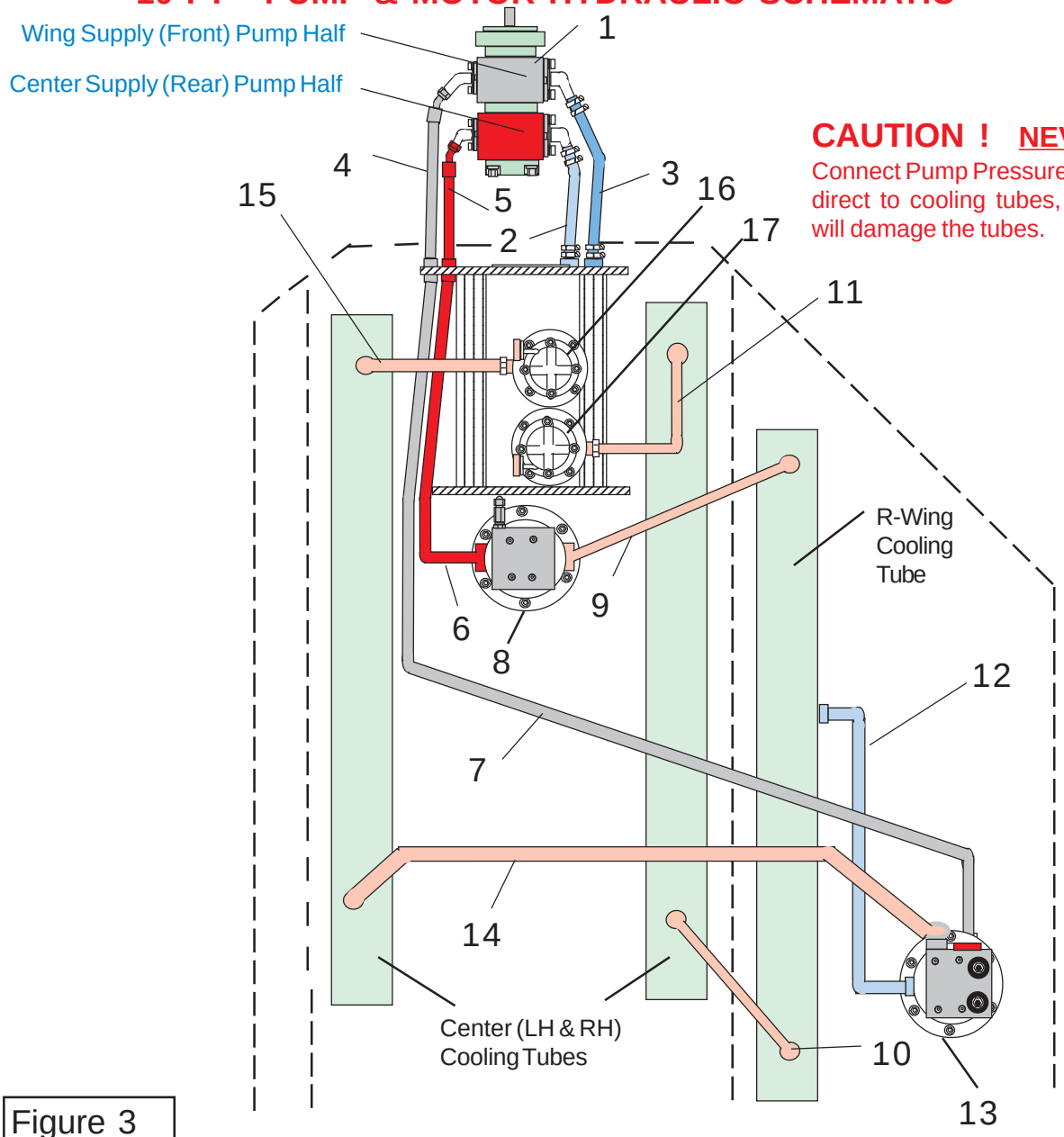


Figure 2

Item	Description
1	Tandem Pump Asy
2	Suction (Tank to Wing Pump)
3	Suction (Tank to Center Pump)
4	Pressure (Pump to Bulk Head Fitting)
5	Pressure (Pump to Bulk Head Fitting)
6	Pressure (Bulk Head Fititng to Center Motor)
7	Pressure (Bulk Head Fitting to Wing Motors)
8	Motor Asy (Center Sction Motor)
9	Return (Center Motor to Wing CoolingTube)
10	Return (Wing Tube to Center Cooling Tube)
11	Return (Center Coolingg Tube to Fiter / Tank)

Item	Description
12	Case Drain (R- Wing Motor to Cooling Tube)
13	Wing Motor Asy (R- Wing)
14	Return / Pressure (f/ R-Wing to L-Wing Motor)
15	Return (Center Cooling Tube to Filter / Tank)
16	Return Filter & Gauge (Wing Motors Return)
17	Return Filter & Gauge (Center Motor Return)
18	Return (L-Wing Motor to Cooling Tube)
19	Case Drain (L-Wing Motor to Cooling Tube)
20	Wing Motor Asy (L-Wing)
21	Return (L-Wing Tube to Center Cooling Tube)

10 FT - PUMP & MOTOR HYDRAULIC SCHEMATIC



CAUTION ! NEVER
Connect Pump Pressure Line direct to cooling tubes, as it will damage the tubes.

Figure 3

Item	Description
1	Tandem Pump Asy
2	Suction (Tank to Wing Pump)
3	Suction (Tank to Center Pump)
4	Pressure (Wing Pump to Bulk Head Fitting)
5	Pressure (Center Pump to Bulk Head Fitting)
6	Pressure (Bulk Head Fititng to Center Motor)
7	Pressure (Bulk Head Fitting to Wing Motor)
8	Motor Asy (Center Sction Motor)
9	Return (Center Motor to Wing CoolingTube)
10	Return (Wing Tube to Center Cooling Tube)
11	Return (Center Coolingg Tube to Fiter / Tank)

Item	Description
12	Case Drain (R- Wing Motor to Cooling Tube)
13	Wing Motor Asy (R- Wing)
14	Return (R-Wing Motor to Cooling Tube)
15	Return (Center Cooling Tube to Filter / Tank)
16	Return Filter & Gauge (Wing Motor Return)
17	Return Filter & Gauge (Center Motor Return)

Recommended Tools:

Listed below are some of the toolds that are recommended for the dis-assembly and re-assembly of the pump for the HYDRO 15 Mower.

1. Arbor Press
2. Awl
3. 1-1/2" Dia steel ball
4. Bearing Puller (Owaonna Tool Co. MD-956 or equivalent)
5. Bushing Remover Tool (figure 4)
6. Clean lintless Cloth
7. Deburing Tool (an old file with cutting teeth ground off)
8. Machinest Hammer
9. Soft Hammer
10. Permatex Aviation Form-A-Gasket.™ (No. 3 non hardening sealant or equal)
11. Medium Grit Carborundurn Stone.
12. Seal removal Tool (figure 6)
13. Oil and Grease
14. Snap Ring Pliers
15. Prick Punch
16. Bushing Installation Tool (figure 5).
17. Scale (1/32" or 1/64" graduations)
18. Small Screw Driver
19. Torque Wrench (in. lbs & ft lbs)
20. Vise with 6" minimum opening
21. Bar for Lip Seal Installation For Center or Wing Motor use 2-1/2" dia X 2" Bar
22. Special Steel Sleeve (figure 7)

Bushing Puller: The bushings in the Motor may be removed from tier bores, using blind hole collet-type bushing pullers similar to those manufactured by Owatonna Tool Co. The Table below illustrates the modification necessary to adapt the OTC collets to this task. Equivalent pullers from other suppliers may be modified in a similar fashion.

Motor	A	B	C	Make f/ OTC Collet No.
Wing Motor	1.122 / 1.122	1.000 / 0.990	.072 / .062	33864
Center Motor	1.382 / 1.372	1.260 / 1.250	.100 / .120	33865

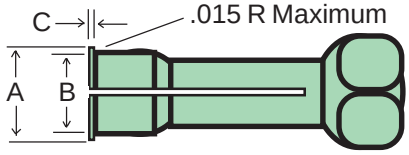


Figure 4

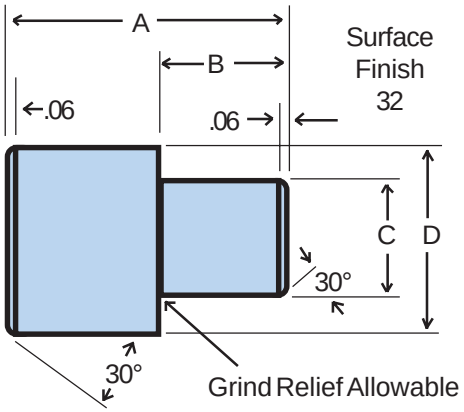


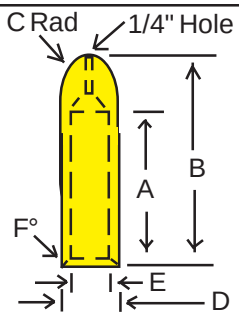
Figure 5

Motor	A	B	C dia.	D dia.
Wing Motor	3.00	1.47	1.282 + .000 - .002	1.625
Center Motor	3.00	1.73	1.492 + .000 - .002	1.750

Seal Removal Tool: Easily made from old screw driver. Heat the tip and bend as shown. Grind the tip to fit the notch behind the shaft seal.

Figure 6

Special Steel Sleeve: The special steel sleeve is used to insert the drive shaft through the lip seal without damage and can be made from bar stock. For the center motor use a 1-1/2" dia X 4-5/8" bar. For wing motor use a 1-3/8" dia X 4-5/8" bar. The drawing and cgart give details for making this special tool.



Motor	A	B	C Rad	D Rad	E dia.	F° Chamfer
Wing Motor	3-3/8"	4-1/2"	9/16"	1.290 + .000 - .002	1.250 + .002 - .000	.015" X 60°
Center Motor	3-3/8"	4-1/2"	9/16"	1.377 + .000 - .002	1.250 + .002 - .000	.015" X 60°

Figure 7

All external surfaces MUST be free of scratches and burrs

Motor Cleaning & Removal:

1. Clean Motor, Hoses and all connections before disconnecting any components from the motors. This will keep contamination from getting into system, (in this illustration the mower is new, clean and un-used). Some type of drain pan will be required to catch the oil that will drain out when hoses are dis-connected. The hoses will need to be capped (plugged) after being disconnected. If cap is not leak proof then hoses must remain elevated above hydraulic tank to prevent oil leak age from hose fittings.

   The Center Motor and the Wing motors are built different and will look different. The easiest way to ID which is which is by the four bolts that hold the motor together. On center motor the bolts are in the open as shown (figure 9), on the wing motors they are down inside a machined hole on the Port End Cover (figure 10, 11 & 12).

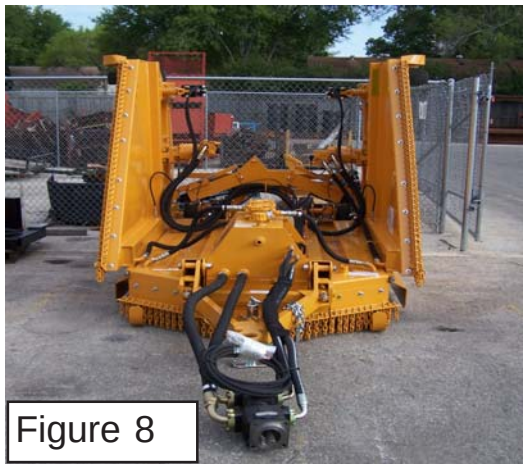


Figure 8

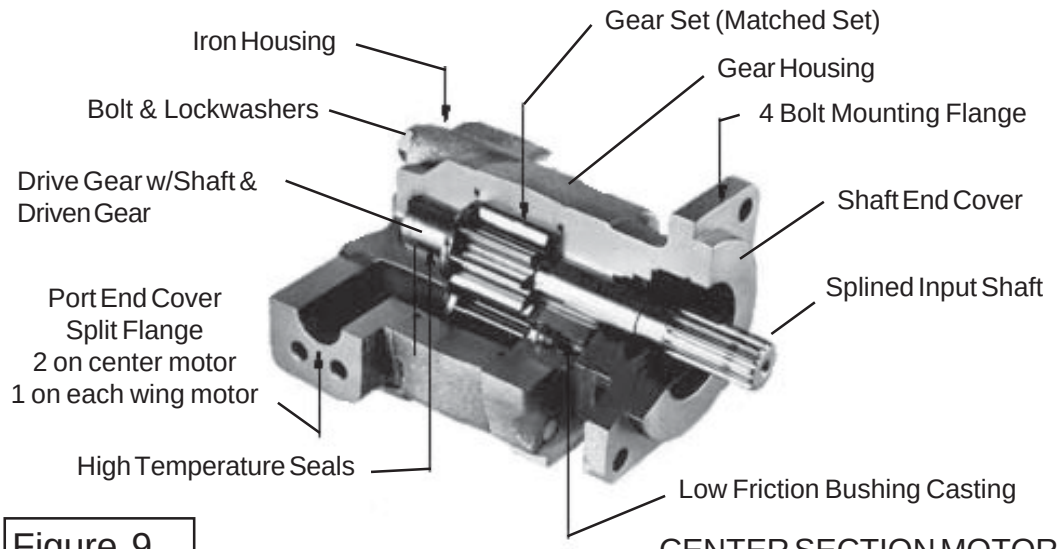


Figure 9

CENTER SECTION MOTOR SHOWN

Motor Information:

Center.

Center motor is very different from the wing motors in design. The Housings are more square than the wings. The manifold blocks are different, the center is thinner and will not use the solenoids that the wings do. The four assembly bolts on the center motor are visible under manifold block. (figure 10) The center motor is assembled to turn in a CW rotation which should be marked on the motor mounting flange from the factory. The rotation is determined by standing on the deck behind the motor facing forward. Make certain which motor is being serviced, Most parts will not interchange between the cent and wing motors.

RH Wing:

The RH wing motor is basically the same as the LH wing motor with the exception of the Port end cap is installed different (figure 11). The wing motor the four assembly bolts are in a machined hole under the manifold block. The manifold block will need to be removed to see them. The RH Wing motor is assembled to turn in CW rotation which should be marked on the motor mounting flange from the factory. The rotation is determined by standing on the deck behind the motor facing forward. On the wing motor the four assembly bolts are in a machined hole under the manifold block. Make certain which motor is being serviced,

LH Wing:

The LH wing motor is basically the same as the R H wing motor with the exception of the Port end cap is installed different (figure 12). The wing motor the four assembly bolts are in a machined hole under the manifold block. The manifold block will need to be removed to see them. LH Wing motor is assembled to turn in CCW rotation which should be marked on the motor mounting flange from the factory. The rotation is determined by standing on the deck behind the motor facing forward. On the wing motor the four assembly bolts are in a machined hole under the manifold block. Make certain which motor is being serviced,

Hydraulic Connections:

Center Motor

The hydraulic connections are connected to the Motor for the inlet and outlet side with a 1 inch split flange connection (figure 10).

RH & LH Wing Motor

The hydraulic connection for the Inlet is connected to the motor with a 1 inch split flange connection, The outlet connection is on the manifold block with a 1 inch split flange connection (figure 11 & 12).

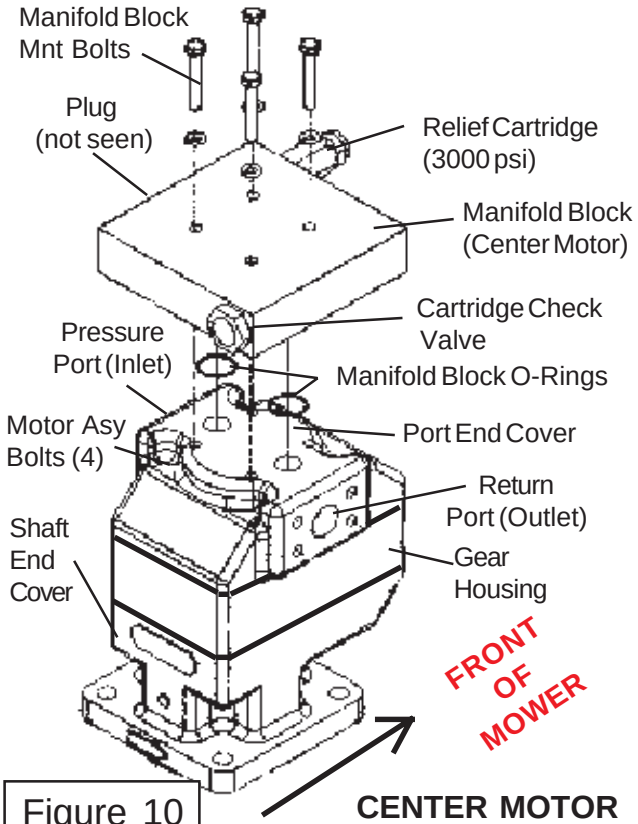


Figure 10 CENTER MOTOR

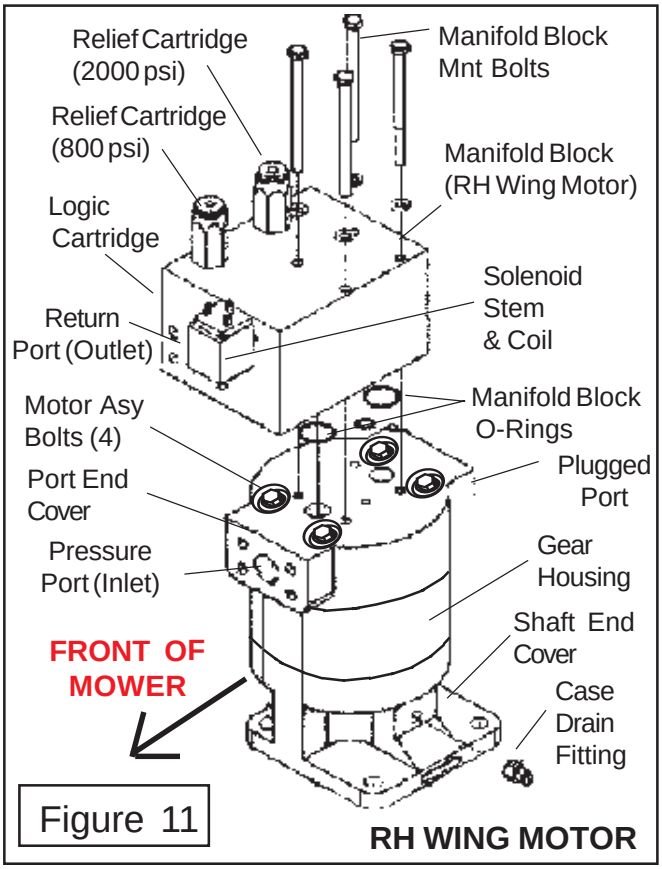


Figure 11 RH WING MOTOR

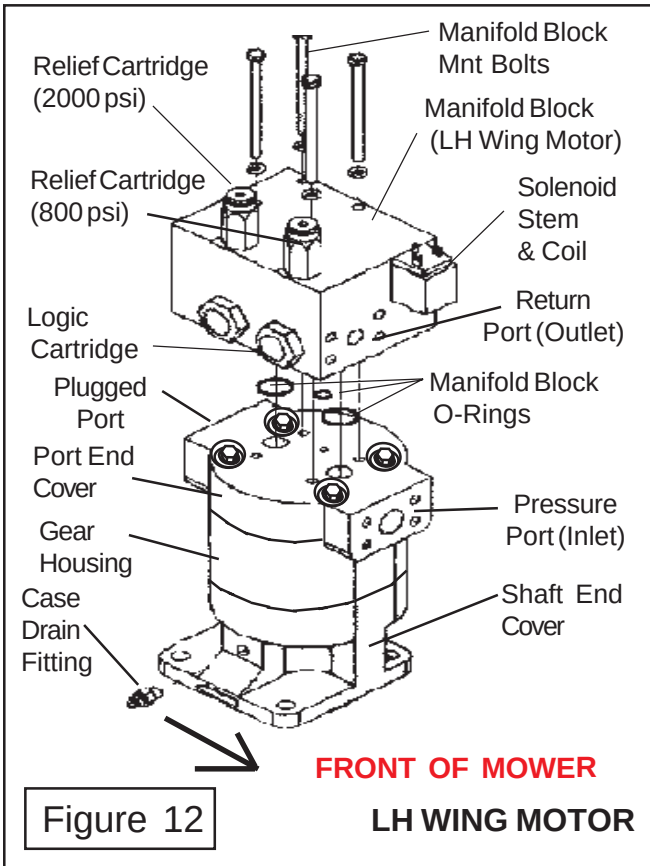


Figure 12 LH WING MOTOR

IMPORTANT ! (CENTER MOTOR)

Mark all Sections of Motor with a Number (or) Symbols that will serve as a guide to all sections being re-installed the same way they were removed. Example: if the numbers (marks) do not line up (1, 2, 3 & 4) as they were marked, the Motor is not being assembled correctly. Check this all through the assembly process. The Motor will rotate in the wrong direction if connected wrong. NOTE: The manifold block will always mount with the relief valve on the same side as the pressure inlet. If installed wrong the motor will not function properly because the relief valve will not work.

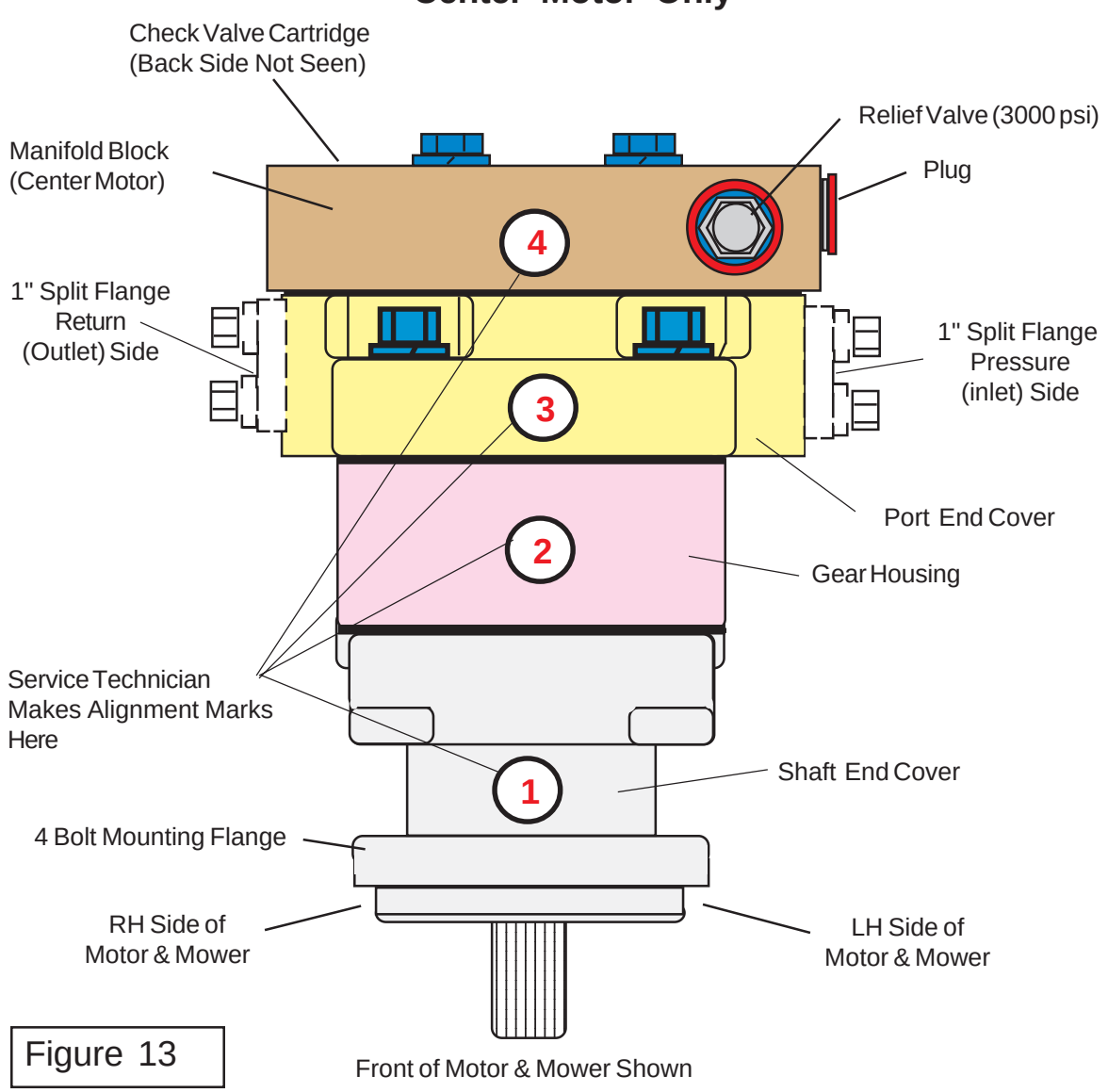


Figure 13

IMPORTANT ! (RH & LH WING MOTOR)

Mark all Sections of Motor with a Number (or) Symbols that will serve as a guide to all sections being re-installed the same way they were removed. Example: if the numbers (marks) do not line up (1, 2, 3 & 4) as they were marked, the Motor is not being assembled correctly. Check this all through the assembly process. The Motor will rotate in the wrong direction if connected wrong. NOTE: The manifold block will always mount with the relief valve on the same side as the pressure inlet. If installed wrong the motor will not function properly because the relief valve will not work.

RH & LH Wing Motor

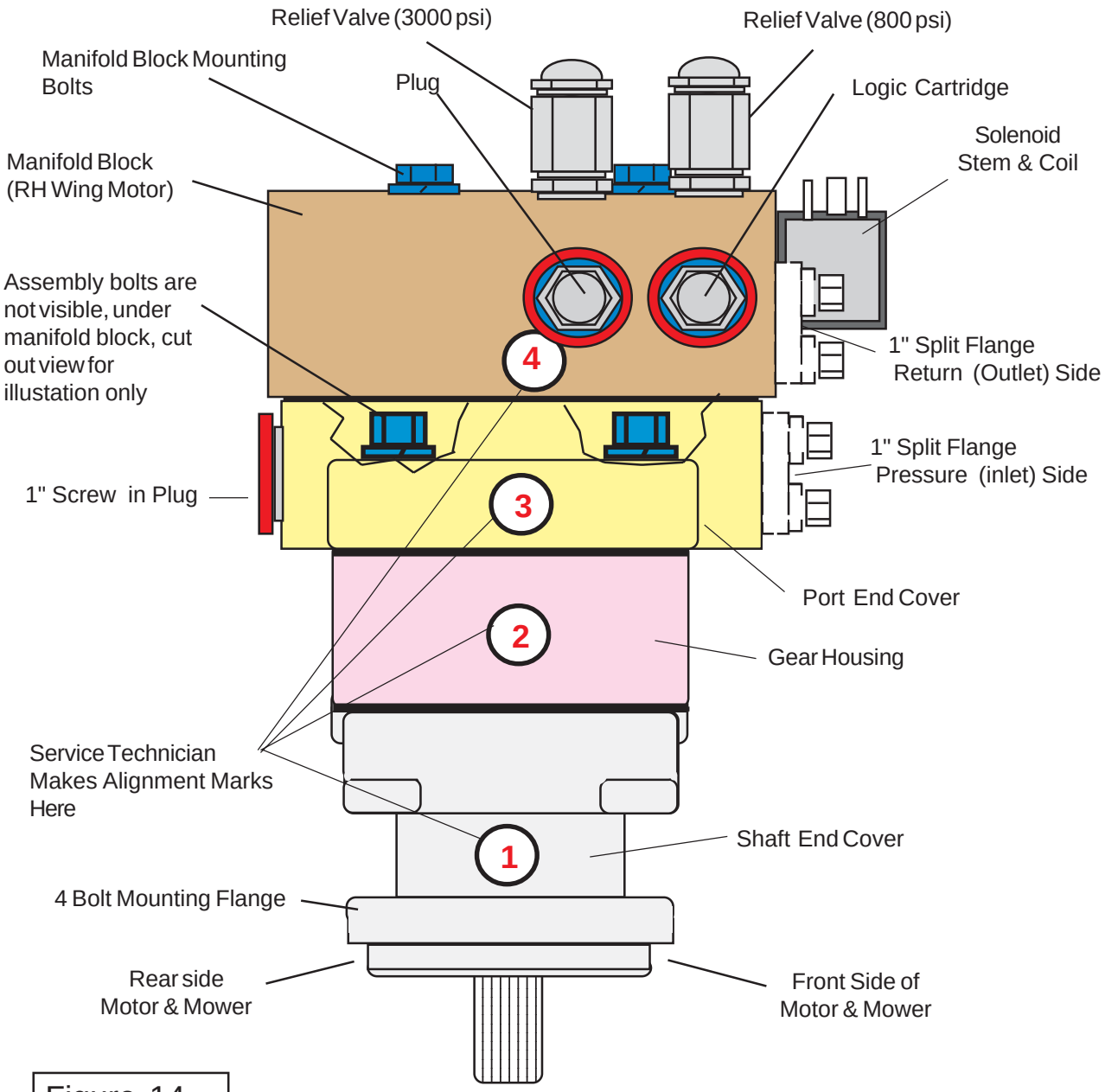


Figure 14

RH Side of Motor & Mower Shown

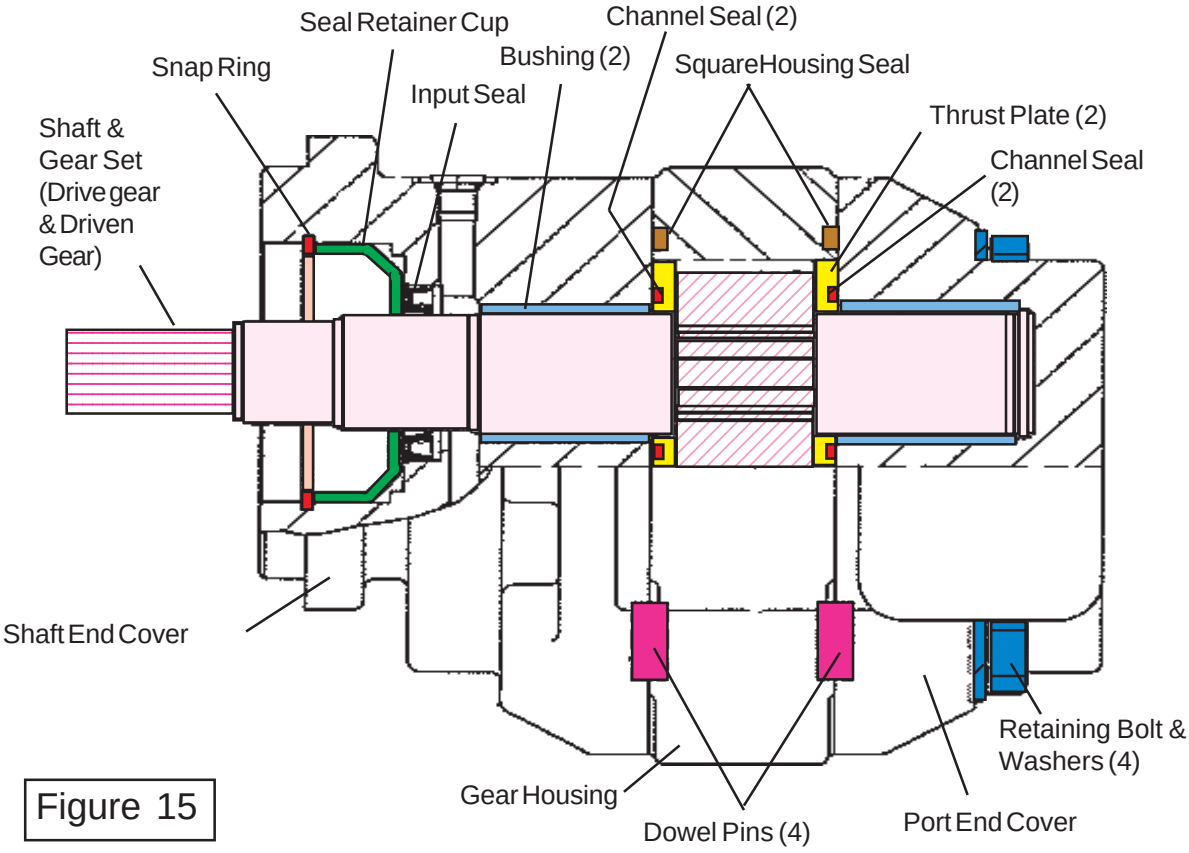


Figure 15

Shown above (figure 15) is a general breakdown of the motor components, The motors are basicaly the same in design and replace componetn procedure. Each motor will asemble different as some of the components are different. Refer back to figure 15 for later motor assembly information

Motor Dis-Assembly CAUTION! :

Important information - read before dis-assembly:

1. If prying off sections becomes necessary, take extreme care not to mar or damage machined surfaces. Excessive force while prying can result in mis-alignment and seriously damage parts.
2. If sections of motor are difficult to come apart during dis-assembly, tap gently with a soft hammer (never use an iron hammer).
3. Gears are closely matched, therefore they must be kept together as sets when removed from the pump. Handle gears with care to avoid damage to journals or teeth. Avoid touching gear journals.
4. Never hammer bushing into bores: always use an arbor press.

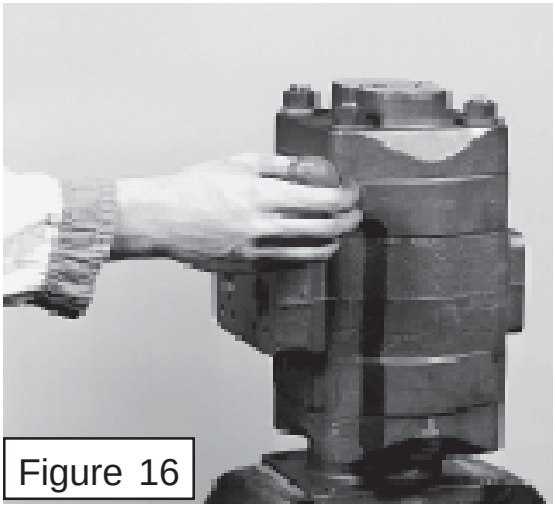


Figure 16

Motor Dis-Assembly:

1. Place the motor in a vise with the drive shaft pointing down. Caution DO NOT grip on or near any machined surfaces of motor during assembly or dis-assembly. Mark all sections of the motor (figure 13, 14 & 15) , these marks must be done in a manner that will not wash off . These marks are to identify the orientation of the component of the motor later for re-assembly. It is recommended that marks be done with metal stamps that will mark components for correct assembly order for & during re-assembly. This is very important as if any of the sections of motor are installed in the wrong direction it could damage motor when re-assembled or when motor is engaged during operation (figure 15). (Remove the four bolts that retain the manifold block to the top of the motor. There are O-rings under the manifold blocks, check to make certain all of these are removed and not stuck to one of the components. (figure 13 & 14)

2. Use a socket Wrench or Boxed end wrenches (Air impact wrenches are not recommended for dis-assembly). Remove the four hex bolts and washers (figure 16) , This will allow for the removal of the port end cover of the motor. Inspect the bolts for thread condition. If bad threads on bolts most likely the threads in that hole are bad, mark the hole so it can be check later.

3. Lift the first port end cover (figure 18), if prying is necessary, be careful not to damage the machined surfaces (figure 18) . Dowel pins (figure 19) will remain in either the port end cover or gear housing. This will be OK because the components must be re-assembled in the same direction and orientation as removed. If one or more of the components are to be replaced as parts then it may require that the dowel pins be removed (figure 19).

4. Remove the thrust plate (figure 19). Make a note how this was removed, there is a smooth side and there is a grooved side. The smooth side will always face the gears, the grooved side will be for the channel seal (figure 19). Inspect the thrust plate for damage or wear at this time (see wear tolerance chart for pump and motors in this section), this will help in looking for other wear or damage to other components and also enable you to start making a list of components that need replacing.

5. The channel seal will fit into a grove on the thrust plate, this groove is all the way around and on both sides of the shaft (Note a Pump channel seal in only on one side) (figure 20). The Thrust plate is flat on one side with two relief notches. The flat side of the thrust plate with the relief notches will always face the gears. The relief notches will be the same and can be installed with either notch to either port, check to make certain when these are removed that they were installed correctly.

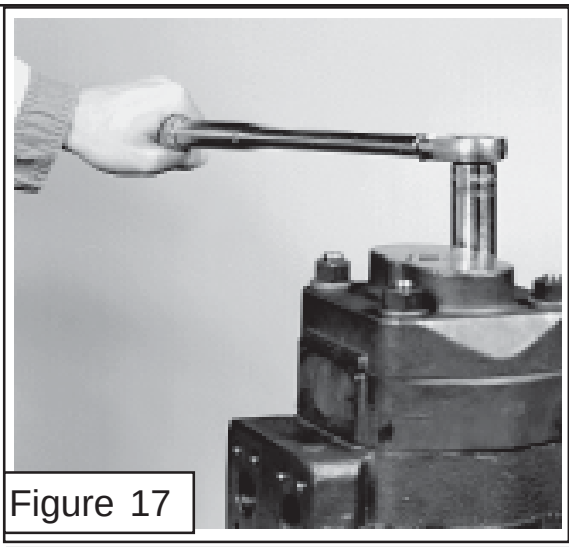


Figure 17

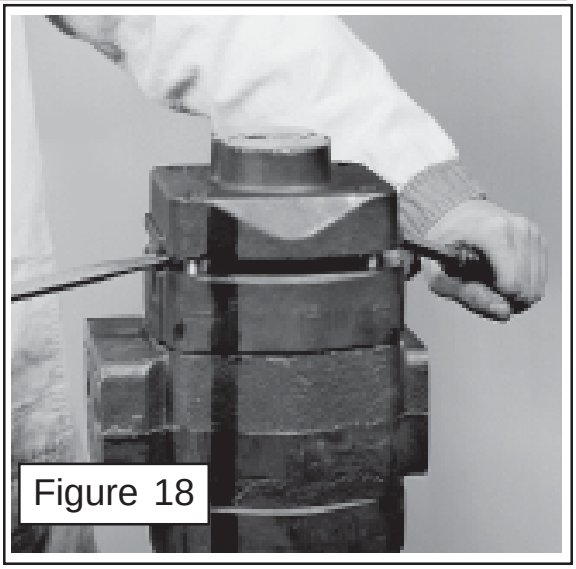


Figure 18

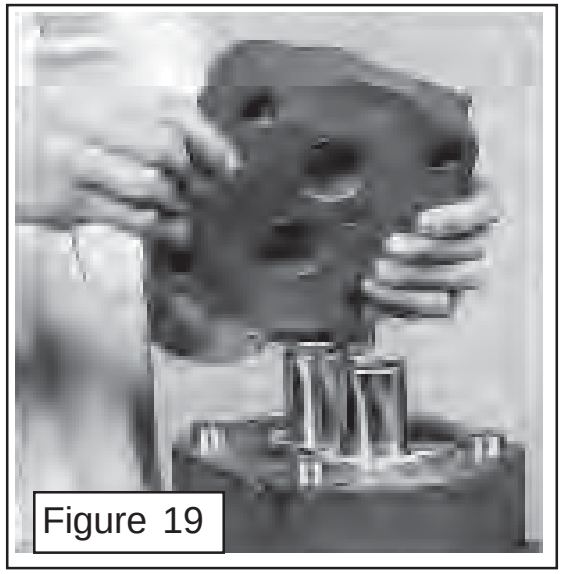


Figure 19

6. Inspect the thrust plate for damage or wear at this time (see wear tolerance chart for pump and motors in this section), this will help in looking for other wear or damage to other components and also enable you to start making a list of components that need replacing. (figure 25)

7. Carefully remove drive gear and driven gear (figure 21). Avoid tapping the gear teeth together or against other hardened surfaces (figure 21), Keep these gears together as they are a matched set. Examine the gears for wear and damage. Note the dowels (figure 21 & 22) that are in gear housing, sometimes these will come out and be in the end cover or they may stay in the gear housing. It will be OK as long as the same components are to be reassembled, but if some components are to be replaced and some are not then these dowel pins will have to be removed and re-inserted.

   IMPORTANT! If working on center, LH & RH motor at same time it is important not to mix the components of the motors. Keep the Gears separated between the motors as gears are matched sets. DO NOT mix used gears and new gears a motor.

8. Remove the second thrust plate (figure 21) , the 2nd thrust plate is at the bottom of gear housing and is visible after gears have been removed. Make a note how this was removed, there is a smooth side and there is a grooved side. The smooth side will always face the gears, the grooved side is for channel seals. Inspect the thrust plate for damage at this time (see wear tolerance chart for pump and motors in this section). Note: Thrust plate can be removed after gear housing if wanted. (figure 25).

9. Remove the gear housing (figure 22). Lift the gear housing up, if prying is necessary take care not to damage machined surface. Examine gear housing for wear and / or damage. (See wear tolerance chart for pump and motors in this section).

10. Remove shaft end cover (figure 23) from vice and turn it 180° over and re-insert it into vice. Using snap ring pliers remove the snap ring (figure 23) as shown.

11. Remove the seal retainer cup (figure 15) The seal retainer cup should pull up out of the end shaft cover. If it will not go on to step 12 and remove the retainer cup with the seal.

12. Remove shaft end cover (figure 10 item 4) from vice and turn it 180° over and re-insert it into vice. Remove the double lip seal by inserting the special seal removal tool (see figure 6 recommended tools). Make note of which way seal is removed. Inspect the shaft end cover seal seat area (figure 24).

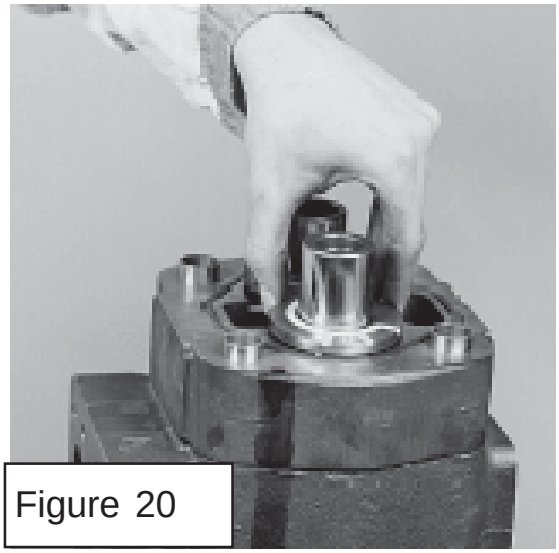


Figure 20

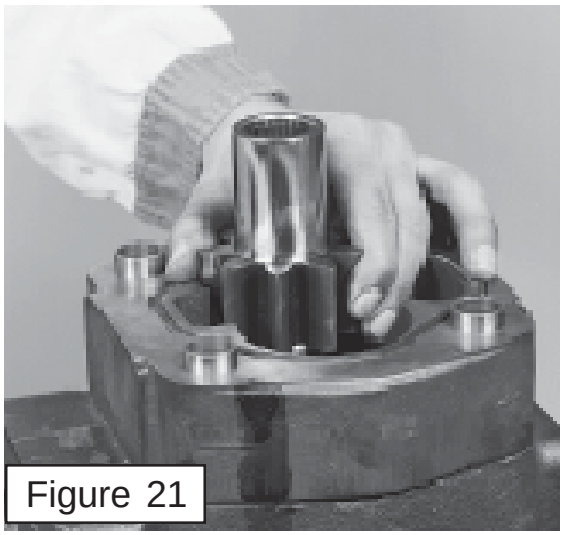


Figure 21

Figure 22

13. Inspect all the components that have been removed (review steps 1 through 12). There are 2 gasket seals (Square Seals) (figure 15) that are installed, one on each side of the gear housing. Make certain the gasket seal have been removed and the gasket grooves are clean. Wash and clean all the components, DO NOT use any material that will leave lint on components, it 's best to air dry the components. Use extreme caution when cleaning gear sets, DO NOT use any abrasive materials at all and DO NOT bang the gears together. Keep the gears in the same sets as they were remove as they are a matched set and must remain as a set. (See next two pages for wear identification).

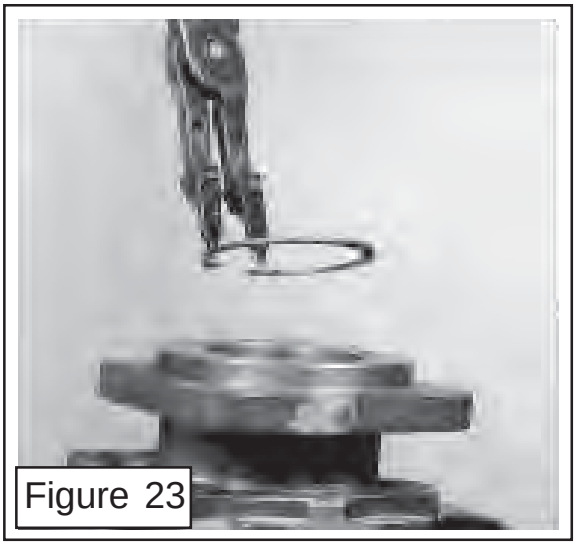


Figure 23

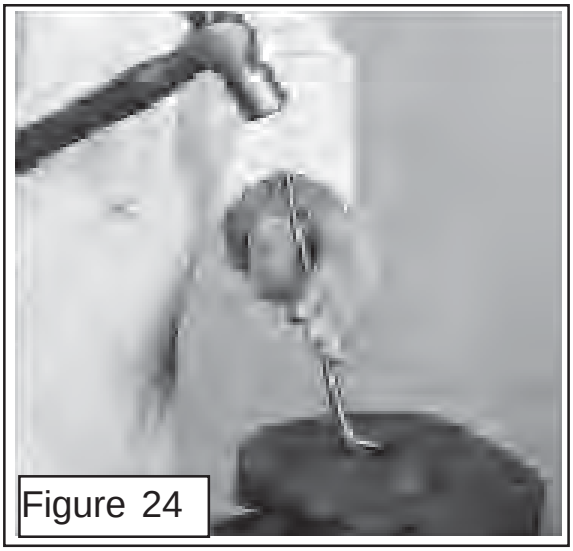
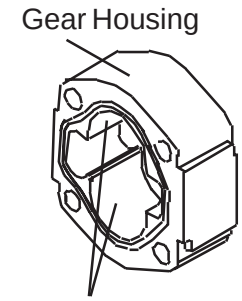


Figure 24

Wear Tolerance for Pump & Motor:

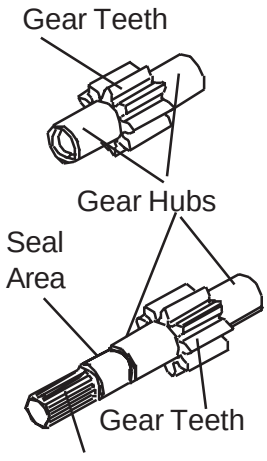
This is suggested Wear Tolerance to Keep Assemblies operating as efficient as possible, Not Complete failure rate. Your Pumps and/or motors may not be exact same as discussed here.



Gear Housing: Gear type Pump and Motor

Wear in excess of .007" cut-out necessitates replacement of the Gear Housing. Place a straight edge across the Bore in the cut out area. If you can slip a .007" feeler gage under the straight edge in the cutout area. Replace the Gear Housing.

Pressure pushes the Gears against the Housing on the Low-Pressure side. As the Hubs and Bushings wear, the cutout becomes more pronounced. Excessive cutout wear in short period of time indicates excessive pressure or Oil contamination. If the relief Valve Settings are within prescribed limits check for shock pressures or tampering. Withdraw Oil Samples and check it and tank for dirt. Where cut-out is moderate, 0.007" or less, gear housing is in good enough condition and may be reused, understand if you are at 0.007" you are at the upper limits and will not be at peak performance. A pump should always produce at least 85% efficiency (Example: if your Pump is rated at 37 GPM it should produce at least 32 GPM).



Gears:

Any scoring on Gear Hubs necessitates Replacement. Scoring, Grooving or Burring of Outside diameter of Teeth requires replacement. Nicking, Grooving or Fretting of Teeth surfaces also necessitates replacement.

Drive Shaft: (with Built on Gear)

If Gear Teeth and Gear Hubs are OK, Inspect Splines on input end (OD) of Shaft and the Splines (ID) Output) Coupler End (Tandem Pump) for condition and Wear.

Inspect Wear or damage to Seal Wear Area. If damage at Seal are check for contamination. Note: Some Pumps and/or Motors may have Keyway or Splines. Either will have to be inspected for condition. If Damage in any of these area the Shaft / Gear will have to be replaced.

Thrust Plate:

The Thrust Plate Seals the Gear Section at the sides of the Gears. Wear will allow internal slippage, which is Oil bypassing within the pump. The Pump and Motor Thrust Plates are different even though they may look very similar. They are built different. They will not interchange.

A Maximum of 0.002" wear is allowable. Replace Thrust Plates if they are scored, eroded or pitted. Wear can be checked usually by comparing thickness at outer edges with thickness at Gear contact area.

1. Check center of Thrust Plates where the Gears mesh. Erosion here indicates Oil contamination.
2. Pitted Thrust Plates indicate cavitation or Oil aeration.
3. Discolored Thrust Plates indicate overheating, probably insufficient Oil.

Thrust Plate CAUTION! : (Figure 25)

Important information - read before assembly:

1. Thrust Plates must not have , scratches or excessive worn places on either side of plate.
2. Thrust plates must be installed correctly, The thrust plate has two surfaces, one surface has a groove for channel seals and the other surface is smooth with two relief grooves (notch) in it.
3. Thrust plate smooth surface with relief notches will always face the gears, the groove side for the channel seal side (smooth with groove side will always face the gear bearing journal bushings never the gears as the gear would destroy the channel seal.
4. The relief grooves will face the both sides of the gear housing on the motor as both relief grooves are the same and will not make any difference which goes to which side.
5. Thrust plates are very important to the way they are installed. If they are installed wrong, the pump will not function properly and other components could be damaged if operated with them wrong.

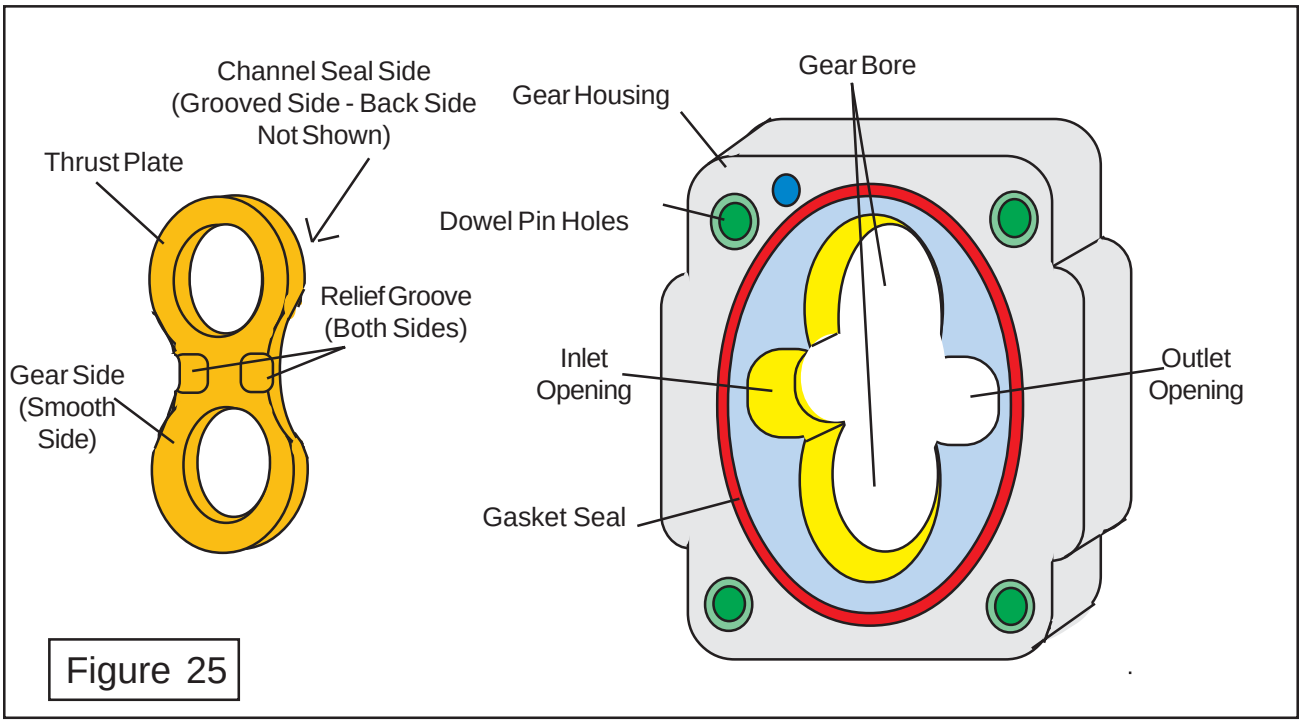


Figure 25

Pump Assembly CAUTION! :

Important information - read before assembly:

1. All sections have been cleaned and inspected, take extreme care not to allow the marring or damage to machined surfaces to occur. Make certain all components are laid out so as not to damage the machined surfaces.
2. Make certain any replacement parts have been compared to the old parts to make certain they are correct.
3. Gears are closely matched, there fore they must be kept together as sets when removed from the pump. Handle gears with care to avoid damage to journals or teeth. Avoid touching gear journals. DO NOT mix new and old gears when reassembling pump.
4. Never hammer bushing into bores: always use an arbor press, Hammering will damage bushings and possibly the bores in the housing.
5. (NOTE illustrations shown here are for a single pump, the tandem pump is longer with more sections, the disassembly will be basically the same with the exception tandem pump has two pump section instead of one. See figure 9 & 10 for reference to components).

Motor Assembly:

1. Check all the machined surfaces on all Motor components to make certain they are level and free of scratches. Minor scratches and slight un-level conditions may be fixed by using a Medium Grit Carborundurn Stone. This must be done equal all the way across the face of the machine surface to keep it level (figure 26). ALL part must be cleaned and dried if stone is used it. If deep scratches or excessively un-level the section needs to be replaced, make certain this is checked before continuing installation of other components. Replace the parts with machined surfaces if required. Check components for wear or damage now before continuing.

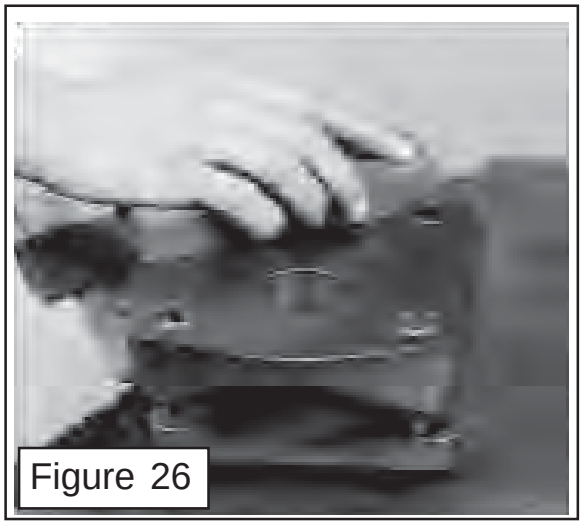


Figure 26

2. Insert the shaft end cover in the vise with the machined surface up (figure 27).

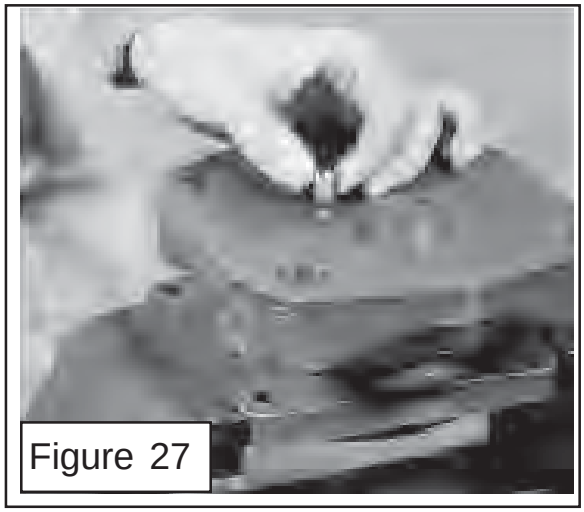


Figure 27

3. If the bushings (figure 28) are to be replaced with new ones. After the old ones have been removed, Inspect the holes where the new bushing will be pressed in. If there are burrs or rough edges at the tops of the holes they can be de-burred by using your finger and emory cloth. Keep the emory cloth on an angle and only around the top of the bore (figure 28). Do this to each hole for the bushing that are to be replaced. IMPORTANT ! Bushing must be pressed in with an arbor press DO NOT drive them in with a hammer.

4. Note: Steps 5, 6, 7 & 8 apply to Shaft End Cover and Port End Cover (figure 15) Any bushing removed from the shaft end cover, port end cover or bearing end cover should be assembled in the drive bores with the grooves to the top of unit (12 O'clock). Assemble the bushings in the driven bores with the groove to the bottom of the unit (6 O'clock). The Grooves refer to the bearing seam (figure 29).

5. Bushings should be pressed into the bores one at a time, Use the special installation tool (figure 5 Tools recco-mmended list) and an arbor pres. Be sure that the groove (or seam) are positioned as stated in step 5 previously. Be sure to support casting so they are square and level to the arbor press and the bushings are straight before attempting to press them in. The bushing must be pressed into the bores flush with the casting face (figure 30).


Figure 28

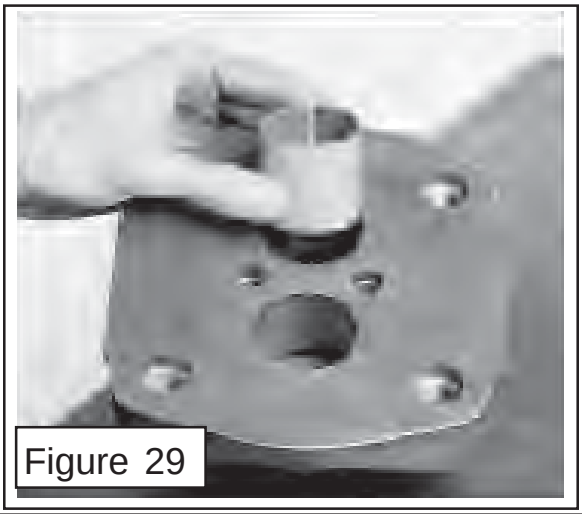


Figure 29

6. Just as earlier if the stone is used parts it is used on MUST be washed and dried. Make certain bushings are flush with castings and there are NO burrs on the top ID of bushings. (figure 31). Bushing must not be higher than face of casting, Motor will not bolt together correctly if it does.

7. Check to make certain that the dowel pins are in place in any new castings and that the location corresponds with the mating casting. Before inserting any dowel pins check to make certain holes are clean, the top of the holes do not have burrs. To insert dowels hold the dowel in alignment with the hole. Gently start the pin into the hole straight, tap lightly with a soft hammer until dowel is seated into hole. (figure 32). Note as shown, dowel pins have holes in the center, this is for the retaining bolts to go through.

8. Remove the shaft end cover from the vice and turn it over 180° and re-insert it into the vise with the splined side up (figure 34). Before inserting the new lip seal into the shaft end cover. Coat the outer edge of the lip seal with Permatex Aviation Form-A- Gasket™ No. 3 non-hardening sealant or equivalent (figure 33). With the metal side of the seal up, press it into the mounting flange side of the shaft end cover with an arbor press and bar (see recommended tools list). Be careful not to damage the lip seal. Press the lip seal in until flush with the recess, wipe off excess sealant.

9. Install the Seal Retaining Cup (figure 15), guide the Seal Retaining Cup into the recess in the shaft end cover. This is a light press fit and can be pressed in with the arbor press or it can be lightly tapped into the bore. DO NOT use excessive force to insert retaining cup, if it will not go with light force check for size error or other reason. Forcing an over size bearing in will damage bearing and casting (figure 15 & 44).

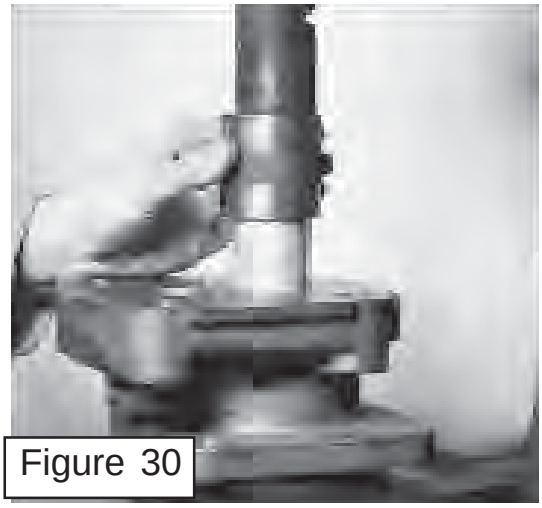


Figure 30

Figure 31

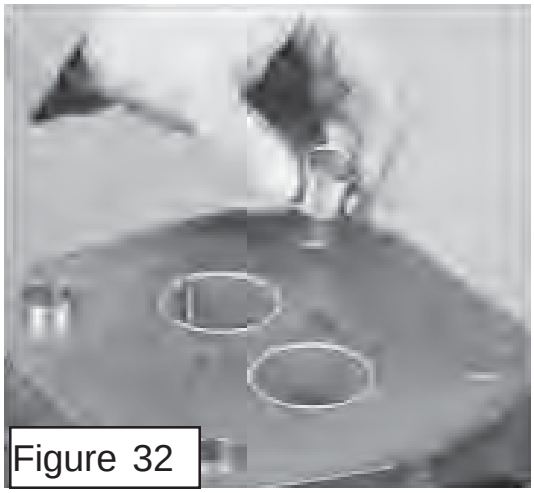


Figure 32

Figure 33

10. Using the snap ring pliers as shown. Install the snap ring into the flange side of the shaft end cover (figure 35). Lightly tap the snap ring with a small punch and hammer to make certain it is seated into the snap ring groove of the shaft end cover.

11 Remove the shaft end cover (figure 36) from the vice and turn it over 180° and re-insert it into the vise with the splined side down and re-insert it into the vise. **Grease the new Gasket Seals (figure 15) and insert it in both sides of all gear housing. Position the gear housing (figure 36) onto the shaft end housing (figure 35) aligning it with the holes for the dowel pins. Tap it with a soft hammer until it rest tightly against the shaft end cover. Be careful not to pinch the seal gasket (figure 36).**


Figure 34

12. Assemble the channel seals (figure 37 & 38) into the grooves in the thrust plates, with the flat side of the seal facing away from the thrust plates as shown (figure 37 & 38). IMPORTANT NOTE: Channel seals will always be on side of thrust plate away from gears, only the smooth side of thrust plates are against gears. The channel Seals will be all around gear shaft journal opening on motors.

13. Gently slip the thrust plate (figure 39) into the gear housing and into place on the shaft end cover (figure 39). The channel seal from step 13 should face the shaft end cover. The relief grooves in the thrust plate should face the outlet gears figure 39).

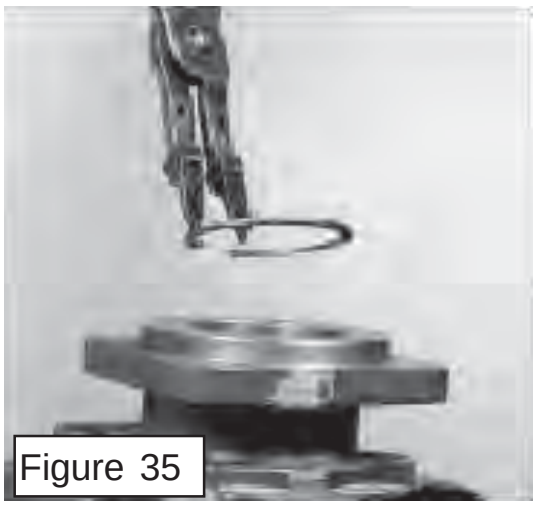


Figure 35

14. Coat the driven gear journal with light coat of oil, Slide the driven gear (figure 40) through the housing and into the bushing in the shaft end cover (figure 40) Coat the drive gear splined shaft end with light coat of grease, insert shaft into the special steel sleeve (figure 7 recommended tools list). Lightly seal. Remove steel sleeve, squirt clean oil over gears (figure 40). Note purpose of sleeve is to prevent splines on the shaft from damaging double lip seal. Coat the steel sleeve with grease. Place the lightly greased drive gear shaft inside the sleeve and slide both through shaft end cover with a twisting motion until the integral gear rest against thrust plate. Avoid damaging double lip seal. Remove steel sleeve, squirt clean oil over gears (figure 40). Note purpose of sleeve is to prevent splines on the shaft from damaging double lip seal.

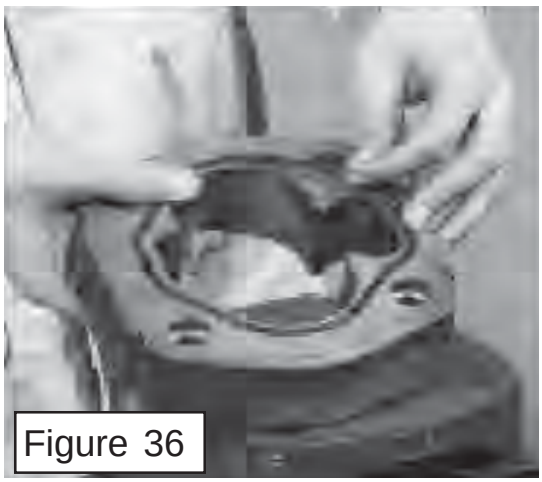


Figure 36

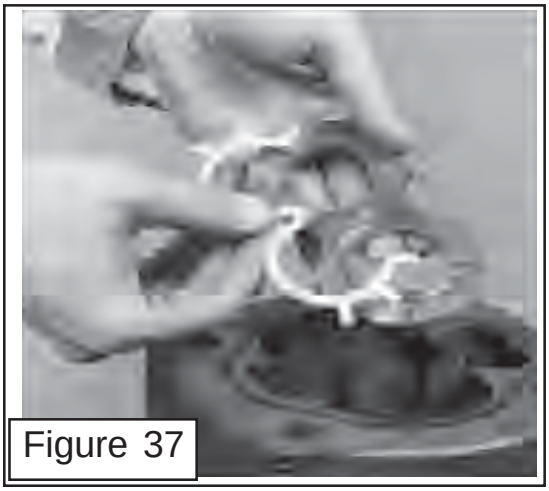


Figure 37

15. Slip the second thrust plate with the channel seal installed (figure 41) over the gear journals and into the down over the gear shaft journals (figure 41). The flat side of the seal should face down with the relief groove of thrust plate facing the gears. Check the gear housing gasket seal (figure 15) is still in place on gear housing (figure 36).

16. Lightly coat the gear journals with grease. When placing the Port end housing (figure 42) over gears, use caution so you don't hit and damage gear shaft journals. Place the bearing carrier onto gear shaft journals of the drive and the driven gears. Be sure to align the dowel pin holes over with dowel pins. When the parts are parallel squeeze them together or alternately tap over each dowel until the parts are together. DO NOT use excessive force to put housing together, if light taping won't do it something is wrong (figure 42). MAKING CERTAIN the marks made to keep the components in the same orientation when re-assembled are aligned (figure 13 & 14).

17. Thread the bolts & lockwashers in through shaft end cover of gear housing until threads are started into bearing housing. Alternately tighten the bolts in increments that will make the three components pull down evenly (figure 42 & 43). Torque the bolts in increments until the bolts (qty 4) are torqued to 200 ft. lbs.

18 Install the manifold block to top of the motor. The manifold block on the LH and RH wing are the same and will mount with the return line toward the front of the mower. The manifold block for the center motor will only work with the center motor and is installed with the relief cartridge toward the front on the LH side. The Wing motors use two large O-Rings and one small O-Ring on each manifold, The center motor uses two large O-Rings to install manifold block. When tightening the four retaining bolts, they MUST be tightened evenly in increments so block remains un-distorted. DO NOT over tighten any one bolt it will distort aluminum manifold block. Torque the 5/16" Gr 5 bolts to 16 to 20 ft. lbs. (figure 45. 46 & 47).

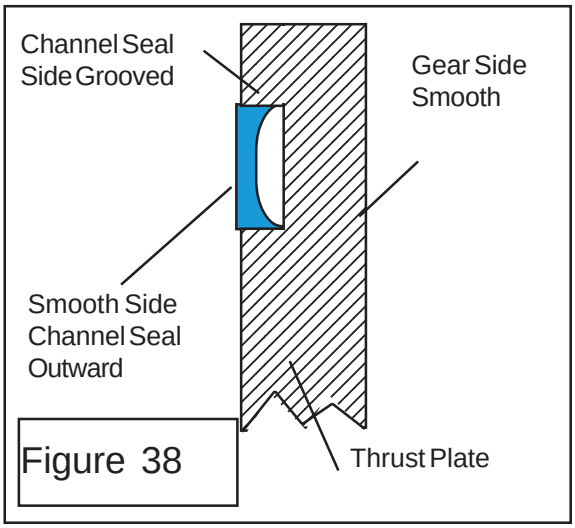


Figure 38

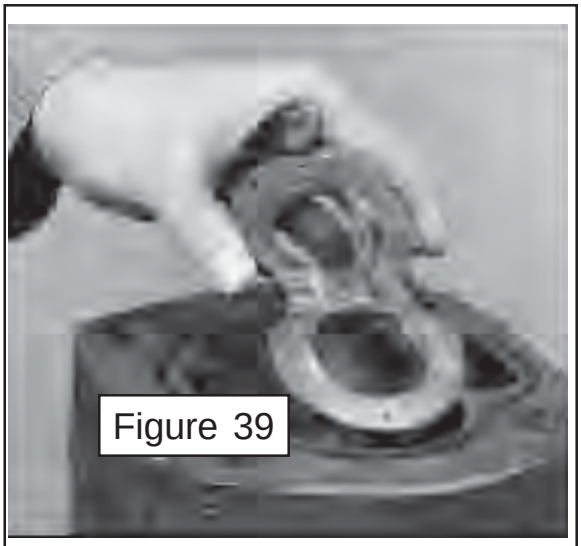


Figure 39

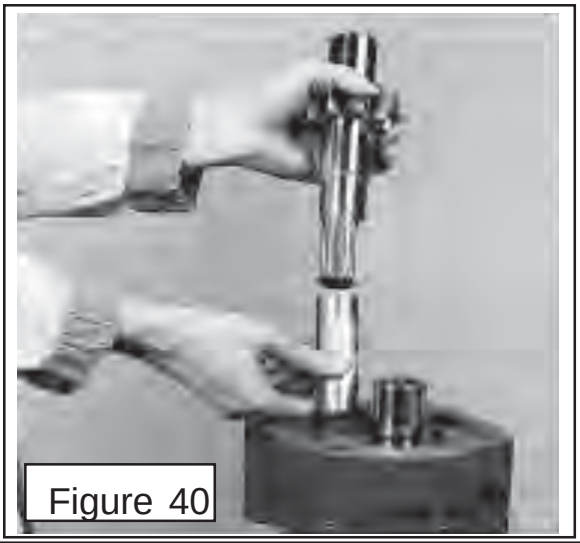


Figure 40

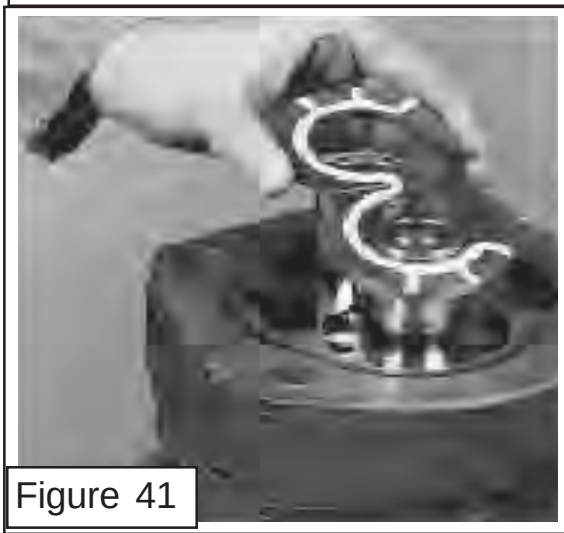


Figure 41

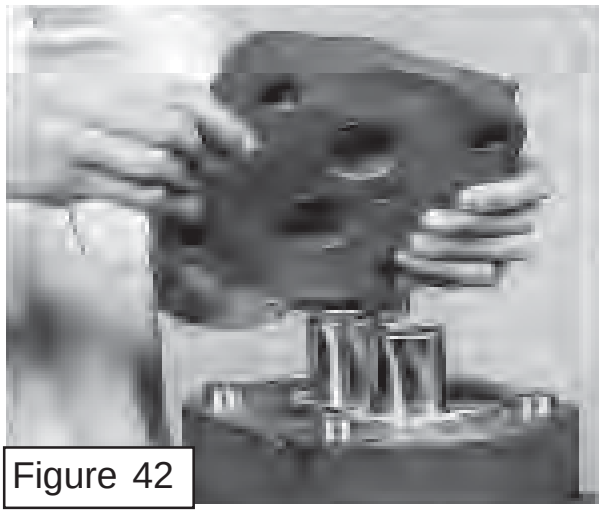


Figure 42

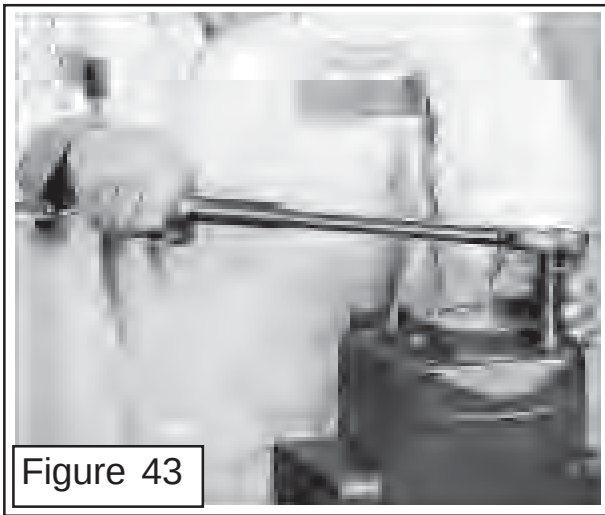


Figure 43

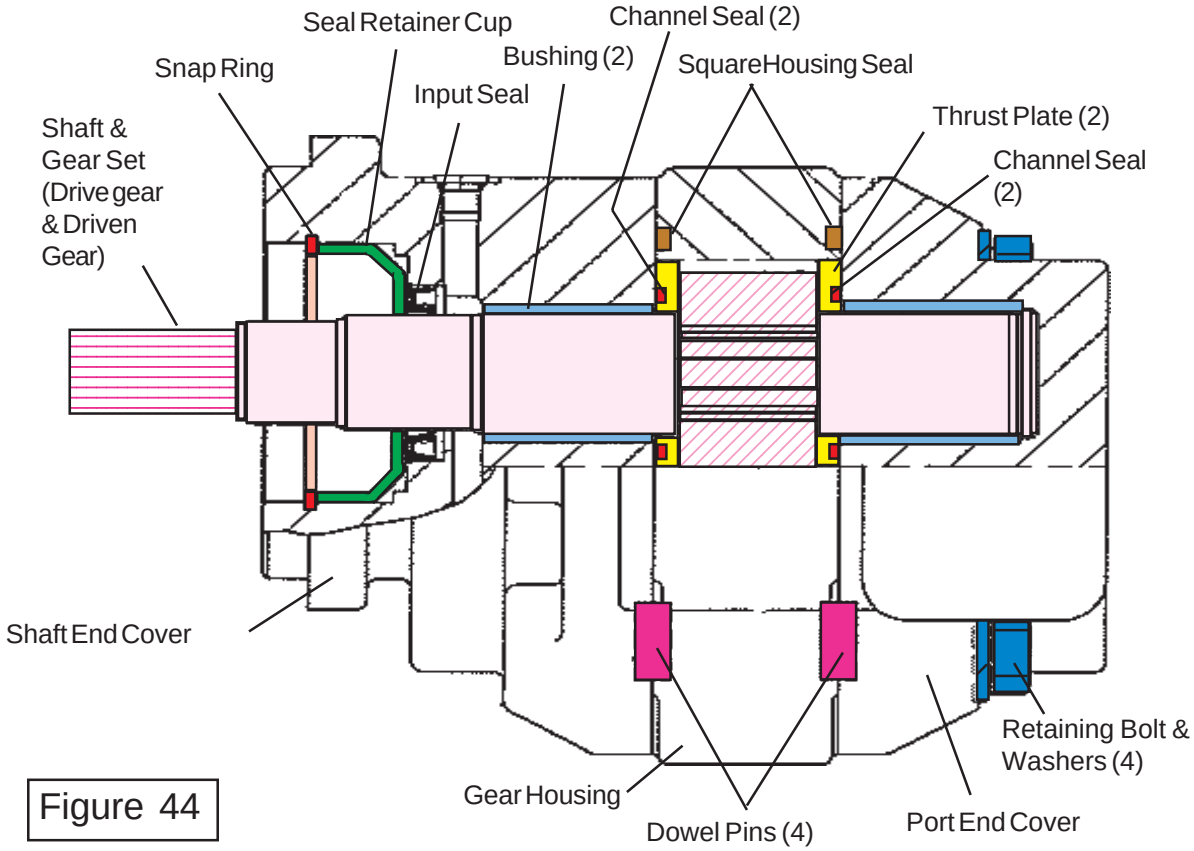


Figure 44

18 Review all assembly steps to make certain the assembly is correct. Wipe and clean any grease that may be on the outside of motors. Review the illustration to determine the motors were assembled correctly. Fill motors with clean oil through the pressure ports, this will assist motor during first start up. IF PUMP was replaced see start up procedure in pump repair section. If only the motor is being replaced make certain not to start system if oil is warm and motor is cold. If motor is cold and oil is warm start and stop system until motor and oil is temperature is equaled. Warm oil and cold motor could damage motor.

19. Mount Motor onto Spindle. The motor bolts to the spindle with 1/2" grade 8 bolts. Install a new gasket between motor and spindle. Torque the 1/2" bolts to mount motor to spindle to 95 ft. lbs.

20. Mount Spindle to deck use 3/4" bolts with lock nuts. Torque the 3/4" bolts to 350 ft. lbs.

IMPORTANT!

See Step 18 for proper installation of motor manifold blocks, it is critical that these be installed correctly and properly torqued to prevent leakage or distortion (figures 45, 46 & 47).

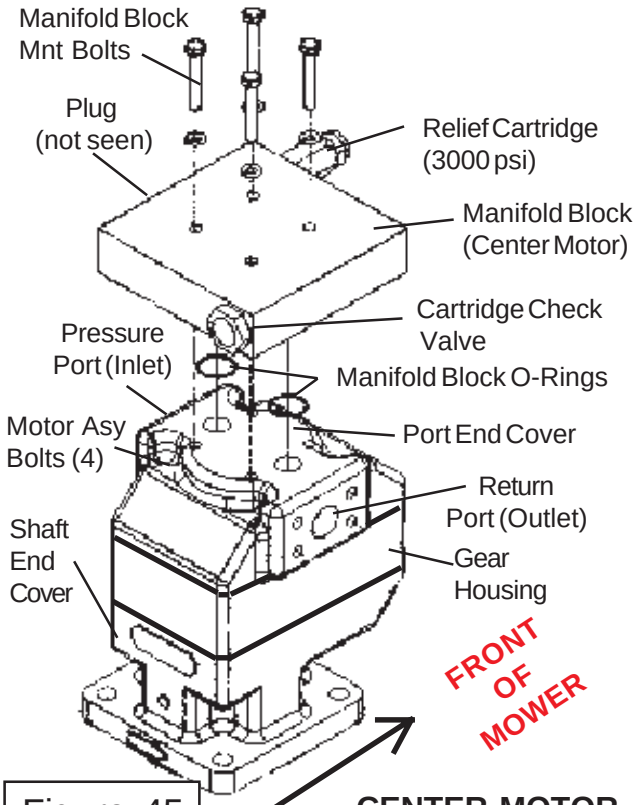


Figure 45 — CENTER MOTOR

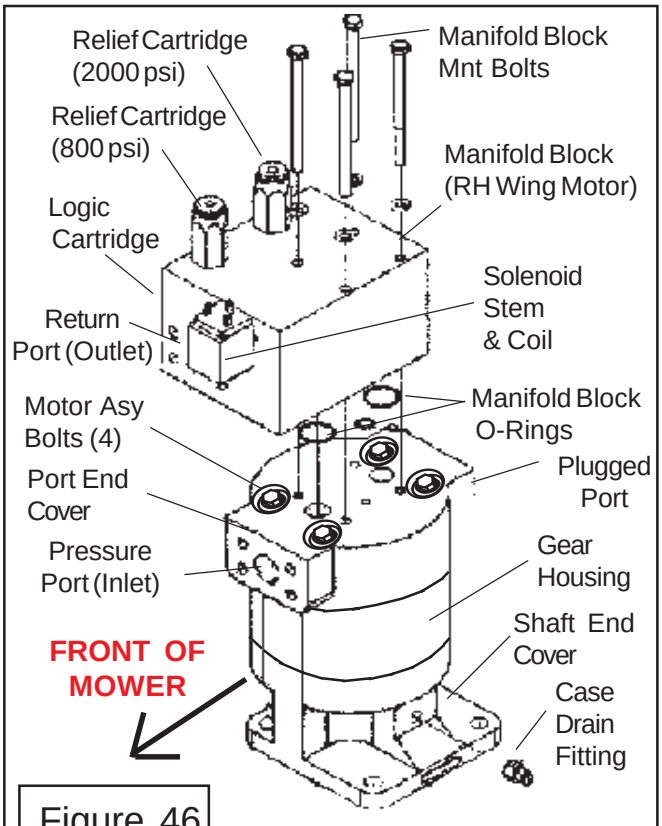


Figure 46 — RH WING MOTOR

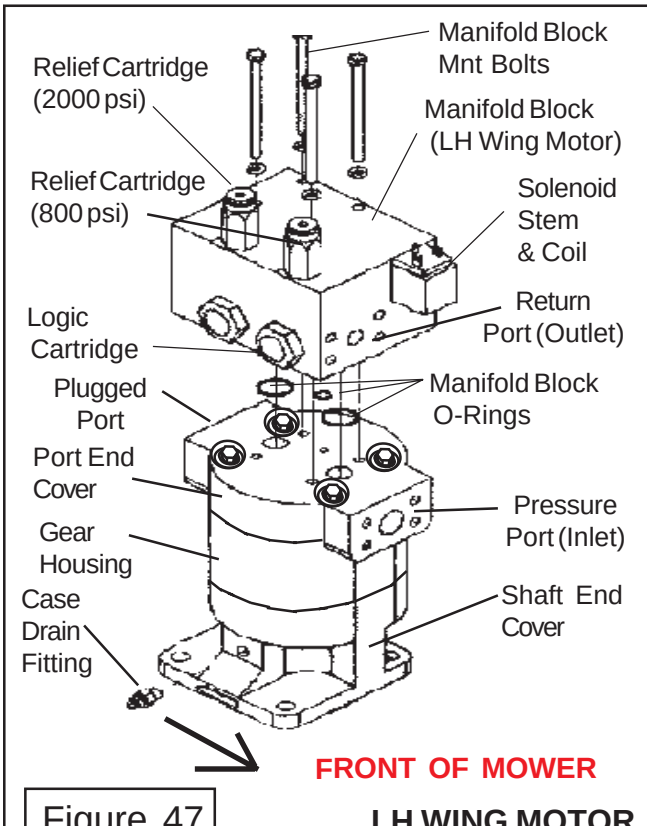


Figure 47 — LH WING MOTOR

Recommended Start-Up Procedure For New Or Rebuilt Pump & Motor: (Important Steps 26 through 30)

1. Before installing a new or rebuilt pump or motor, back off the main relief valves until the spring tension on the adjusting screw is relieved (See Specification section for relief valve settings). This will avoid the possibility of immediate damage to the replacement pump in the event the relief valve has been set to high.

2. Before connecting any lines (hoses) to the pump fill all the ports with clean oil to provide initial lubrication on start up, fill the suction hoses with oil. This is particularly important if the pump is located above the reservoir. Use thread sealant on all fittings and hose threads. DO NOT USE TEFLON TAPE.

3. Make certain the oil reservoir is full of clean oil. Test oil before running a replacement pump. Contaminated oil will damage a replacement pump even oil ran a minute or so. Review the type of failure that had occurred and investigate any damage that may have been caused due to that failure. DO NOT run the replacement pump if the cause of the failure has not been corrected. Any oil added to or to fill reservoir must be ran through a 100 micron screen before going into tank. See the tank fill section for available equipment for this purpose. Never run hot oil through a cold pump or motor, the hot oil will cause damage to the cold components. Gradually warm components by turning pump on then off, on then of until temperature is equalized.

4. After connecting the lines (hoses) and mounting the replacement pump, operate the pump at least two minutes at no load and at low RPM (400 rpm). During this break-in period, the mower should run free (no load) and not develope an excessive amount of heat. If the unit operates properly, speed and pressure can then be increased to normal operating settings (See Specification Section).

5. Reset the main relief if needed to its proper setting while the pump is running at maximum operating engine (motor) speed for the PTO rating. (See Specification Section)

Wing Motor Electric Switches:

1 Wing Motors are equipped with electrical solenoids located it the motor manifold blocks, these are designed to function with magnetic switched on brackets that are connected to the wing lift cylinders. The wings are designed through these solenoid switches to turn the motors off when the wing is raised to a set angle. The motors are also equipped with hydraulic brakes that are designed to speed the time it takes to stop the motor, these also work through the motor manifold block. (figure 48 LH Wing Shown)

2. The Center Section Motor is controlled by engaging or dis-engaging the tractor PTO.

3. Any time motors are being started the tractor RPM should be reduced during start-up of motors.

4. Cylinder Switch Brackets bolt to cylinder with a U-Bolt and the cylinder mounting bolts (figure 49 RH Wing Shown). The switches and magnetic pickups will bolt to the cylinder bracket. The Switch will have two wires a white wire and a black wire. The wires will have a female spade connector on the black wire which will connect to the black/white wire on the wire harness (figure 50). The switch white wire will have a male spade connector which will connect to the white wire of the wire harness (figure 50).

5. The leads to the tractor are to be connected with the positive 12 volt negative ground source that is only activated when the tractors ignition key is on. If it is connected to a constant power source it will run the

Continued Next Page

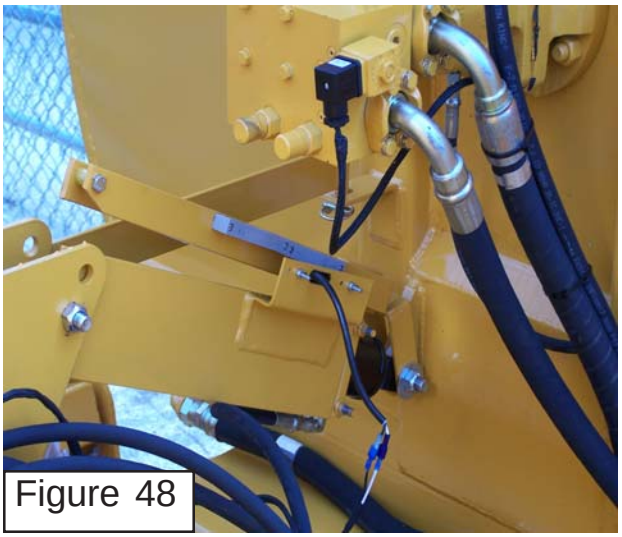


Figure 48

Continued from Previous Page

battery down when tractor is parked and not running. When running wire harness to tractor tie the harness away form any object that might catch it and also leave enough slack that when turning the wire harness it not to short and pulls apart. This will be service technicians choice and responsibility as most trac tors are different in design. There are spacers that are used with the magnetic pickups (figure 48, 49 & 50)

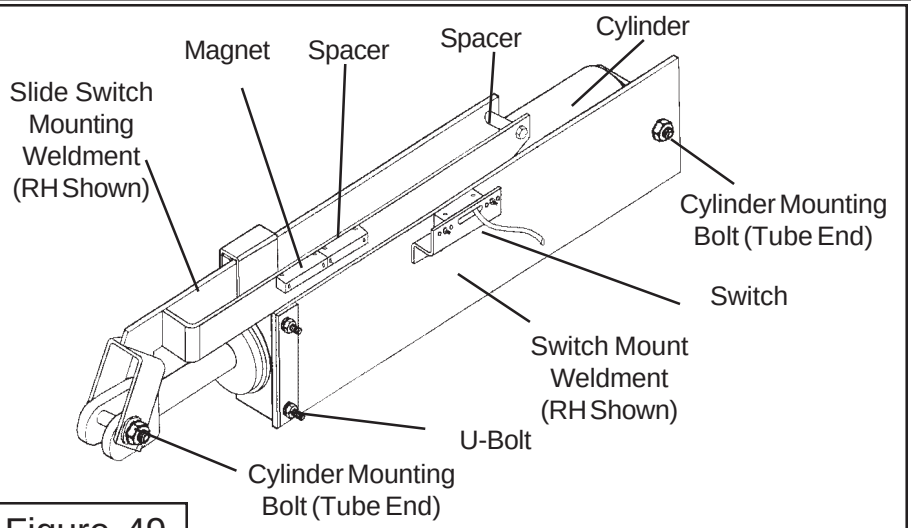


Figure 49

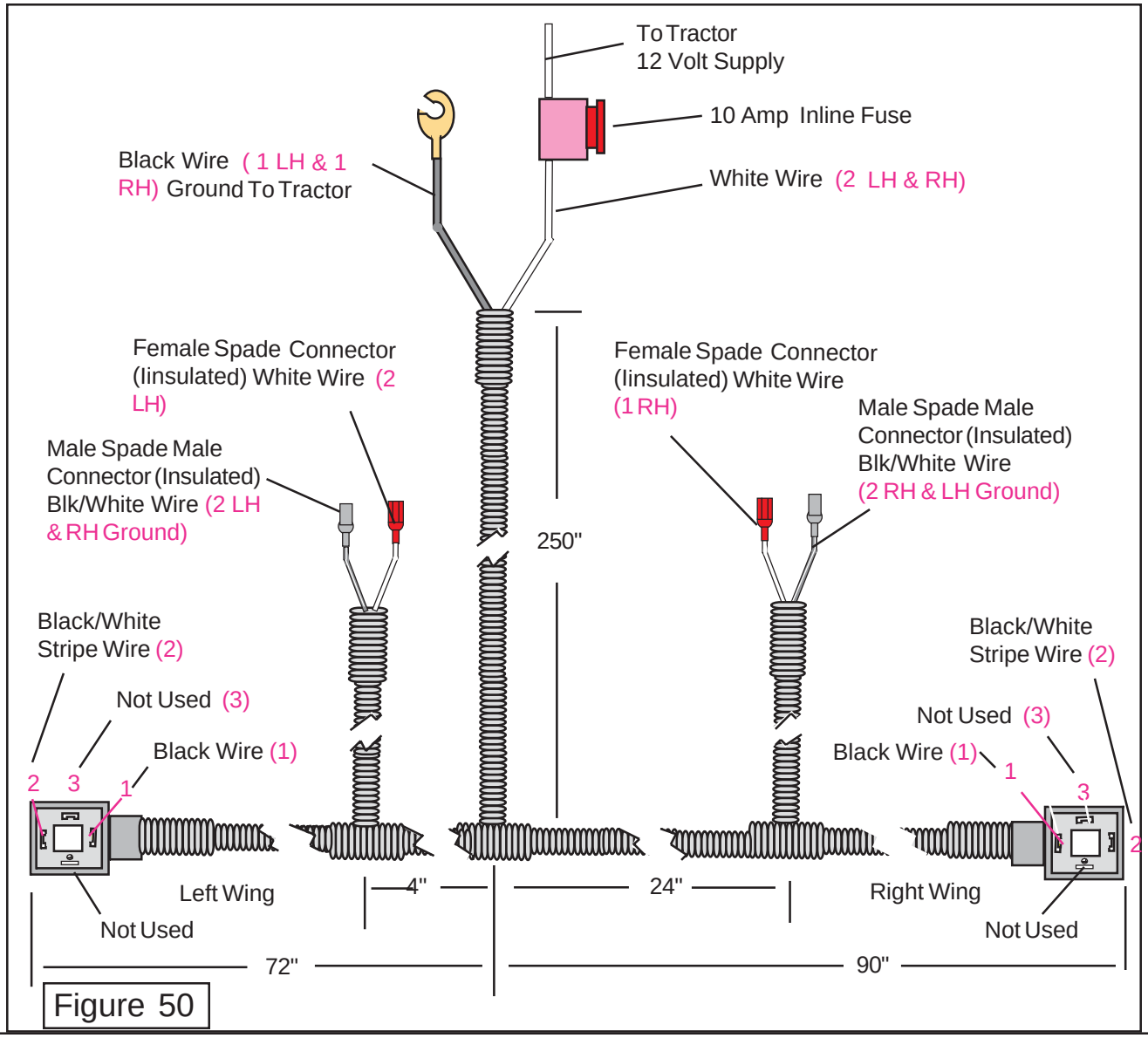


Figure 50

NOTES

Section 4

HYDRO 15

Spindle Asy Service & Repair

SPINDLE ASSEMBLY - SERVICE & REPAIR

Item	Qty	Description
1	1	Housing
2	1	Spindle
3	1	Bearing Ring
4	1	Lower Seal Seal
5	1	Snap Ring
6	1	Lower Bearing, Cup and Cone
7	1	Upper Bearing, Cup and Cone
8	1	Stake Nut
9	1	Plug, Pressure Relief Fitting
10	1	Grease Fitting Plug
11	6	Locknut (mount Spindle to Deck)
12	6	Bolt (mount Spindle to Deck)
13	6	Washer (mount Spindle to Deck)
14	--	Grease NLGI EP # 2

Fill with NLGI EP # 2 Lithium Based Grease, Alamo Industrial P/N 00900000 Fill until Grease is forced out of top bearing (while on work bench after re-assembly)

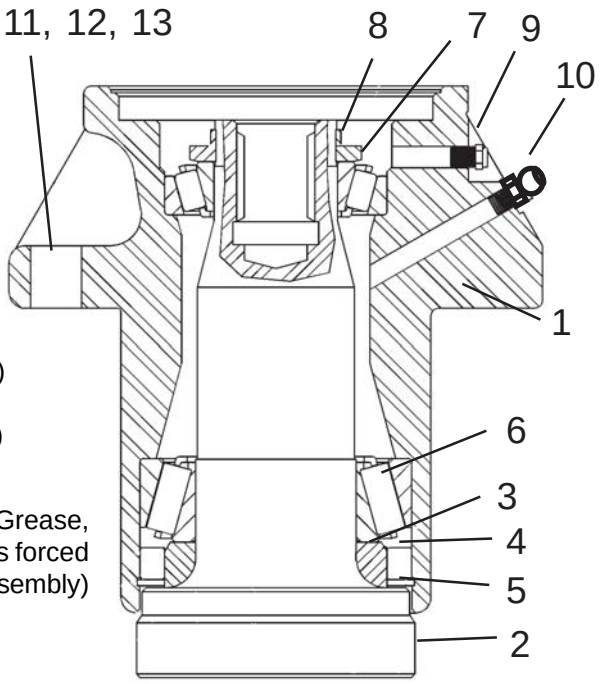


Figure 1

Spindle Housing: Spindle asy should be removed from deck when making repairs or rebuilding .

1. Clean the deck, motor and spindle area of debris before beginning any dis-assembly. When removing the spindles it WILL NOT require the removal or dis-connecting of any hydraulic lines (hoses).
2. Remove the Blade Bar or Pan Assembly (figure 2). Use caution, make certain blade carrier is supported before removing the 4 socket head bolts in the center of the blade carrier. It is recommended a hoist with sufficient rating for weight be used to hold blade carriers for wing. Center section blade carrier should be supported by jackstands (at least 3 jackstands) while being unbolted and lowered with a jack that has a large top surface area. CAUTION: Measure the length of the socket head bolts that mount the blade carrier to the spindle shaft. Make certain not to use bolts that are longer that what was removed. DO NOT screw the bolts into shaft while the spindle assembly is completely assembled. If longer bolts or the ones that came out are screwed in to far the spindle shaft, bearing ring, bearings or other components can be damaged.
3. Unbolt the hydraulic motor (figure 3). Hoses & Motor can be left connected to motor. Remove the bolts attaching the motor to spindle. Lift motor up and off of spindle. Motor can be left sitting on deck with hydraulic lines attached but make certain not to sit motor in debris that may be on deck, keep the motor shaft clean..

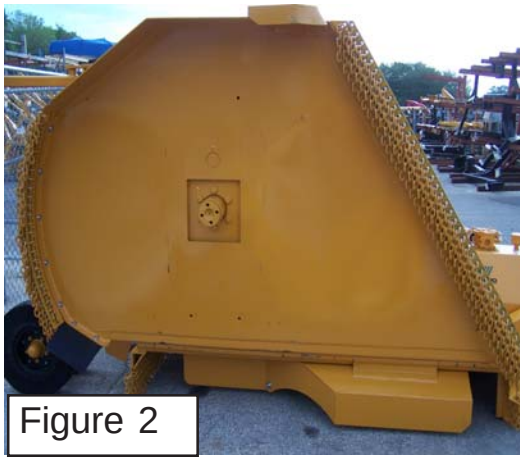


Figure 2

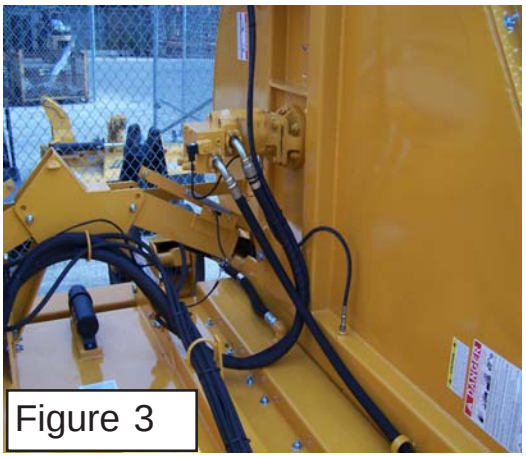


Figure 3

4. Remove the spindle assembly from the Mower Deck, unbolt and remove the six spindle retaining bolts that mount the spindle to deck. The spindle will pull up and away from deck.

Spindle Housing Dis-Assembly:

1. NOTE: For illustrations only the spindle shown was not filled with grease. If you are working on a spindle remove from the mower most likly the spindle has been filled with grease, the grease cannot be cleaned out until after dis-asy. it may require you to wipe grease out of the way to see components
2. Inspect the housing for cracks or other damage, which would deem it unusable. (figure 4)
3. Place a 3/16" angled chisel, parallel with and into one of the staking slots in the threaded section of the shaft. Using a hammer, drive the chisel downward until the bent part of the staking flange on the adjusting nut is bent outward and is free of the slot and threads of the shaft. This procedure is done in two places on the shaft. A new nut will be required for reassemble. (figure 5).
4. If the Spindle is equipped with a tabbed locking washer, use a chisel to bend the locking tang until it is free from the slot in the nut.
5. Use a four pronged socket or a suitable punch and hammer to remove the shaft nut. (figure 6)
6. Insert the original blade bar or pan bolts into the threaded spindle shaft. Turn bolts until they contact the bearing ring. Rotate each bolt in a clockwise pattern 1/4 turn at a time for 2&1/2 revolutions (figure 7).
7. Remove the original bolts and replace them with 4 shanked bolts. In a clockwise pattern, rotate each bolt 1/4 turn at a time until the spindle shaft is free from the housing (figure 8). In some cases it may be necessary to use a drift punch and hammer to fully dislodge the shaft. Care should be taken to avoid damage to the shaft or housing. (figure 9).

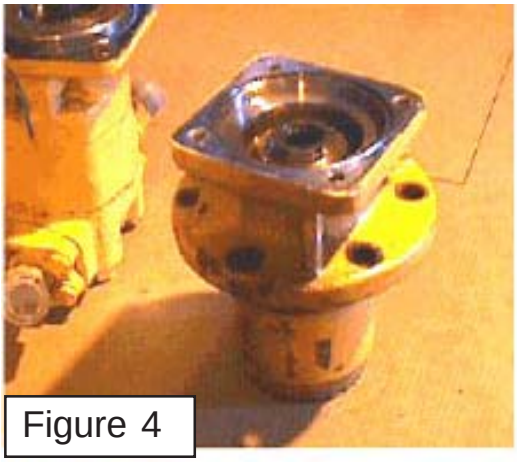


Figure 4

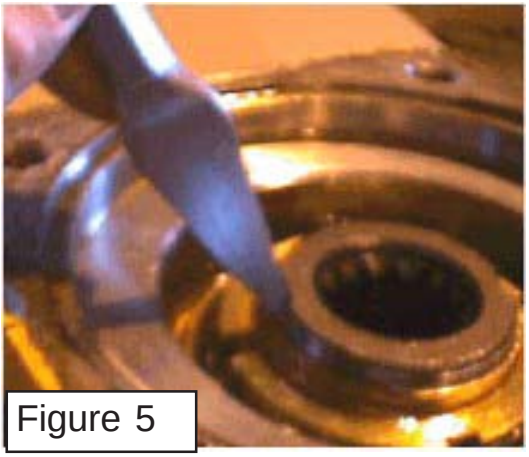
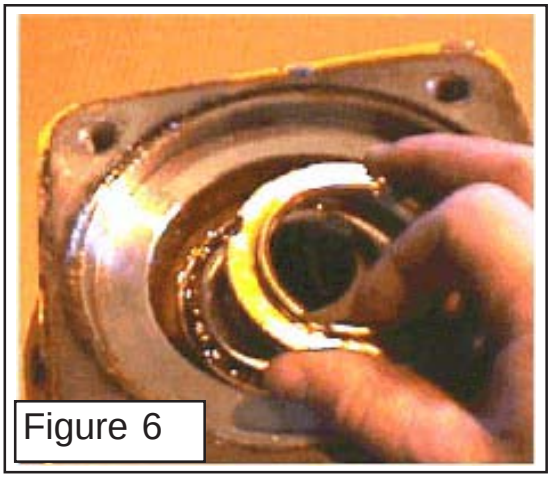


Figure 5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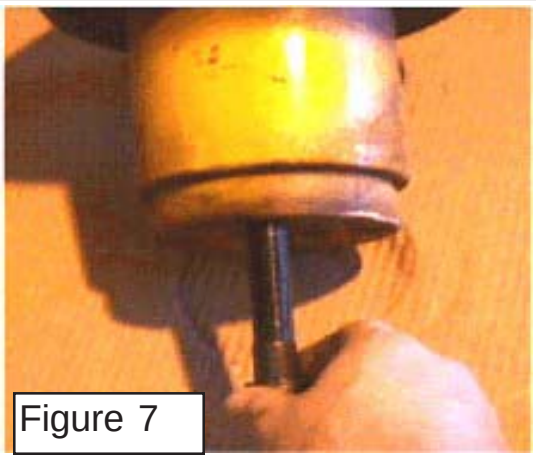
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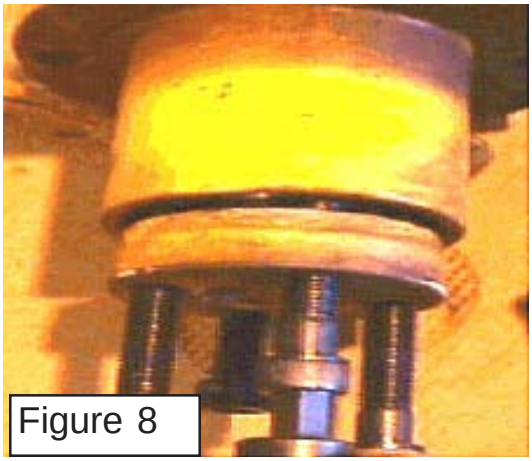
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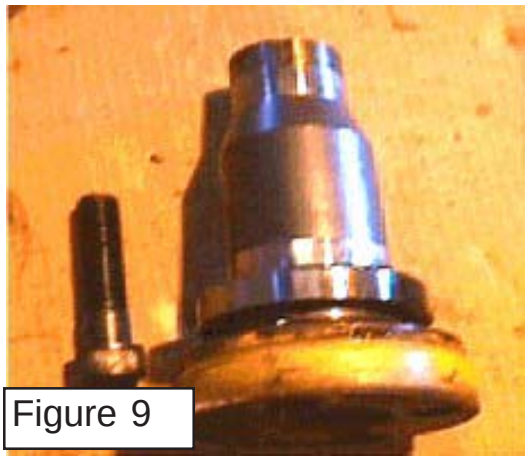


Figure 9

8. Place the housing in a suitable vise with the motor flange facing down as shown. (figure 10). Use a flat blade screwdriver to remove the seal retaining ring. (figure 11).

9. Pry out the lower seal. **BE CAREFUL NOT TO DAMAGE THE SPINDLE HOUSING.** A new seal is required for rebuild of the spindle. (figure 12). Remove the bearing and check it for damage or excessive wear (figure 13).

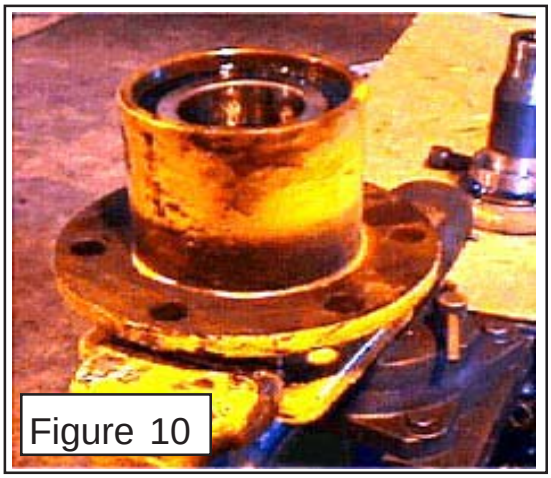


Figure 10

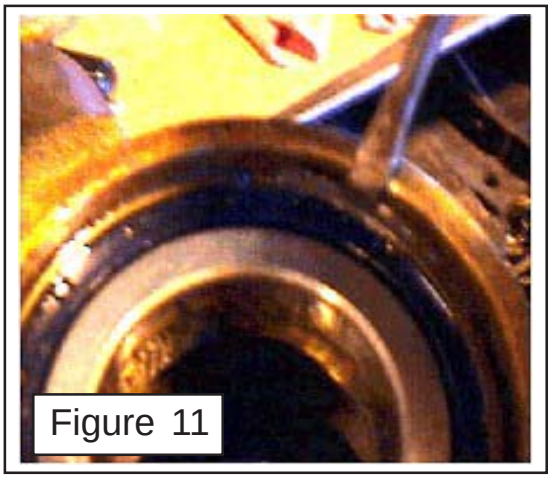


Figure 11

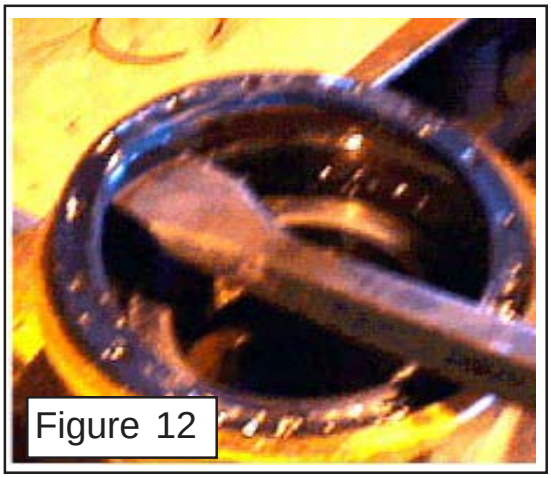


Figure 12

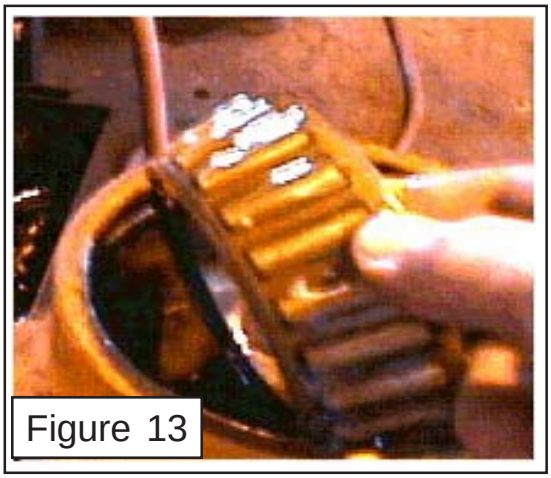


Figure 13

10. Use a suitable drift punch to remove the bearing races. **BE CAREFUL NOT TO DAMAGE THE SPINDLE HOUSING. (figure 14),** Remove and inspect the vent and filler plugs and passageways. Be sure the vent is free from clogs due to debris or paint. Always install the vent plug above the filler plug (figure 15).

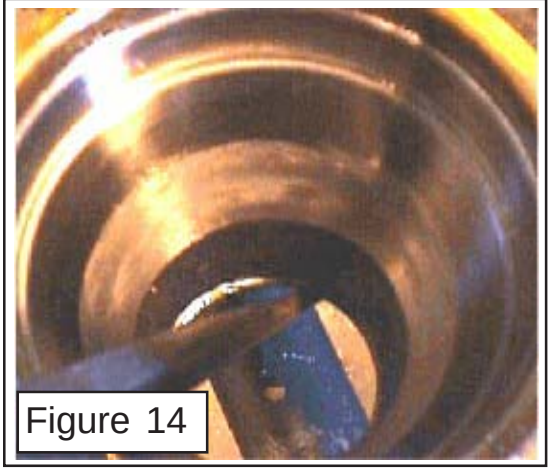


Figure 14

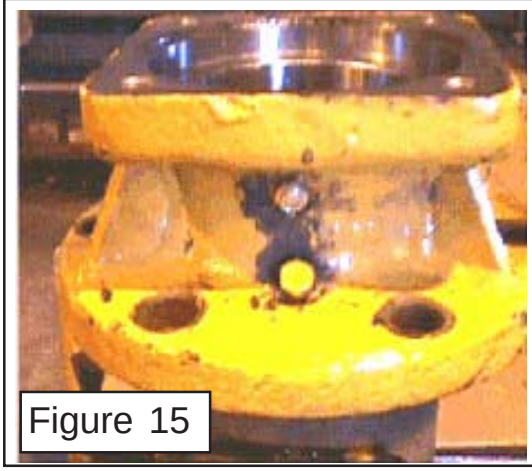


Figure 15

SPINDLE HOUSING INSPECTION:

1. Inspect the bearings and bearing cups for nicks, pitting, discoloration and wear. If any exist, replace the bearing and bearing cup. Inspect the housing for cracks, wear at the bearing cup bores, or impact damage. Replace if necessary. Inspect the spindle shaft for pulled bolt threads, cracks, adjusting nut thread damage, or machined surface damage. Replace if required.

SPINDLE HOUSING ASSEMBLY:

1. Always install cups and cones toghter if new bearings are being used, DO NOT mix used and new bearing components. When installing the bearing cups, make sure that they are properly seated into the housing. **DO NOT DRIVE AGAINST THE BEARING SURFACE.** All parts should be thouroughly cleaned. The bearing nut, the lower seal and the motor flange seal cannot be reused. Therefore, replacements should be ordered (figure 16).

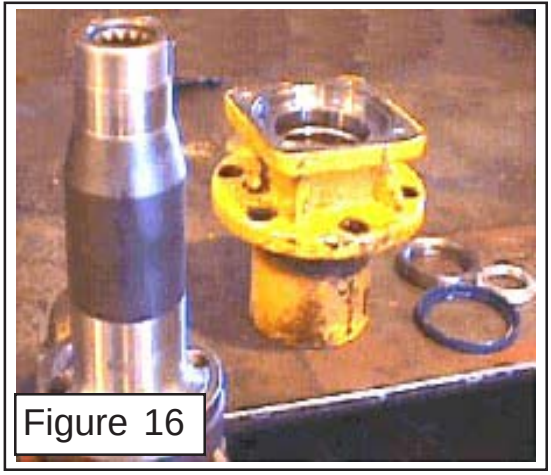


Figure 16

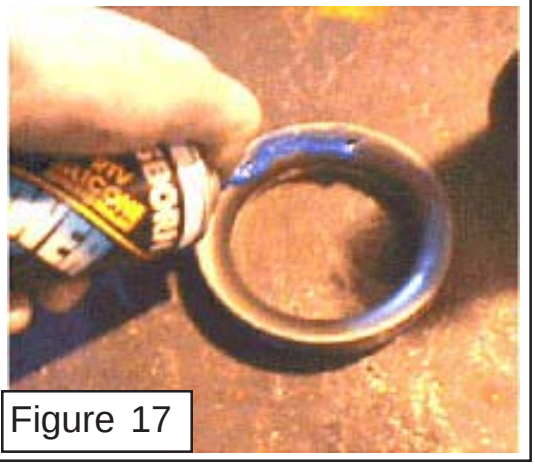


Figure 17

SPINDLE ASSEMBLY - SERVICE & REPAIR

2. It is recommended to apply Loctite # 5900 Silicone Gasket Sealer around the Shaft (figure 18) or a thin coat of silicone on the inside (tapered side) of the bearing ring but DO NOT DO BOTH (figure 17)
. Place the bearing ring on the spindle shaft. The tapered surface should face downward to fit the contour of the spindle shaft. (figure 18). Use a piece of 2-3/4" 16 gauge tubing, 8" long to drive the bearing ring down on to the spindle until the bearing ring bottoms out against the spindle. (figure 19).Remove any excess silicone from the spindle shaft and bearing ring. (figure 20). Turn the housing upside down so that the bearing seal and retaining ring may be installed. Lubricate the seal prior to installation. (figure 21).

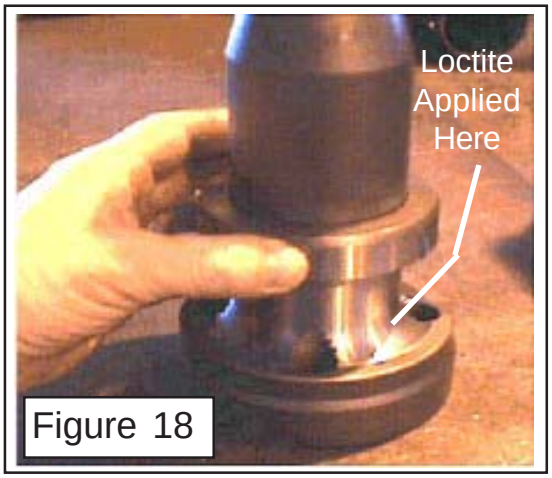


Figure 18

Figure 19

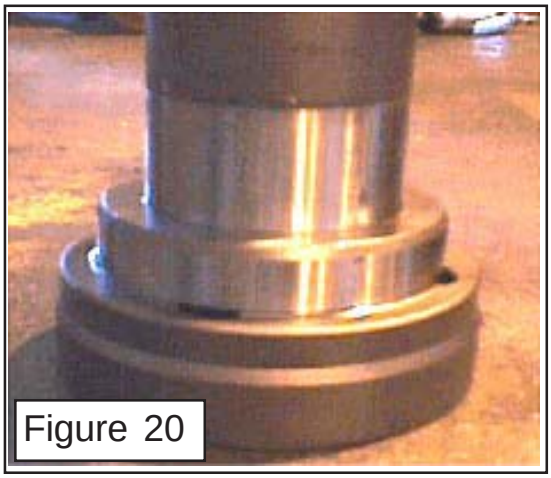


Figure 20


Figure 21

3. Install the lower Bearing Cup (lower bearing race). Drive the lower bearing cup into the lower end of housing. Use a Bearing driver to seat the bearing cup into the housing, make certain the cup is completely seated. The lowering bearing cone must be packed with grease, use a bearing grease packer or the proper hand packing technique. Install the lower bearing Cone (packed with grease) into the lower bearing cup (figure 21).
4. Install the seal to approximately 1/4" from the edge of the Spindle Housing, Seal must be even with lower edge of lock ring groove in spindle housing. Place the Retaining Ring in the housing on top of the seal. (figure 22). Using a suitable driver, EVENLY press the seal and retaining ring into the housing until the retaining ring snaps into place in the ring groove. Be sure the retaining ring is in the groove all the way around and the seal is against the retaining ring. (figure 23). Coat the ID of the seal with a light coat of grease.

5. Place the spindle shaft with the bearing ring installed into the spindle housing. Turn the assembly over so that the housing is sitting upright and the spindle shaft is supporting the housing. (figure 24 & 25). Make certain to support the spindle housing to keep it straight up as the lower bearing ring is being inserted into the seal as the lower bearing is being driven down onto the shaft (figure 26). Use the 2-3/4" 16 gauge tubing to drive the lower bearing down onto the bearing ring (figure 26). .MAKE CERTAIN THAT THE BEARING IS FULLY SEATED ONTO THE SPINDLE. **If the bearing ring is not seated, or if the bearing is not properly seated against the bearing ring, the assembly will lose bearing preload and rapidly fail** (figure 25).


Figure 22

6. Remove the 2-3/4" 16 gauge pipe from the spindle housing. Check to make certain the shaft, bearing ring and lower bearing are seated properly. Install the upper bearing cup using proper size driver. Make certain the bearing cup is seated completely into the spindle housing (figure 26 & 27).

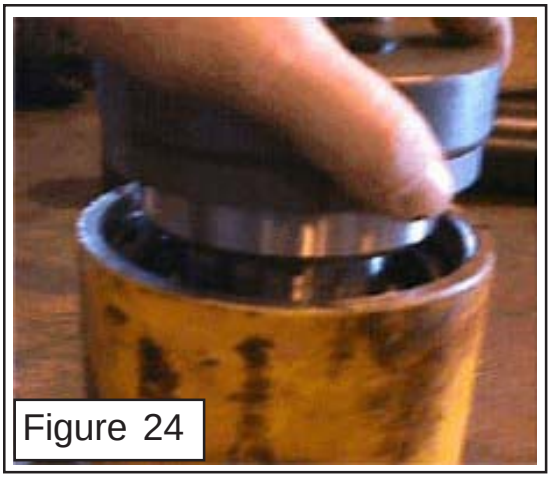


Figure 24

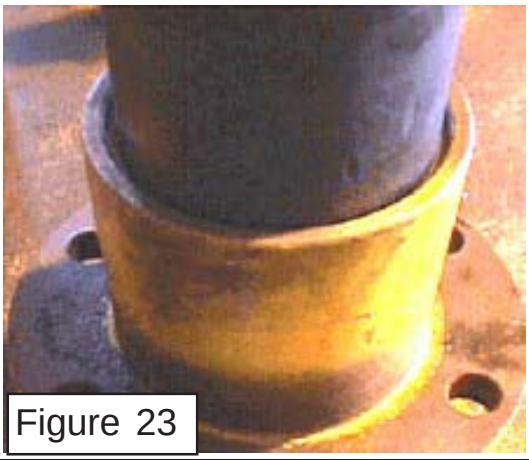


Figure 23

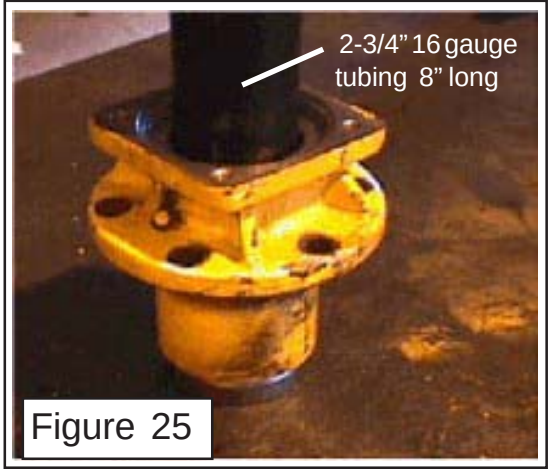


Figure 25

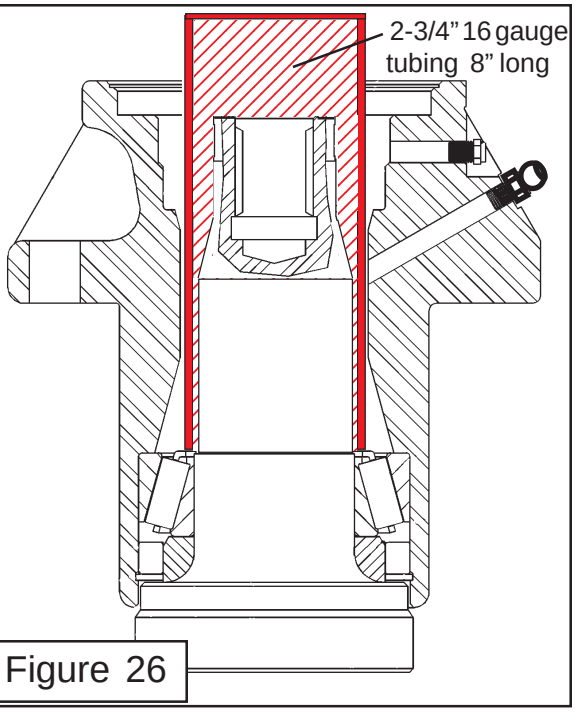


Figure 26

7. Fill the spindle housing with NLGI EP # 2 grease Alamo Industrial PN 00900000 (figure 28). The proper level will be up to the upper bear cup bottom side for now, do not fill with grease above the bottom of upper bearing cup, if you do it will interfere with adjusting bearing preload.
8. Pack the upper bearing cone with grease completely. Install upper bearing cone down over the top of the spindle shaft, if needed use a bearing driver to seat bearing cone into bearing cup
9. Apply Locktite # 277 to the spindle threads where the bearing nut screws on, It may require grease to be cleaned off of threads to apply locktite. (figure 29) . Start the New Locknut onto the shaft threads, the nut should start by hand, make certain it is started straight. (figure 29).

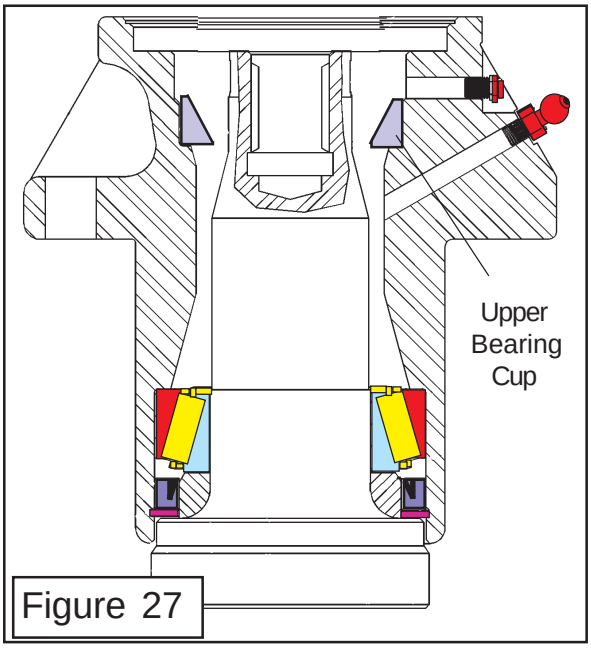


Figure 27

10. Tighten the new Lock Nut with a 4 prong socket and hand ratchet until tight Back the nut off until 12 to 15 INCH POUNDS of rolling resistance is achieved (figure 29).
11. Use a punch to stake the bearing nut in place. Be sure to stake the nut at both slot locations. (figure 30).
12. Useing the grease fitting to the side of the spindle housinf pump grease in to spindle housing. Watch the upper bearing cone, when grease is being forced through the roller bearings of the upper bearing cone spindle is full (figure 31).
13. Install the new motor flange gasket. Apply a thin film of silicone to both sides of the gasket to ensure a good seal (figure 31).

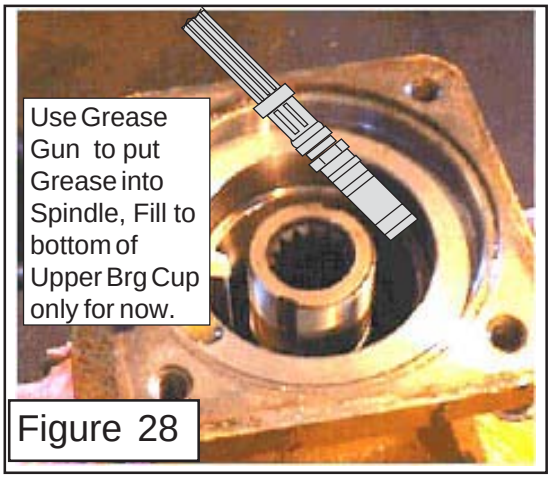


Figure 28

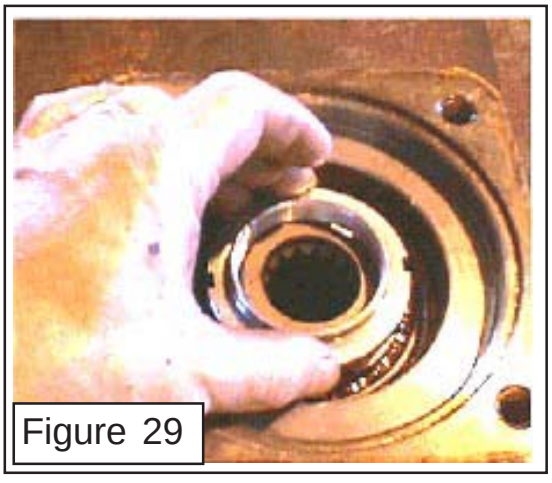


Figure 29

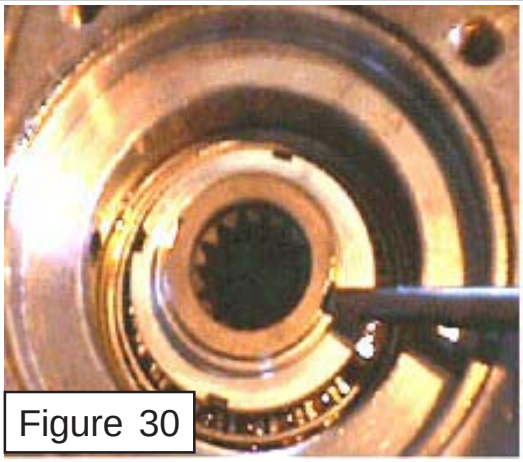


Figure 30

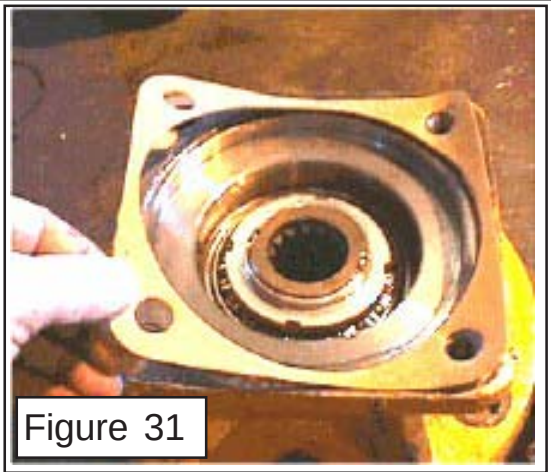


Figure 31

14. Install the spindle to the mower deck to where the fill plug and vent plug are pointing to the rear or the front of the mower, this should allow easy access to the plug for service (figure 32).
15. Make certain a new gasket has been in stalled to spindle Re-Install the motor onto the spindle making certain that the motor is facing the correct direction and none of the hoses are twisted or kinked (figure 32).

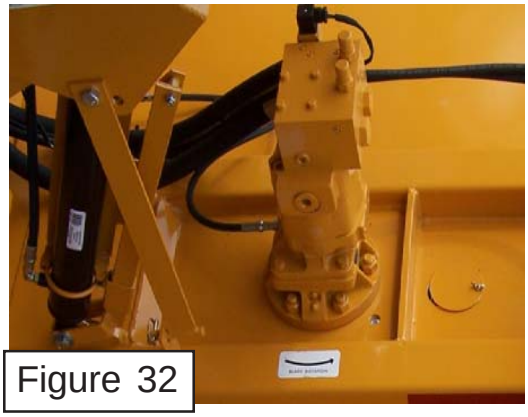


Figure 32

BLADE CARRIERS:

1. There are 2 blade carrier options, Blade Bar or Blade Pan (figure 33). The carrier are bolted to the of spindle with 4 socket head bolts. these bolts length are to be used with a particular carrier option. ALWAYS use the same length and quality bolt that was removed when changing bolts. Damage will result if wrong bolts are used, refer to the replacement parts manual for correct bolt numbers to match the carrier option being used.
2. Install the blade bar or pan using the correct 4 bolts & lockwashers. Use a suitable locktite on the bolts. Torque the bolts to 400 ft. lbs. using a progressive torque and staggered tightenin pattern (figure 33).

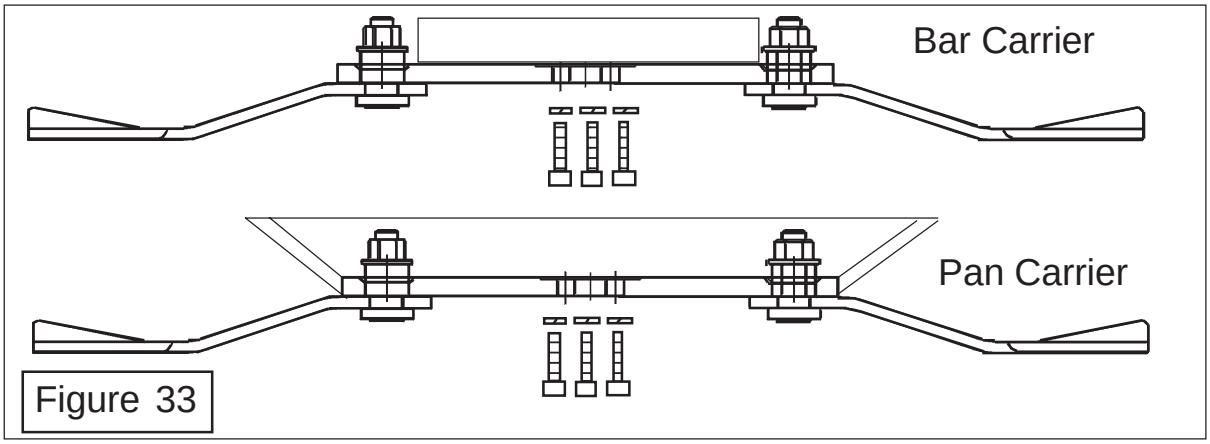
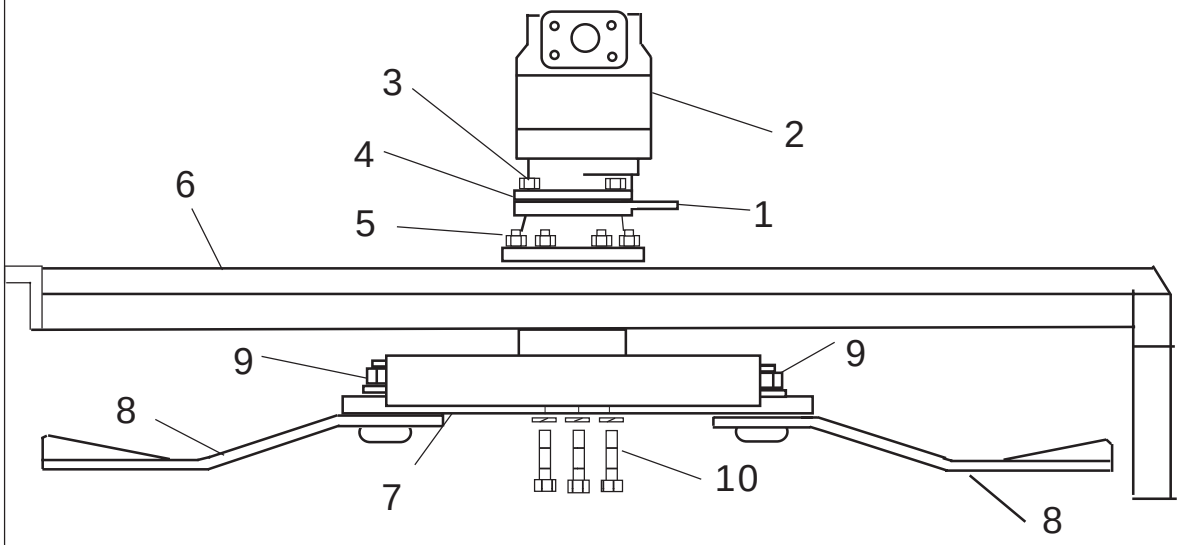


Figure 33

3. Mount Motor onto Spindle. The motor bolts to the spindle with 1/2" grade 8 bolts. Install a new gasket between motor and spindle. Torque the 1/2" bolts to mount motor to spindle to 95 ft. lbs. (figure 34)

4. Mount Spindle to deck use 3/4" bolts with lock nuts. Torque the 3/4" bolts to 350 ft. lbs. (figure 34)

(Bar Carrier Shown)



Item	Qty	Description
1	1	Spindle Housing Assembly
2	1	Motor Assembly
3	4	Motor To Spindle Retaining Bolts (Torque to 95 ft lbs)
4	1	Motor Spindle Gasket
5	6	Spindle to Deck Retaining Bolts (Torque to 350 ft. lbs.)
6	1	Deck (Mainframe)
7	1	Blade Bar or Pan Carrier Assembly (Bar Shown)
8	2	Blades
9	2	Blade Bolts, Bolt, Nut and Washer (Torque to 400 ft. lbs.)
10	4	Blade Bar Carrier Retaining Bolts & Washers (Torque to 400 ft. lbs.)

Figure 34

IMPORTANT NOTE:

BOLTS of different lengths are used for the installation of the blade bar or pan blade carrier attachement to the spindle shaft. The required length is dependant on which carrier is used. DO NOT change the length of the bolts on the carrier installation, use only the length that came with the mower. The spindle shaft and spindle componets can be damages if longer bolts are used as well as the blade carrier can not be torqued porperly. See Parts Manual for correct part numbers. (figure 34)

DO NOT mix old and new blades on same blade carrier, Blades MUST be equal in weight to maintan carrer balamce. If A vibration exist in the blade carrier the balance is off. The problem causing the out of balance condition must be corrected. If mower is run without correcting balance problem damage will be done to the deck and other components. The extend and speed of the damage will increase with the severity of the unbalance problem.

Section 5

HYDRO 15

Hydraluic Cylinder Service and Repair

HYDRAULIC SCHEMATICS

1 - WING LIFT & FOLD CYLINDERS

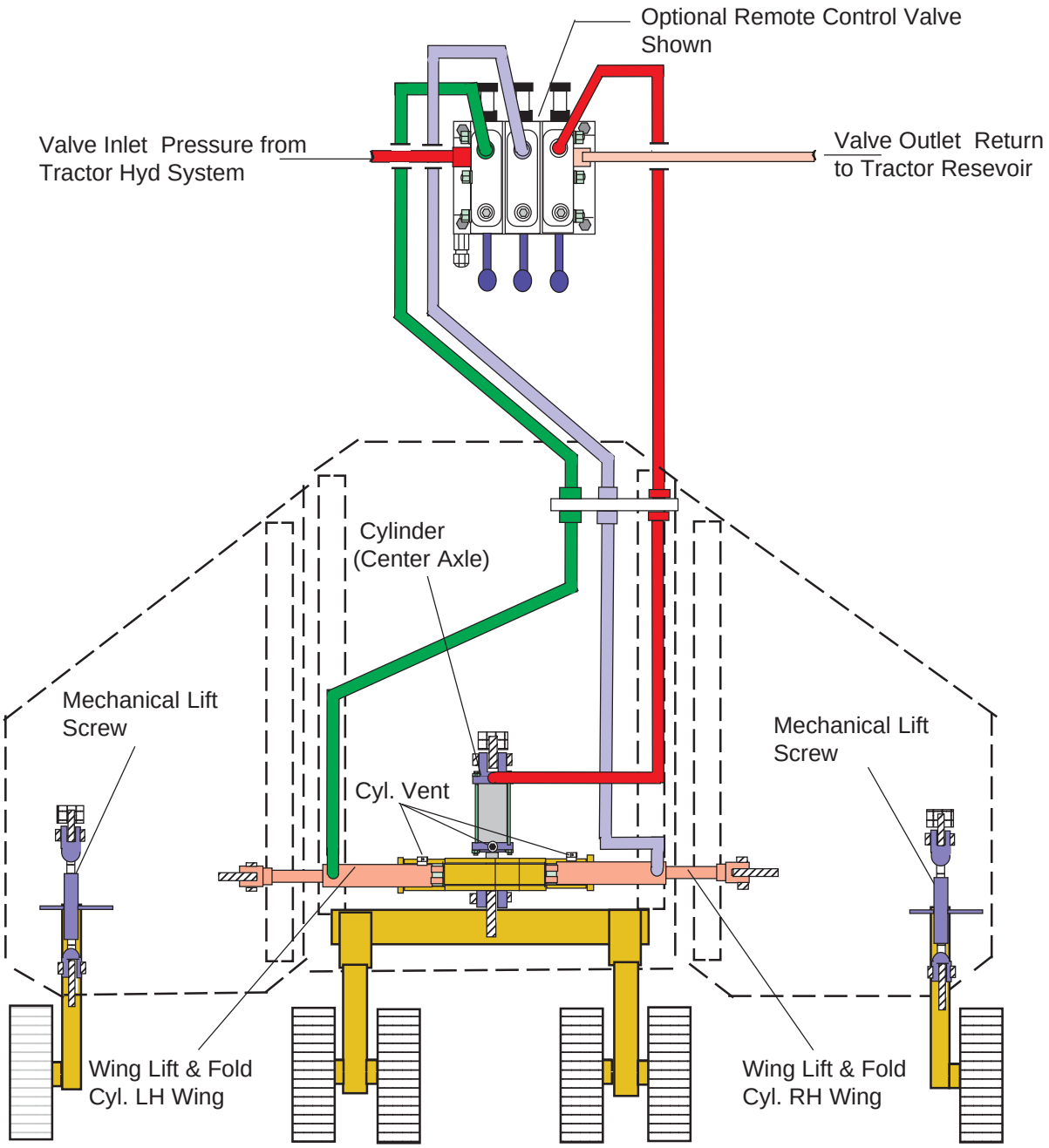
2 - STANDARD AXLE LIFT CYLINDER

3 - OPTIONAL AXLE LEVEL LIFT CYLINDERS

This section contains the procedures to service and/or repair the mower wing lift cylinders, standard axle lift cylinder and the optional axle level lift cylinders. Review the cylinder schematics to determine which axle lift system was installed on the mower. The 15 foot Model and the 10 foot model are the same with the exception only one wing is used on the 10 foot model.

WING LIFT & FOLD - STD AXLE LIFT CYLINDERS

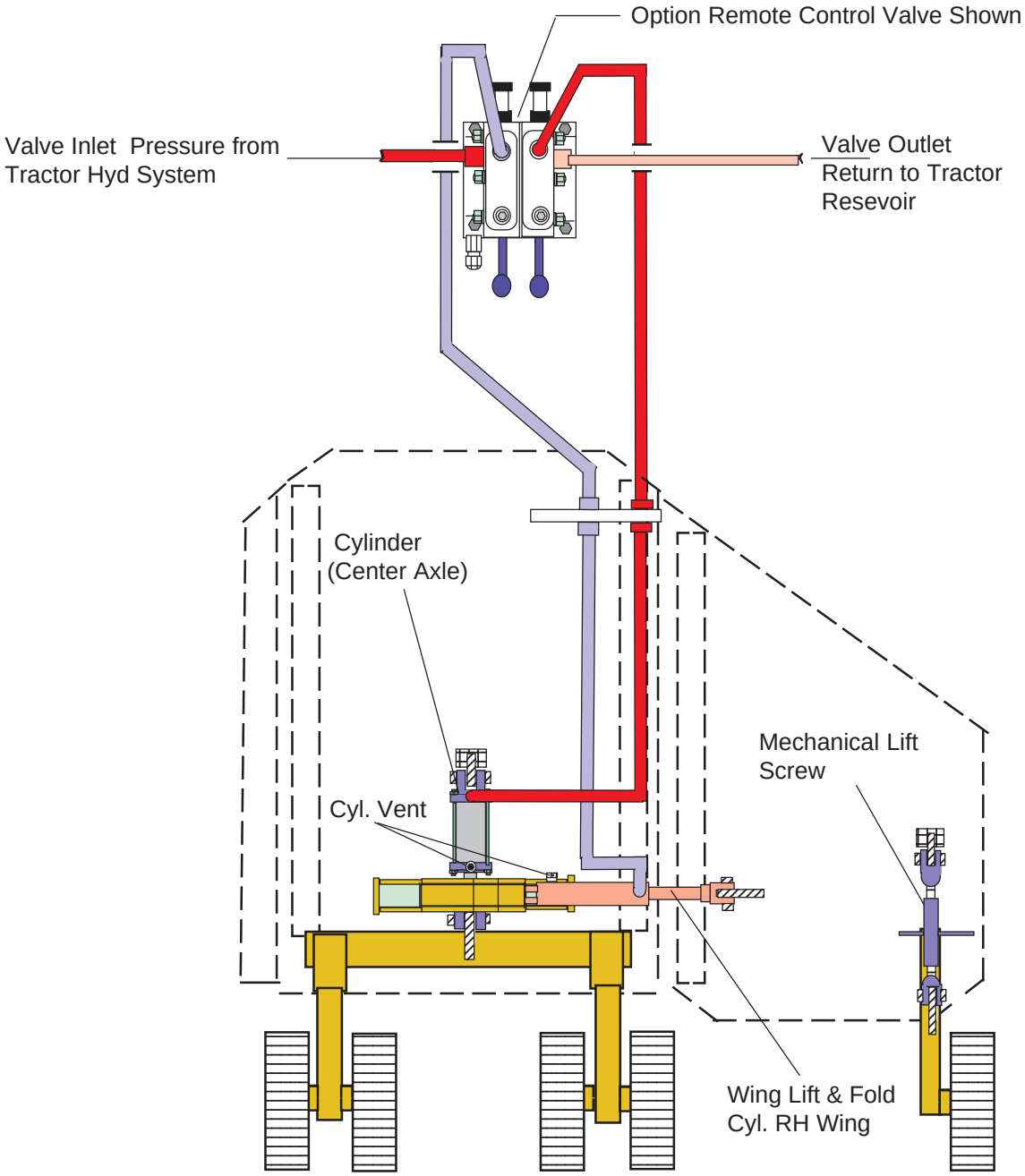
15 FT - STANDARD HYD AXLE LIFT - W/ STD WING LIFT / FOLD



Note: Standard Hydraulic Axle Lift. This has one axle cylinder on center axle only. This cylinder is 3" bore. The hydraulic hose is routed to the base end of cylinder. The hose routing must be this way to work properly. There is NO return hose connected to gland end of center axle cylinder, only a vent plug, this vent plug allows cylinder to move freely without creating a vacuum inside cylinder barrel. If optional Valve is not used and cylinders are connected direct to tractor, it is recommended tractor have at least three remotes. It is also recommended these remotes have detent on them to allow wings to float or damage to deck could occur. The wing axles are adjusted manually using the mechanical lift screws. This can be used on tractor with only two remotes by connecting the wing cylinders together with a Tee fitting, but if doing this you will lose the ability to decide which wing folds first (The wing with the least resistance will fold first).

WING LIFT & FOLD - STD AXLE LIFT CYLINDERS

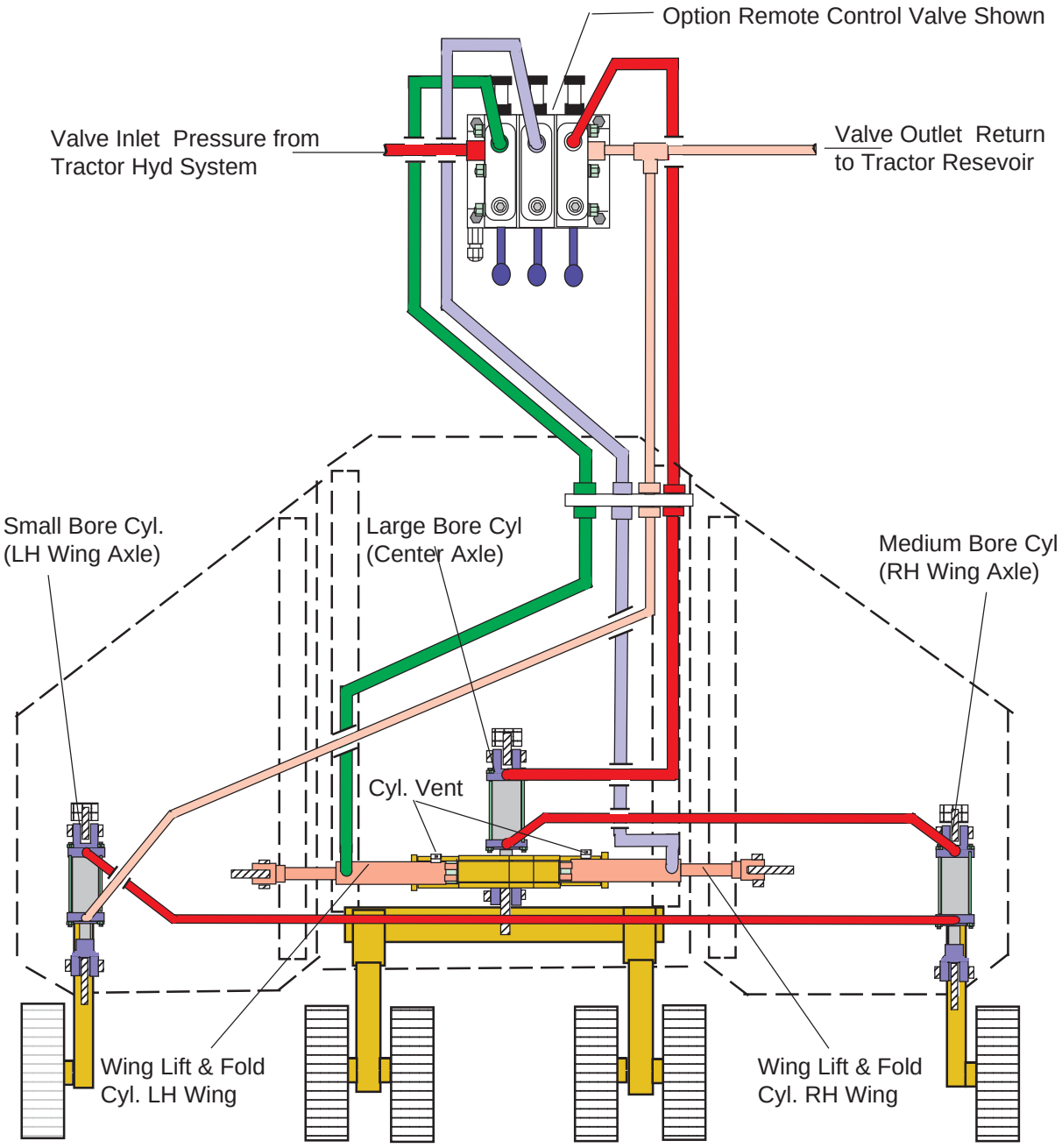
10 FT - STANDARD HYD AXLE LIFT - W/ STD WING LIFT / FOLD



Note: Standard Hydraulic Axle Lift. This has one axle cylinder on center axle only. This cylinder is 3" bore. The hydraulic hose is routed to the base end of cylinder. The hose routing must be this way to work properly. There is NO return hose connected to gland end of center axle cylinder, only a vent plug, this vent plug allows cylinder to move freely without creating a vacuum inside cylinder barrel. If optional Valve is not used and cylinders are connected direct to tractor, it will need at least two remotes. It is also recommended these remotes have detent on them to allow wing to float, or damage to deck could occur. The wing axles are adjusted manually using the mechanical lift screws.

WING LIFT/FOLD - OPTIONAL AXLE LEVEL LIFT CYL'S

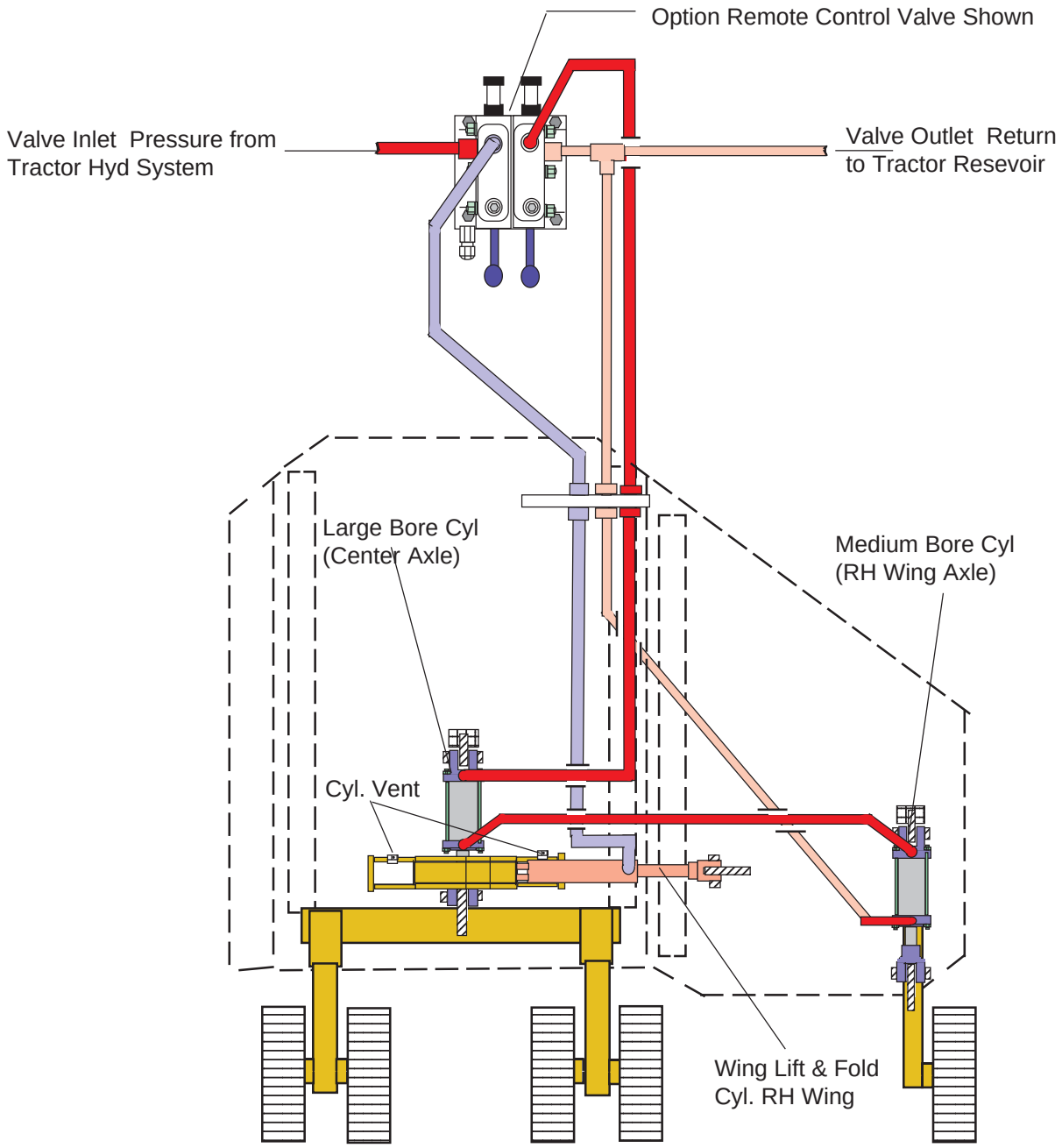
15 FT - OPTIONAL HYD LEVEL LIFT AXLE - W/ STD WING LIFT / FOLD



Note: Hydraulic Axle Lift Option. This has three axle cylinders, one center and one each wing. These cylinder are different bore size, the center is 3-1/2" bore, RH wing 3-1/4" bore and LH wing 3" bore. The hydraulic hose's are routed to largest bore, medium bore and then to the smallest bore cylinder. The hose routing must be this way to work properly. The system has cylinders that have bypass grooves in the top end of the barrels to allow the hydraulic oil to pass from one cylinder to the other. The return hose is connected to the return valves return hose, this is recommended connection as this puts the return hose at hydraulic oil level and helps prevent air from accumulating in the cylinders during use. If optional Valve is not used and cylinders are connected direct to tractor, the return hose should be connected below hydraulic oil to keep hose full of oil. Tractor connections must have the detent positions.

WING LIFT/FOLD - OPTIONAL AXLE LEVEL LIFT CYL'S

10 FT - OPTIONAL HYD LEVEL LIFT AXLE - W/ STD WING LIFT / FOLD



Note: Hydraulic Axle Lift Option. This has two axle cylinders, one center and one wing. These cylinder are different bore size, the center is 3-1/2" bore and RH wing 3-1/4" bore. The hydraulic hose's are routed to largest bore then smallest bore cylinder. The hose routing must be this way to work properly. The system has cylinders that have bypass grooves in the top end of the barrels to allow the hydraulic oil to pass from one cylinder to the other. The return hose is connected to the return valves return hose, this is recommended connection as this puts the return hose at hydraulic oil level and helps prevent air from accumulating in the cylinders during use. If optional Valve is not used and cylinders are connected direct to tractor, the return hose should be connected below hydraulic oil to keep hose full of oil. Tractor connections must have the detent positions.

NOTES

WING LIFT AND FOLD CYLINDERS SERVICE & REPAIR

WING LIFT & FOLD CYLINDER REPAIR

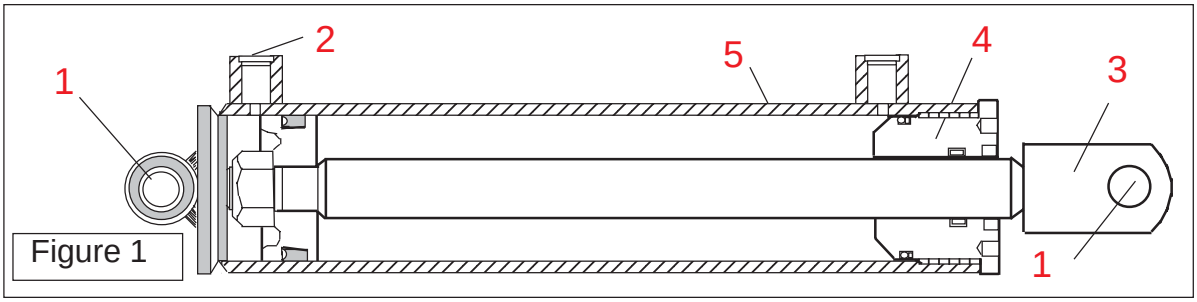


Figure 1

Cylinder Removal: (LH or RH Wing Cylinder)

1. Make Certain Wings are in the lowered position before disconnection any component. Make certain tractor is securely parked with brakes set. Make certain tractor engine is in off position and key secured to prevent starting. It is recommended mower be disconnected from tractor or battery cable be removed from battery while repairs are being made.
2. Make certain that all hydraulic pressure has been released from lines after wings and axles have been completely lowered. This may require the tractor hydraulic controls and / or remote control valve be worked to release hydraulic pressure. NEVER disconnect any cylinder hydraulic hose's or fittings if all mower components (wings and deck) are not resting in the completely lowered to the ground position.
3. Remove the cylinder mounting pins (figure 1 item 1), this allows the cylinder to be raised upward off the wing lug and outward from the cylinder mount of the winch stand.
4. Before disconnecting the base end hose (figure 1 item 2) form the wing cylinder put a drain pan under the hose connection at the base end of the cylinder. Begin to loosen the hose slowly, If any hydraulic pressure is in the hose STOP and reread step 2 above. If no Hydraulic pressure, continue removing the hose from the base end of the cylinder while keeping the hose and cylinder over the drain pan. When hoseis removed hold cylinder over drain pan until oil has drained from cylinder. Install a cap onto the cylinder hose to seal it.

Cylinder Dis-Assembly: (LH or RH Wing Cylinder)

1. Clamp cylinder to work bench (DO NOT over tighten clamp and bend or distort the shape of the barrel) only tight enough to hold cylinder. Place a drain pan under cylinder head to catch any oil that may leak out.
2. Pull the Cylinder Rod Clevis Weldment (figure 2 item 3) outward at least 3 inches, This will allow the Cylinder Head (figure 2 item 4) to be unscrewed from Barrel (figure 2 item 5) using a commercially available two point spanner wrench (figure 13). The cylinder head will screw counter clockwise out until it is away from the cylinder barrel. Hold the Cyl rod (figure 2 item 3) as straight as possible when cylinder head is unscrewed.Keep drain pan under open end of barrel to catch oil that may drain from barrel.
3. Pull the Cylinder Rod Clevis Weldment (figure 2 item 3) outward, it will pull the piston out of the barrel (figure 2 item 6). When pulling the rod and piston out do it slowly, the amount of resistance should be about the same all the way out, if you encounter a spot where the piston pulls easier than others make a mark on the OD of the barrel approx where the piston is in the barrel. These loose places may indicate a worn are that will need to be checked later. Pull the rod out slowly holding the rod as straight as possible until the piston (figure 2 item 6) and cylinder rod weldment pulls completely out of barrel (figure 2 item 5). Be careful not to bump the threads on the cylinder head or damage them.
4. Clamp cylinder rod clevis weldment in a vice (figure 3) on the clevis end as shown. Clamp the rod with the mounting pin hole upward as shown (See Rod Clevis Weldment figure 3), if the clevis is clamped with the hole the other way, the clevis could be bent together and cause the clevis to

5. Remove the 3/4" RH Thread Piston Retaining Locknut (figure 3 item 7). The piston (figure 3 item 6) will not slide off of the cylinder rod weldment (figure 3 item 3). Care must be taken when removing the piston so as not to damage it, DO NOT hammer on piston or cylinder rod. The piston was pressed on cylinder rod using a loctite 271 or equivalent. Piston WILL HAVE TO be pressed off of cylinder rod, when pressing piston off make certain to support piston so as not to damage it and use something to protect the threads on cylinder rod from being damaged by press. Support the cylinder rod while in press from falling and damaging piston nut threads.

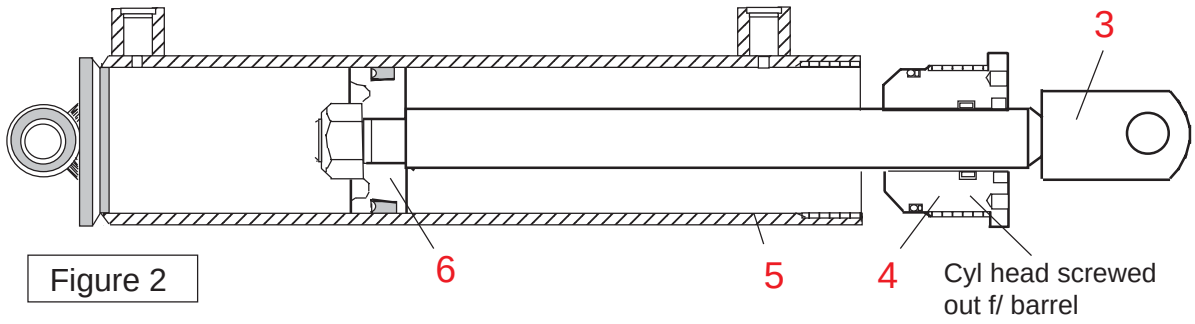


Figure 2

6. Slide the cylinder head (figure 3 item 4) off the cylinder rod (figure 3 item 3) in the direction of the piston.DO NOT hammer on cylinder head or cylinder rod. Cylinder head should slide by hand with a minimum amount of effort, if it will not slide by hand check the cylinder rod for damage, scored or bent. If cylinder head is forced over a damage area or bend it could damage cylinder head.

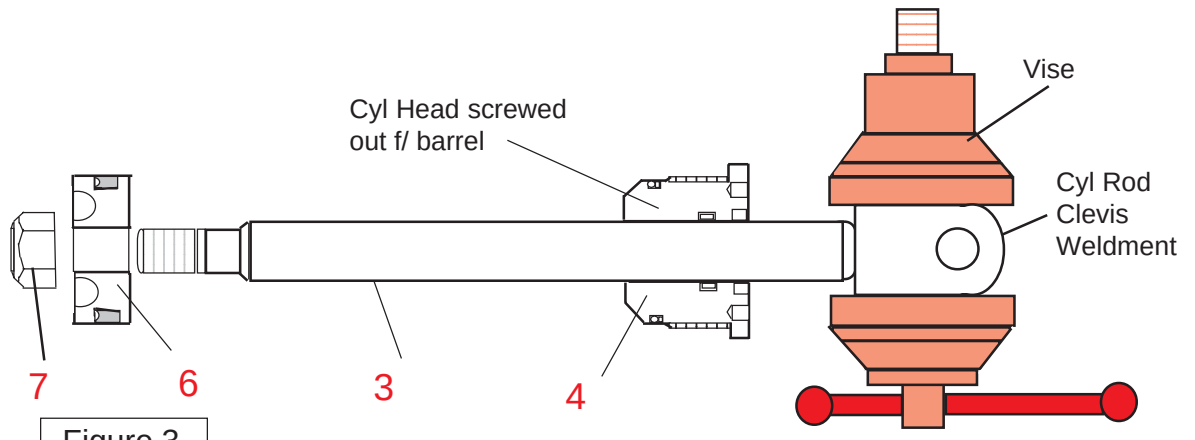


Figure 3

Clean & Inspect Cylinder Components: (LH or RH Wing Cylinder)

1. Inspect the barrel, check for scratches, severe wear areas, distorted tube dia. If no serious damage is detected clean the Barrel (figure 4 item 5), this can be done with solvent or with pressure (Steam) washer. Inspect the tube closely, look at the OD of the tube for any dents or bulges. Inspect the ID of the tube for serious wear. Inspect the base mount to make certain it is not worn or damaged. Inspect the hose ports condition, check the threads in these ports.

2 If water was used to clean the barrel make certain all water (moisture has been dried off, DO NOT use anything that has lent ot dirt on it to dry the Barrel ID, it is recommended that air be used. Put a light coat of clean hydraulic Oil (See Specifications for recommended type of oil for this model) on the ID of the barrel.

3. Using a straight edge (figure 4) check the OD of the barrel in several places, look for high or low spot in the tube. Also use the straight edge top check the ID in several places, check to make certain there are no over sized wear places in tube.
4. If the barrel has minor scratches or a glaze on the ID the barrel can by lightly honed useing a cylinder hone with the proper honing liquid, the hone will need a long shank. DO NOT over hone the ID of the Barrel and DO NOT damage the threads for the cylinder head with the hone. If honeing the barrel the barrel will have to be cleaned again.
5. Inspect threads in hose ports (figure 4 item 2) of barrel, if O-Ring Boss is used in ports insect the area machined to seat O-Rings. Make certain the ports are clean and free of debris.

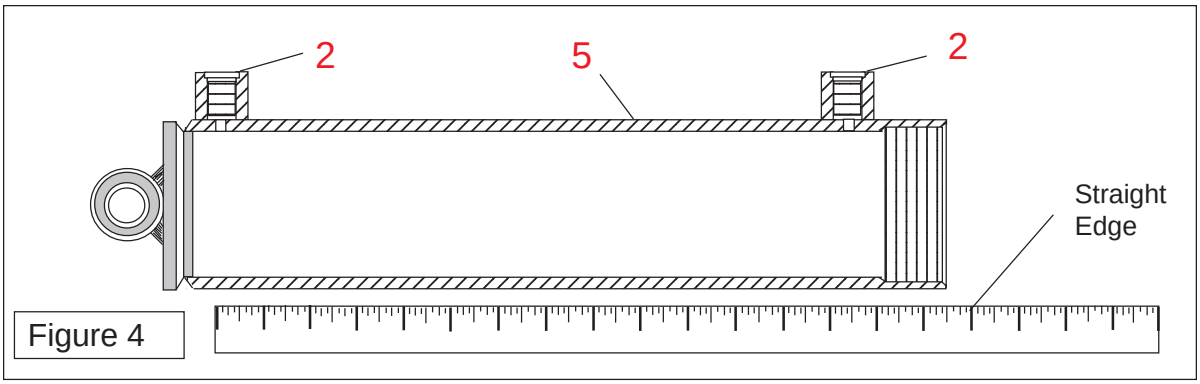


Figure 4

6. With the cylinder rod weldment still clamped in vice (figure 5) slide the cylinder head (figure 5 item 4) off the rod. Inspect and clean the cylinder rod, check the cylinder rod for any bend, scratches, metal flaking, rust spots or pitting. Use a straight edge (figure 4) to check for bends in rod. Check rod clevis mounting pin hole for wear or distortion. Check the threads and piston seat surface. If rod has been cleaned and is dry make certain to coat it with a light coat of oil.
7. Inspect the cylinder head general condition and the threads where it screws into the barrel (figure 5). When working on the cylinder head never clamp it in a vice as it is made of aluminum and could be damaged, be careful when removing old seals not to damage thread on OD of cylinder head. Remove the Seals from the Cylinder Head.

   First remove the O-Ring and back up washer (figure 5 item 4A), when removing these note that the back-up washer is on the outward side with the O-Ring inward toward ID of Barrel.

   Second remove the snap in rod wiper seal (figure 5 item 4B), make a note of the lip on seal that it is pointing outward to enable the lip to wipe the dirt from rod.

   Third remove the inner Rod seal (figure 5 item 4C) by prying it out on one side until it is across the ID of the cylinder head, push the seal on out of the head using a nylon (plastic) rod and a light hammering on end of rod. Clean and inspect cylinder head. Check the ID of the cylinder head to make certain it is still round and without excessive wear.
8. Inspect the general condition of the piston (figure 5 item 6). Remove the U-Cup Seal (figure 5 item 6C) from the piston, make a note of which way the U-Cup seal came off the piston. Insect the groove for the seal make certain it is not scratched or worn. Make certain the piston has nut been struck and is deformed. Check the OD of the piston to make certain it is not scored or worn excessively around the OD, if it is it is recommended that a second look is taken at the cylinder head ID.
9. Inspect the threads of the locknut (figure 5 item 7), if they appear to be damaged, take a second look at the threads on the cylinder rod clevis weldment (figure 5 item 3). It is recommended that the piston locknut (figure 5 item 7) be replaced and not re-used.

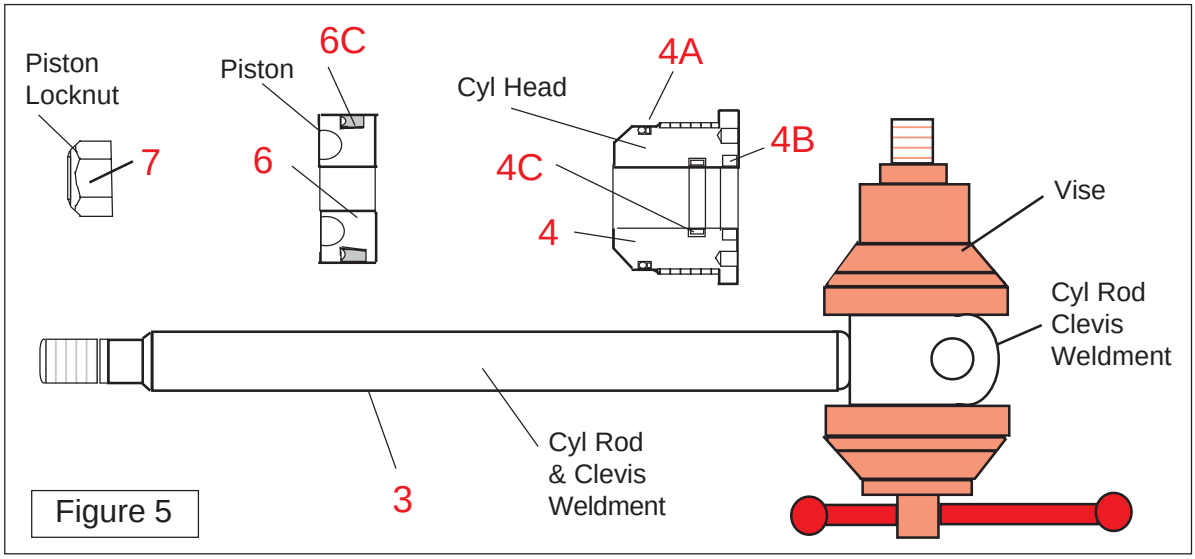


Figure 5

Cylinder Re-Assembly: (LH or RH Wing)

1. With all components inspected and in usable condition or replaced sort the part out and make certain all are clean and free of rust.
2. The barrel (figure 6 item 5) will need to be prepared for for re-assembly. It barrel has been replaced or the old barrel is being used it will need cleaning and a light coat of appropriate hydraulic oil applied. Once done clamp the barrel done with only enough force to hold it but not so much as to damage it.

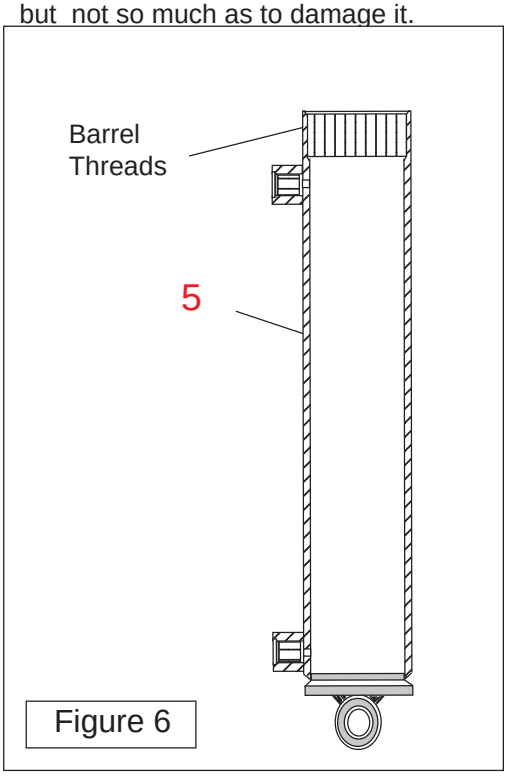


Figure 6

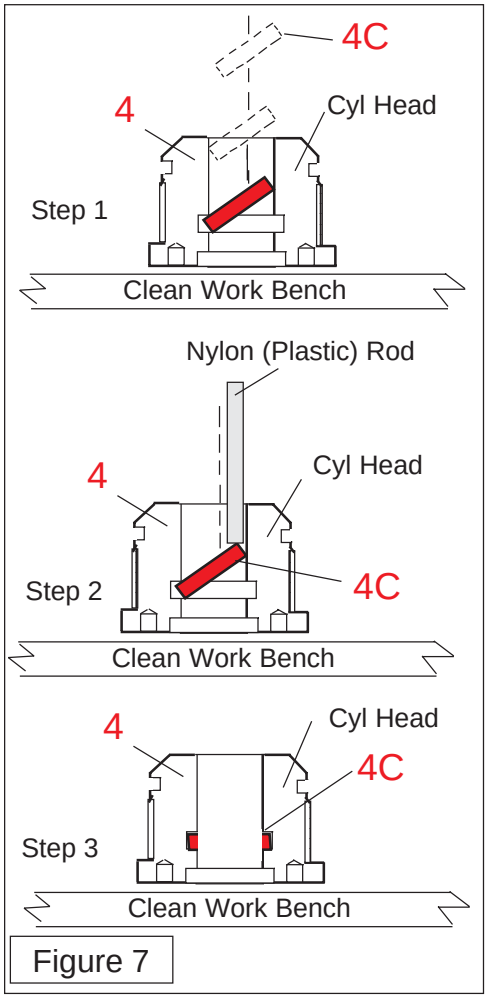


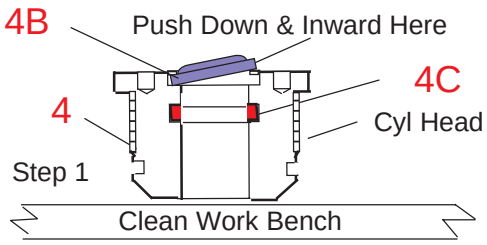
Figure 7

3. Install the cylinder rod seal into the cylinder head (figure 7 item 4C). Install the rod seal first coating the seal with petroleum jelly (vaselene) on the OD of seal. Slide the seal into the ID of the of the cylinder head (figure 7 step 1). Using a nylon (plastic) rod press down on seal, light taps with small hammer will be ok providing you watch the bottom of the seal and make certain it is started in the seal groove and not being driven on through cutting seal (Figure 7 step 2). drive seal in until it is seated into the groove (Figure 7 step 3).

4. Install the snap in cylinder rod wiper seal into the cylinder head (figure 8 item 4B). Turn the cylinder head over where the groove for the wiper seal is up-ward. Install the wiper seal first coating the seal with petroleum jelly (vaselene) on the OD of seal. Slide the seal into the ID of the of the cylinder head (figure 8 step 1). Press down and inward on seal until seal is seated in groove (Figure 8 step 2). Check seal to make certain it was nut cut during installation.

5. Install cylinder head seal (figure 8 step 1 item 4A). Turn the cylinder head over as shown (figure 9 step 1). Coat the back-up ring with light coat of oil and slide it down over cylinder head, NOTE: some back rings have a round depression in one side, this side will be mounted up so the round O-ring seal will fit in the depression. Slide the back-up ring down over cylinder head until it is seated into the groove (figure 9 step 2 item 4A). Coat the O-Ring (figure 9 item 4A) with oil and slide it down onto the cylinder head until it is seated into the groove (Figure 9 step 2 item 4A). The Cylinder head is complete, set it aside for now.

6. Install the Cylinder Head (figure 10 item 4) onto the cylinder rod. Coat the cylinder rod with light coat ofoil and slide the cylinder head onto it. It should slide on with minimum effort but it must be slid on square and straight, DO NOT use a hammer to force the cylinder head onto cylinder rod if it will not slide on by hand force check the components something is wrong and forcing it could damage head and seals.



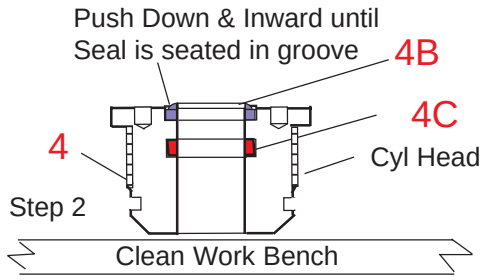
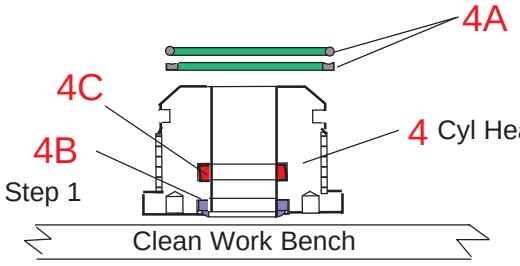


Figure 8



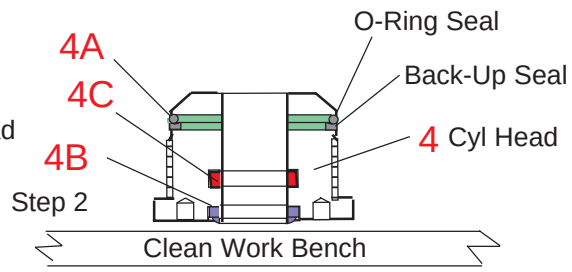


Figure 9

7. Installing the Piston on the cylinder rod (figure 10 item 6) will require a press, DO NOT try to press piston onto cylinder rod with the piston nut. Use Locktite 271 or equivalent when pressing piston onto cylinder rod. Make certain piston and rod are in alignment when pressing piston, make certain piston and rod are protected from damage.

8. Install the U-Cup Seal (figure 10 item 6C) onto Piston (figure 10 item 6). The U-Cup Piston seal is a directional seal and is designed to be used as a single action cylinder. The U-Cup seal should be installed so the U-Cup side of seal is toward the pressure side of the piston which is the rod side on this cylinder.
9. The cylinder rod weldment is clamped into vice as shown (figure 10 item 3) Clamp the rod with the mounting pin hole upward as shown (See Rod Clevis Weldment figure 10 item 3), if the clevis is clamped with the hole the other way, the clevis could be bent together and cause the clevis to be deformed.
10. Install the new Piston retaining locknut (figure 10 item 7) onto the cylinder rod. (Note it is not recommended that old locknut be reused). Before tightening the locknut down make certain that piston is seated onto cylinder rod completely, this can be done by visually inspecting back side of piston against shoulder of cylinder rod. Torque Piston Locknut 350 to 400 ft lbs.

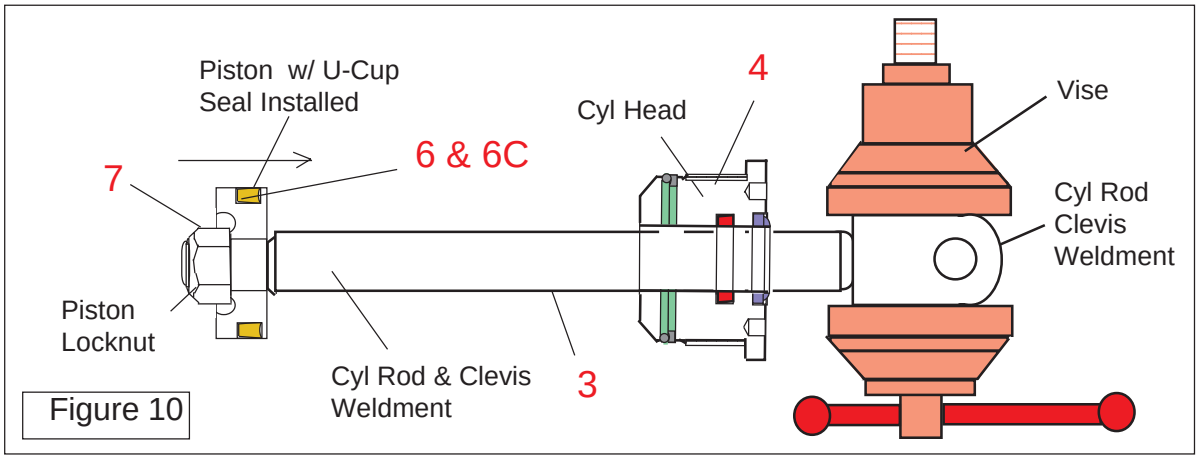


Figure 10

11. Coat the piston (figure 10 item 6) and ID of the barrel (figure 11 item 5) with light coat of hydraulic oil. Clamp the barrel down just enough to hold it being careful not to over tighten it, or the barrel could be distorted. Holding the cylinder rod straight slowly slide the piston into the barrel, be careful at the front of the barrel when sliding piston across the threads in the barrel (figure 11 Item 5 Threads) so as not to damage U-Cup seal on piston (figure 11 item 6). When piston is being slid into barrel do it slowly feeling the resistance, the resistance should remain about the same all the way in, if not recheck barrel for wear. Continued to slide piston in holding rod as straight as possible until it is in barrel approx 10 to 12 inches making certain the cylinder head (figure 11 item 4) is not inside barrel.

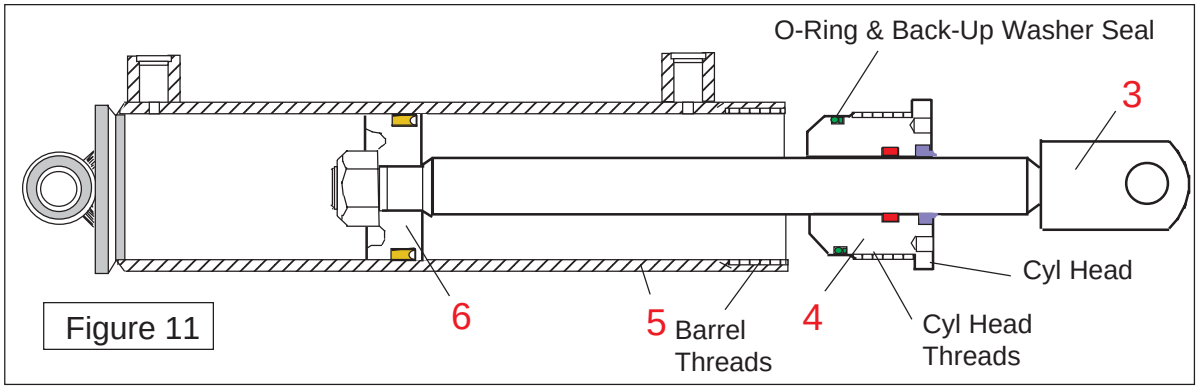


Figure 11

12. Coat the O-Ring & Back-Up Washer Seal (figure 11 item 4) with light coat of hydraulic oil. Holding the cylinder rod (figure 11 item 3) straight slide the cylinder head down cylinder rod until the threads are at the threads of the barrel. (Important !) Apply a drop of locktite 242 in 3 places (120° apart) on the first two threads of the cylinder head. Making certain the cylinder rod is straight thread the cylinder head clockwise (RH threads) into the barrel. This can be done by hand if the threads are in good condition, once the threads are started straight, a two pin spanner wrench (figure 13) can be used to tighten cylinder head into barrel (read step 14 about spanner wrench). Tighten the cylinder head until it is fully seated against barrel, the two pin holes for the spanner wrench should be straight up and down from the barrel ports as shown (Figure 12 item 4). The cylinder head should be tughtened to what would be equal to 100 ft. lbs of toque.

13. Using a new O-Ring install the vent plug (figure 12) in the base end cylinder barrel port. Install the pressure hose and existing fittings using a new O-Ring into the rod end of barrel (figure 12). When first using the rebuilt and/or new cylinder it is not unusual for a light amount of oil to be pushed out of the vent. The amount is the amount that was used to oil components during assembly. If excessive amount leaks through vent cylinder is not functioning properly. Recheck the assembly steps for possible assembly error.

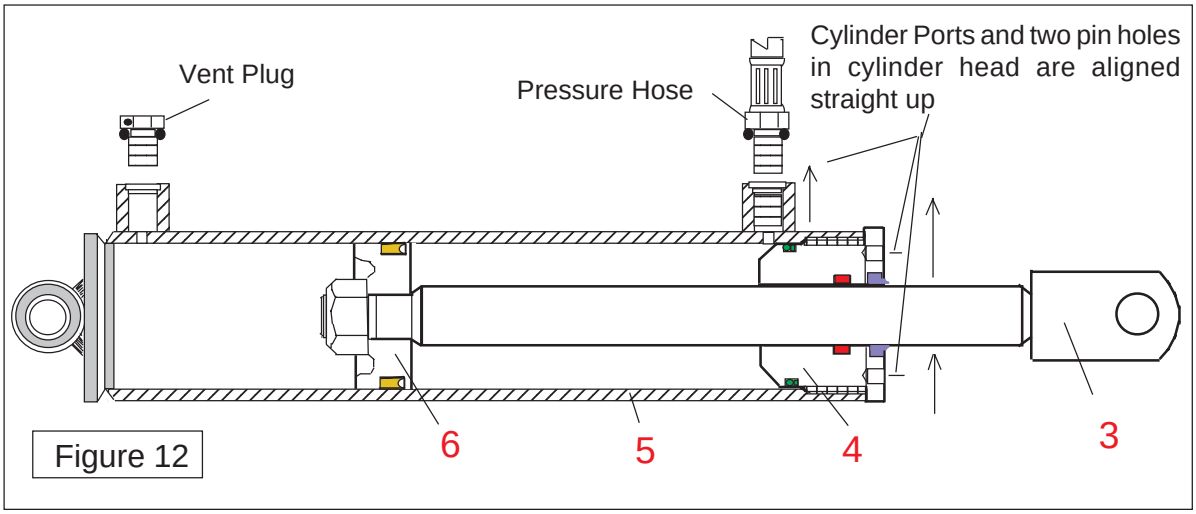


Figure 12

14. A Spanner wrench (figure 13) can be purchased commercially or it can be built by the repair technician. The Pins will need to be the same size and width as the two holes in the cyl head. The opening in the center must be large enough not to hit the cylinder rod. The wrench must be built of material thick enough it will withl stand the pressure and handle is long enough to give the leverage needed when turning cylinder head. When using a spanner wrench it is recommended that the cylinder rod be covered well by wrapping and taping cardboard around it to protect the rod, or wrap a cloth around rod.

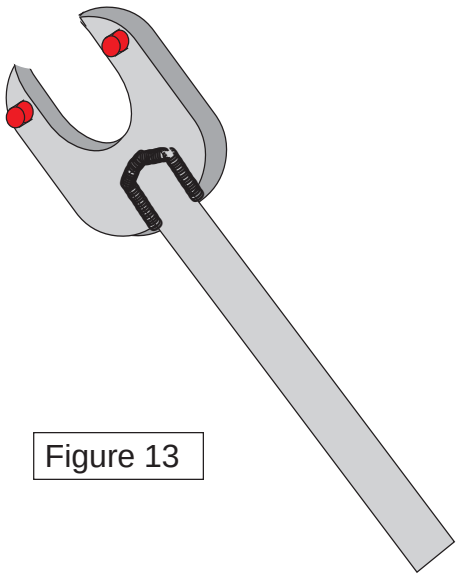


Figure 13

STANDARD AXLE LIFT CYLINDER SERVICE & REPAIR

STANDARD AXLE LIFT CYLINDER REPAIR

Cylinder Removal: (Axle Lift Cylinder, Standard)

1. Make Certain axles are in the lowered position before disconnection any component. **Make certain** tractor is securely parked with brakes set. **Make certain** tractor engine is in off position and key secured to prevent starting. It is recommended mower be disconnected from tractor or battery cable be removed from battery while repairs are being made. Front and rear of mower must be securely supported on strong jackstands before hydraulic lines or cylinder mounting pins of the axle hydraulic assembly are disconnected.
2. **Make certain** that all hydraulic pressure has been released from lines after wings and axles have been completely lowered. This may require the tractor hydraulic controls and / or remote control valve be worked to release hydraulic pressure. NEVER disconnect any cylinder hydraulic hose's or fittings if all mower components (wings and deck) are not resting in the completely lowered to the ground position or supported on jackstand position.
3. Do not remove cylinder pressure hose before the cylinder is dismounted from deck. Remove the cylinder mounting pins (figure 1 item 1), this allows the cylinder to be raised upward off the deck mounting lug and the axle lug. Place a drain pan under the pressure hose to catch the hydraulic oil when hose is disconnected. Drain cylinder and hose into drain pan. Plug the pressure hose to keep contamination out of it.
4. Plug all openings in cylinder before cleaning the cylinder. Remove the Vent Plug (figure 1 item 10) and insert a plug (plastic plugs will work). Base end of cylinder (figure 1 item 8) will have two ports, Pressure hose port (figure 1 item 11) and second plugged port on side (figure 1 item 12) which should still be in cylinder base.

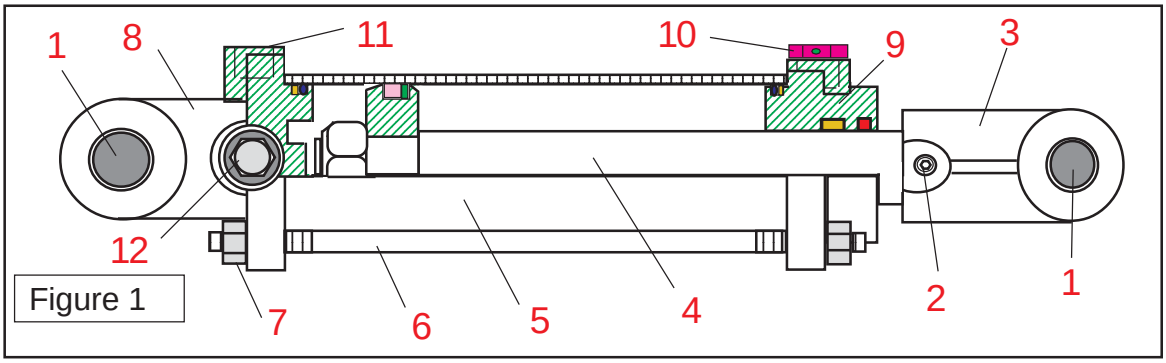


Figure 1

Cylinder Dis-Assembly: (Axle Lift Cylinder, Standard)

1. This is a Tie-Rod construction type cylinder, the four tie-rods (figure 1 item 6) and the 8 hex nuts (figure 1 item 7) bolt the cylinder together. When these tie-rods are unbolted the cylinder will come apart with minimum effort but DO NOT unbolt tie-rods until later. It is recommended that the barrel of the cylinder be marked as to which end isthe cylinder rod end and which is the cylinder base clevis end.
2. Place the cylinder in a bench vise (figure 2), use pieces of wood or other soft material between vise jaws and cylinder barrel. DO NOT over tighten vise and distort the shape of the barrel, vise only needs to be tightened enough to hold cylinder.
3. Place drain pans under cylinder to catch hydraulic oil that may still be in cylinder (figure 2 Drain Pans). Using ratchet w/ sockets or boxed end wrenches (repair technicians choice) remove the tie-rod hex nuts (figure 2 item 7). The tie-rods have a hex nut on each end (figure 2 item 7), not all the hex nuts will screw off on the same side. The hex nut with the least amount of resistance is going to screw off. This is OK as the tie-rods can be pulled out from either direction.
4. When a hex nut has been removed from each tie-rod (it will not matter which end of tie-rod) pull the tie rods out from the cylinder base and cylinder head (figure 2 item 6). There are a total of 4 tie-rods that will need to be removed (see figure 3). .

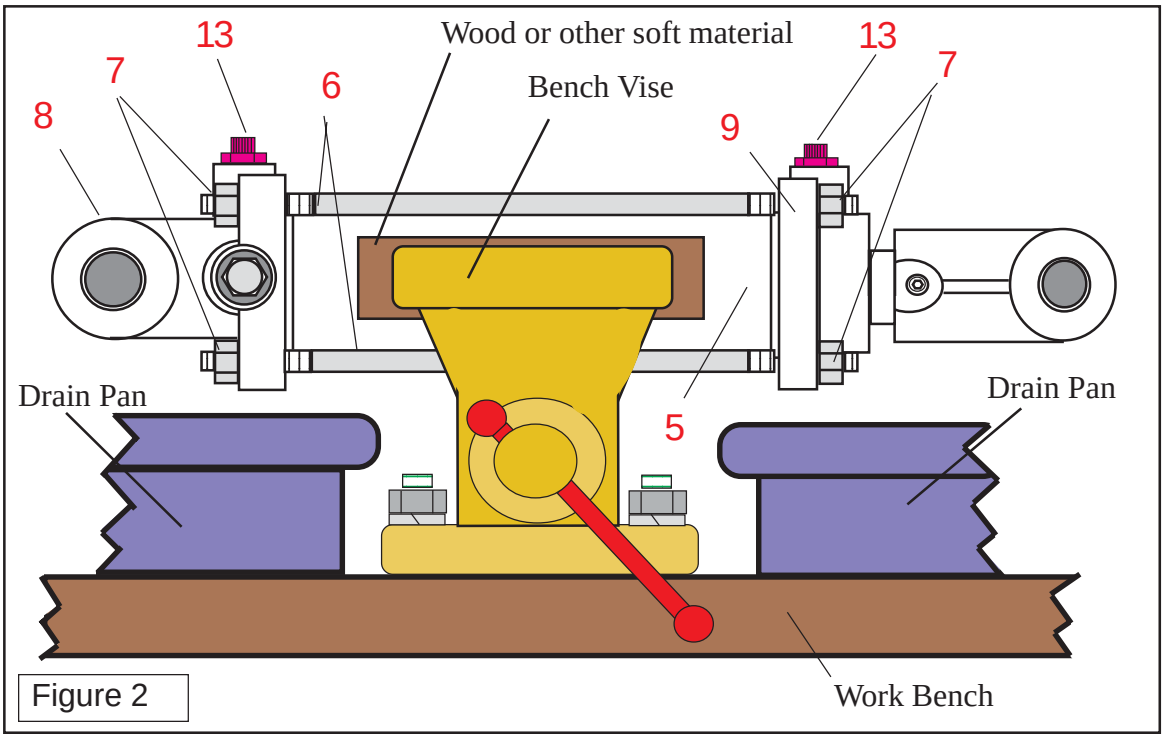


Figure 2

5. Remove the cylinder Base end cap (figure 2 Item 8). To remove the cylinder base end cap use a small brass (soft metal hammer) tap the base end cap until it slide out of the cylinder barrel (figure 2 item 5). The base end of the cylinder will now be open (See figure 3).

6. Remove the cylinder head (figure 3 item 9). Pull the cylinder rod out from inside barrel approx 2 inches by pulling on the cylinder rod clevis (figure 3 item 3). Using a brass (soft metal) hammer tap the barrel side of the cylinder head (figure 3 item 9). Cylinder head will slide out of barrel, when the shoulder of the cylinder head comes out of the barrel, pull the cylinder clevis (figure 3 item 3). The cylinder rod clevis, cylinder rod, cylinder head, piston and piston nut will all pull out as an assembly when pulled from the barrel (see figure 4).

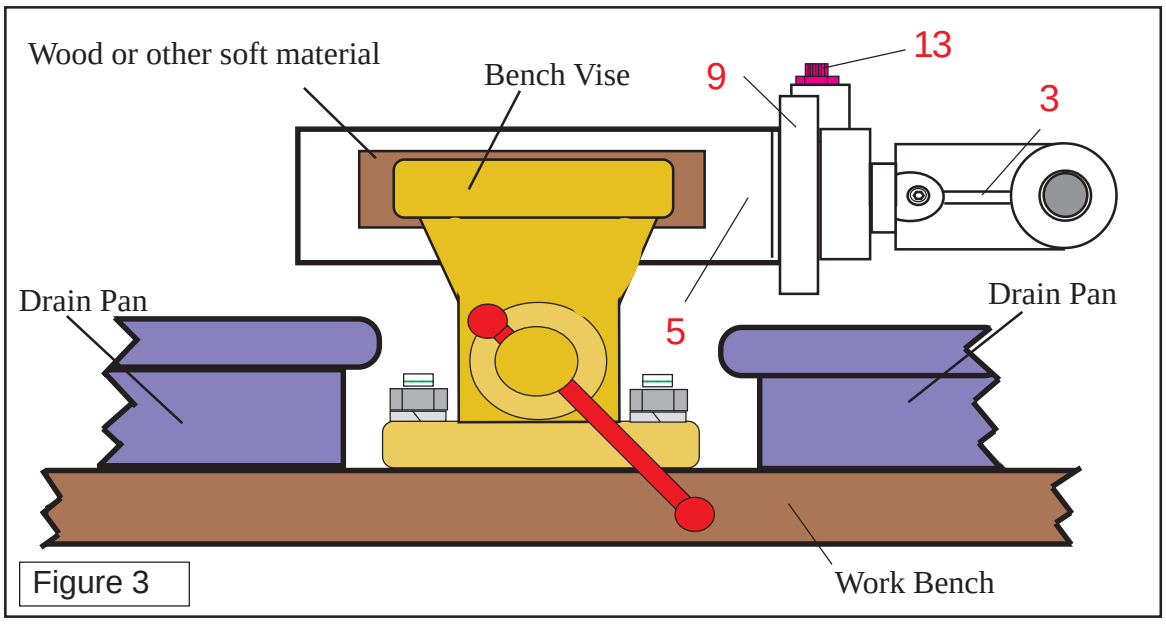


Figure 3

7. Remove the plastic plug (figure 3 item 13) from the cylinder head. With cylinder head, piston, cylinder rod and cylinder rod clevis assembly removed from the barrel, the barrel can be removed from the vise, the drain pans can be set aside (see figure 3).
8. Clamp the cylinder rod, cylinder head and piston assembly into the vise (see figure 4). When clamping the cylinder rod clevis into the vise make certain to clamp it as shown (figure 4). the clevis must be clamped as shown or the clevis could be damaged by bending the ears of the clevis.
9. Slide a block of wood (figure 4 wood support block) between cylinder rod and work bench, insert a material between block (figure 4 soft non-scratching material) and the cylinder rod, this will protect the cylinder rod from damage. Use a strap wrench to hold the cylinder rod (figure 4 strap wrench) to hold the cylinder rod from turning while screwing the piston nut (figure 4 piston nut) off the piston nut is RH Thread locknut.

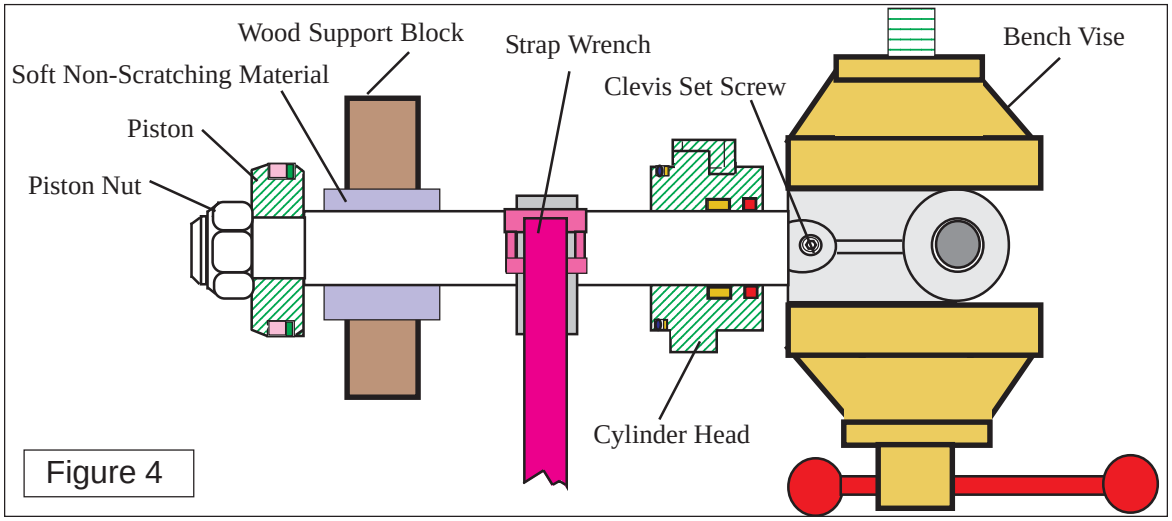


Figure 4

10. Remove piston nut (figure 4 & 5), the Piston from the cylinder rod. Move the support block and the strap wrench (figure 4 & 5) Slide the cylinder head down the cylinder rod and off (figure 5)
11 remove the setscrew from the cylinder rod clevis (figure 4 clevis set screw). There is a nylon thread protector under the setscrew to protect the thread on the cylinder rod, it will most likely stay in the threaded hole (see figure 5). The cylinder rod will screw out of clevis, it has RH threads, if it cannot be turned by hand DO NOT use any type of tool that will damage the cylinder rod. Use a strap wrench that only uses the strap to grab the rod (see figure 4& 5). Screw the cylinder rod completely out of the clevis.

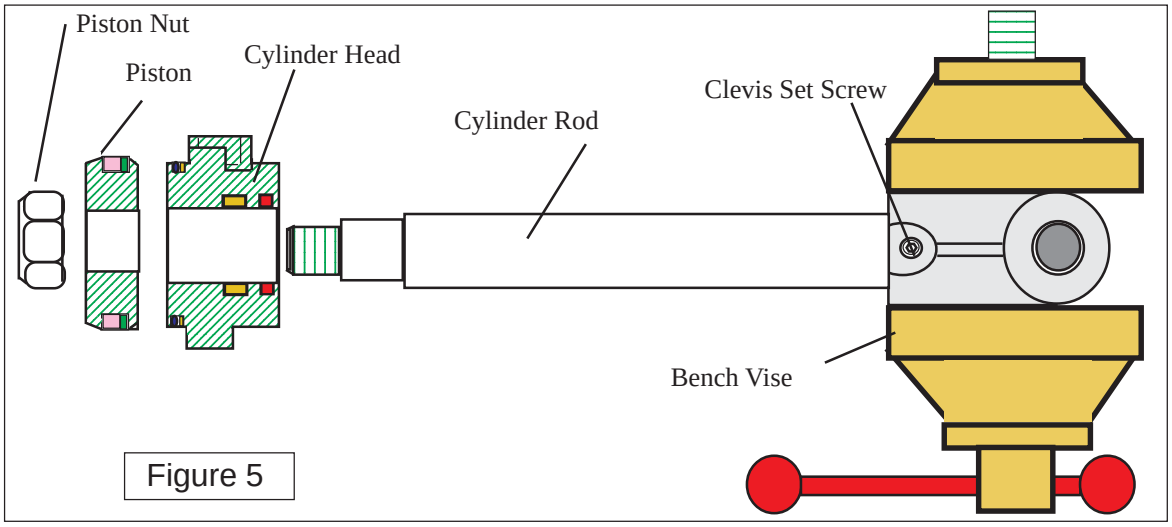


Figure 5

STANDARD AXLE LIFT CYLINDER REPAIR

Clean & Inspect Cylinder Components: (Axle Lift Cylinder, Standard)

1. Clean and inspect parts (figure 6), check cylinder components, look for wear, operation damages, condition of materials. Make certain the piston, cylinder rod, barrel, base clevis, cyl head, rod clevis, tie-rods and nuts, clevis set screw, cylinder rod. Remove the old seals and seal components (figure 4, 5 & 6). Inspect the tie-rods and the tie-rod hex nuts. The tie-rods may need the threads cleaned and/or straightened.
2. All components cleaned and inspected, replace any damaged parts.The Piston Locknut (figure 6 item 14) is recommended that it be replaced with new locknut of same rating. Make a note of which way the seals are installed and in what order. Remove all old seals and replace them with new ones (see figure 6), The nylon thread protector will need to be removed from the rod clevis and replaced (figure 6 item 2).
3. After the seals have been removed inspect all of the grooves where seal seat for condition, make certain none are bent or distorted, they should not have any damage or wear severe enough to damage seals. Check for wear, the ID of the barrel (figure 6 item 5), OD of the piston (figure 6 item 15), ID of the cylinder head (figure 6 item 9).

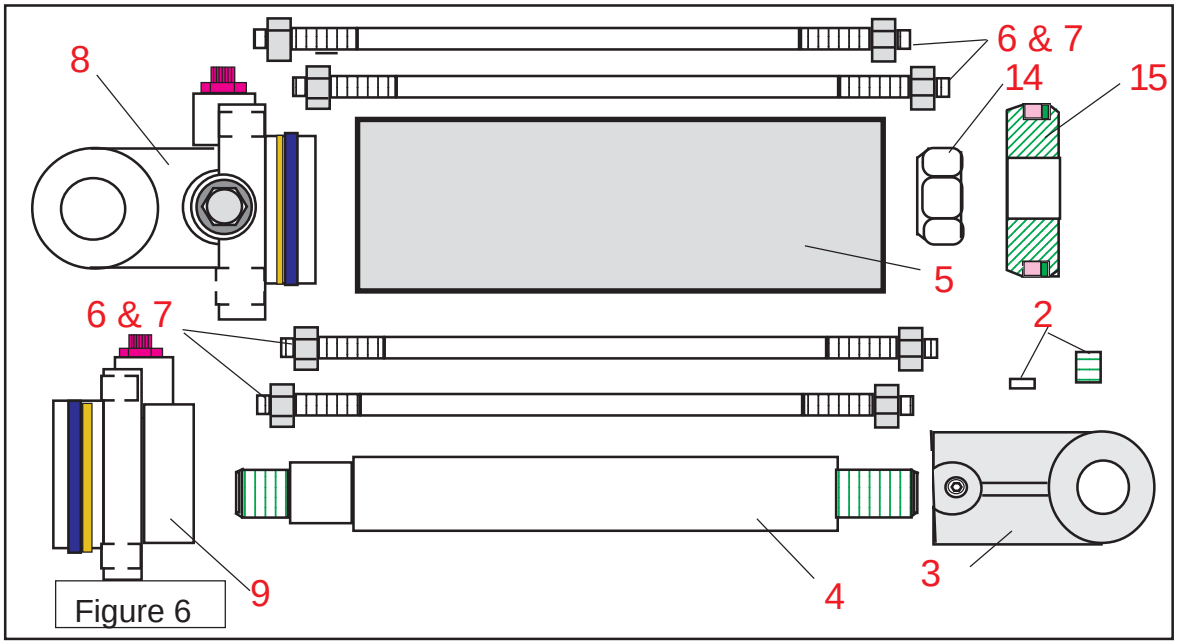


Figure 6

Cylinder Re-Assembly: (Axle Lift Cylinder, Standard)

1. Clamp cylinder rod clevis into bench vise (figure 6 item 3 see figure 7). Make certain the old nylon seal protector has been removed before attempting to screw cylinder rod into clevis. (figure 6 item 2). Using a strap wrench if needed screw the cylinder rod (figure 6 item 4) into the clevis (figure 6 item 3), tighten rod until it is screwed in flush with cylinder rod (see figure 7). Important! DO NOT install nylon thread protector or setscrew (figure 6 item 2) into clevis at this time, it is best to do this later after piston and piston nut has been installed.
2. Replace the seals in the cylinder head (figure 6 item 9), base clevis (figure 6 item 8) and piston (figure 6 item 15) . Make certain to put the seal on in the correct order (figure 6 & 7).
3 Installing the Piston on the cylinder rod (figure 6 & 7 item 15) may require a press, DO NOT try to press piston onto cylinder rod with the piston nut. Use Locktite 271 or equivalent when pressing piston onto cylinder rod. Make certain piston and rod are in alignment when pressing piston, make certain piston and rod are protected from damage.

4. Install the new Piston retaining locknut (figure 6 & 7 item 14) onto the cylinder rod. (Note it is not recommended that old locknut be reused). Before tightening the locknut down make certain that piston is seated onto cylinder rod completely, this can be done by visually inspecting back side of piston against shoulder of cylinder rod. Torque Piston Locknut 300 ft lbs (based on 1" locknut). When tightening piston locknut if support for cylinder rod is needed (see figure 4).

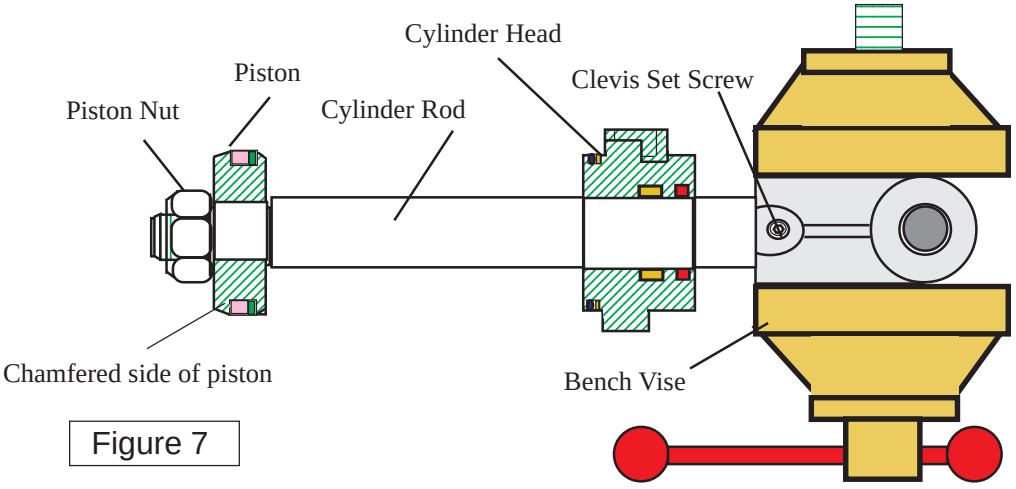


Figure 7

5. Install the new nylon thread protector (figure 6 item 2) into the cylinder rod clevis (figure 6 item 3), Make certain the nylon thread protector is laying flat in the bottom of the threaded hole in the clevis. Insert the setscrew (figure 6 item 2) into the clevis (figure 6 item 3). Tighten the clevis setscrew to 20 ft. lbs.

6. Clamp the barrel (figure 8 item 5) in vise using wood or other soft material to protect barrel (see figure 8), DO NOT tighten vise so tight that the barrel becomes distorted. Make note that the mark that was made to identify which end of the barrel was the rod end is verified. Coat the inside of the barrel with hydraulic oil.

7 Coat the piston, cylinder rod, cylinder head seals with hydraulic oil. Holding the rod, clevis, cylinder head and piston as an assembly. (see figure 7) slide the assembly into the barrel. Make certain that the insertion is on the same end as when it was removed (Not required only recommended). Make certain the port of the cylinder head (figure 8 item 9) is pointing up as shown this will make certain of port alignment when base end of cylinder is installed.

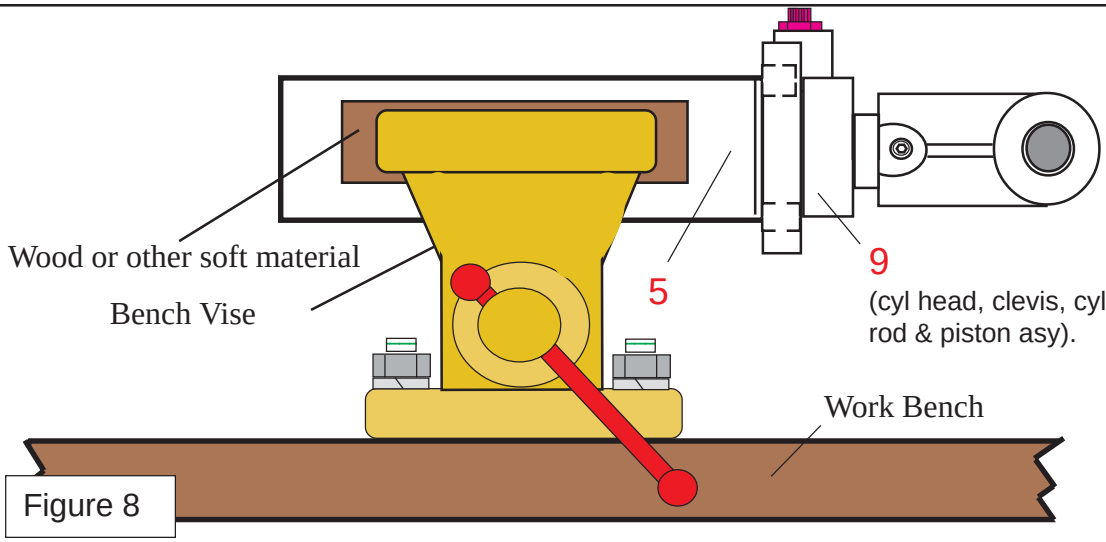


Figure 8

8. Install the new nylon thread protector (figure 6 item 2) into the cylinder rod clevis (figure 6 item 3), Make certain the nylon thread protector is laying flat in the bottom of the threaded hole in the clevis. Insert the setscrew (figure 6 item 2) into the clevis (figure 6 item 3). Tighten the clevis setscrew to 20 ft. lbs (base on 3/8" setscrew).

9. Coat the cylinder base barrel seals (figure 6 & 9 item 8) with coat of hydraulic oil. Install the cylinder base end into the barrel (see figure 9). If plastic plug is installed in base end as shown (see figure 9) it will allow the insertion of the base end into the barrel if plug is removed. Make certain that the ports on the base end are aligned with thew cylinder head as shown (see figure 9 item 8 & 9), the ports must be aligned this way.

10 Install cylinder tie-rods (figure 9 item 6 & 7), make certain that the hex nuts that were left on the tie-rod is loose. Insert the tie- rods (qty 4) and the hex nuts (qty 8) onto the tie-rods. The hex nuts must be screwed on at the same rate and on each end, try to keep the same amount of threads sticking out the nuts on both ends of the tie-rods. Snug the nuts down an all 4 tie rod evenly and alternating as to keep the same amount of pressure evenly. Torque the tie-Rod nuts to 80 ft. lbs (based on a 1/2" tie-rod).

11. Install the vent plug into the cylinder head port (figure 9 item 9) at the Rod End of cylinder. Install the hydraulic elbow adapter to the base end of cylinder (figure 9 item 8). Note; plug the open end of the hydraulic adapter until time to connect the hose to it.

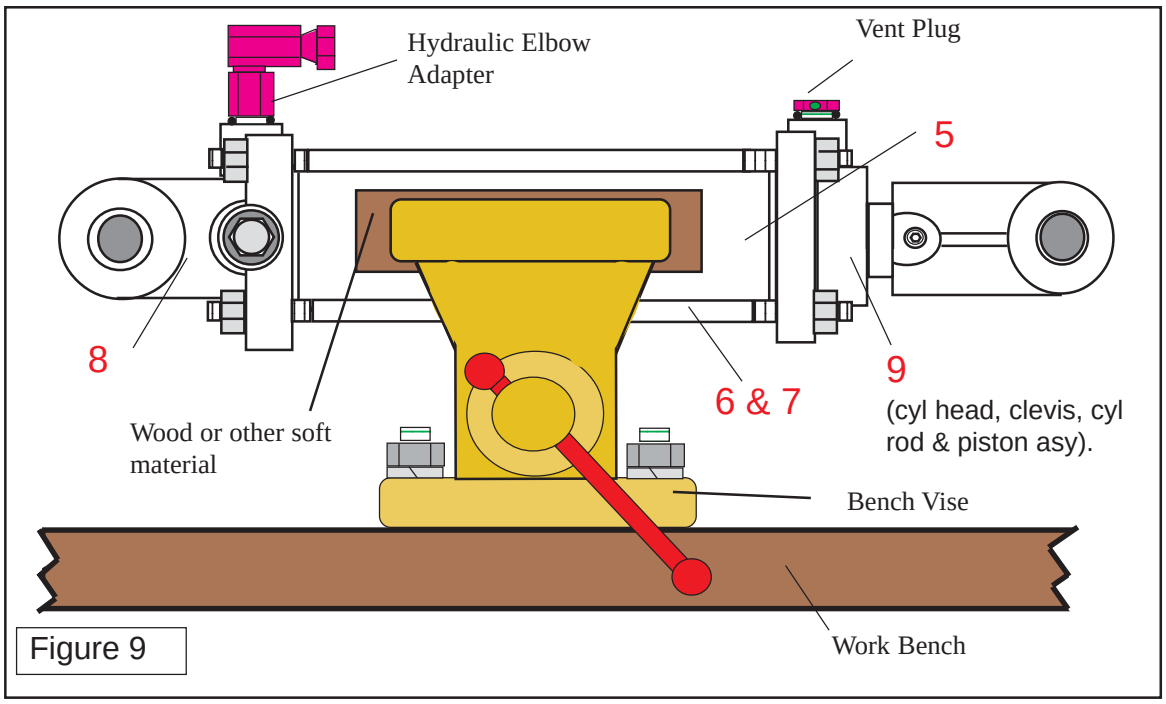


Figure 9

12. Install the cylinder onto mower, Mount the cylinder with the base end (figure 9 item 8) to the deck lug. Mount the cylinder head / rod end (figure 9 item 9) of the cylinder to the axle lug. When first using the rebuilt and/or new cylinder it is not unusual for a light amount of oil to be pushed out of the vent. The amount is the amount that was used to oil components during assembly. If excessive amount leaks through the vent, cylinder is not functioning properly. Recheck the assembly steps for possible assembly error.

NOTES

AXLE LEVEL LIFT CYLINDERS, OPTIONAL SERVICE & REPAIR

IMPORTANT NOTE:

SEE HYDRAULIC SCMATIC AT THE BEGINNING OF THIS SECTION !

This system will use a cylinder on the center axle and a cylinder on each wing axle. These cylinder are connected in series and must be connected in a special way to function properly, See hydraulic schematic for the hose connectors and cylinder mounting sequence for this type of application.

These are rephasing cylinders and each cylinder is different bore size. (15 foot model) = Center cylinder is 3-1/2" bore, Right wing is 3-1/4" bore and Left wing is 3" bore. (10 foot model) = center cylinder and right wing cylinder only Cylinder must be installed in this order and hydraulic lines must be connected in this order, see hydraulic schematics on previous pages.

Cylinder barrels must be installed in the same direction as removed when re-assembled. The machined groove (pressure bypass groove) on the ID of the barrel must always be installed with machined grove on the rod end of cylinder.

Hydraulic lines must be connect to largest bore cylinder, then medium sized then small cylinder.

Return line from smallest cylinder to hydraulic oil supply works best if the return line is connected to the (optional) auxiliary remote control valve pressure return line. If tractor remote is used for cylinder supply/ control, the return line should be connected direct to the oil reservoir and below the oil level to prevent air from enter the re-phasing cylinder on the return side.

OPTIONAL AXLE LEVEL LIFT CYLINDER REPAIR

Cylinder Removal: (Axle Level Lift Cylinders -Optional)

1. Make Certain axles and wings are in the lowered position before disconnection any component. **Make certain** tractor is securely parked with brakes set. **Make certain** tractor engine is in off position and key secured to prevent starting. It is recommended mower be disconnected from tractor and/or battery cable be removed from battery while repairs are being made. Front and rear of mower must be securely supported on strong jackstands before hydraulic lines or cylinder mounting pins of the axle hydraulic assembly are disconnected.
2. **Make certain** that all hydraulic pressure has been released from lines after wings and axles have been completely lowered. This may require the tractor hydraulic controls and / or remote control valve be worked to release hydraulic pressure. NEVER disconnect any cylinder hydraulic hose's or fittings if all mower components (wings and deck) are not resting in the completely lowered to the ground position or supported on jackstand position.
3. Do not remove cylinder pressure hose before the cylinder is dismounted from deck. Remove the cylinder mounting pins (figure 1 item 1), this allows the cylinder to be raised upward off the deck mounting lug and the axle lug. Place a drain pan under the pressure hose to catch the hydraulic oil when hose is disconnected. Drain cylinder and hose into drain pan. Plug the pressure hose and cylinder to keep contamination out of them.
4. Plug all openings in cylinder before cleaning the cylinder. Base end of cylinder (figure 1 item 8) will have two ports, Pressure in hose port (figure 1 item 11) and second plugged port on side (figure 1 item 12) which should still be in the cylinder base. The other port on the cylinder head is the bypass pressure out port.
5. **IMPORTANT!** These cylinders must be marked so the barrels will be rassembled with the bypass grooves in the rod end, or the repair technician must keep in mind that the barrel end with the groove machined into the ID must always be assembled with groove to the rod end.

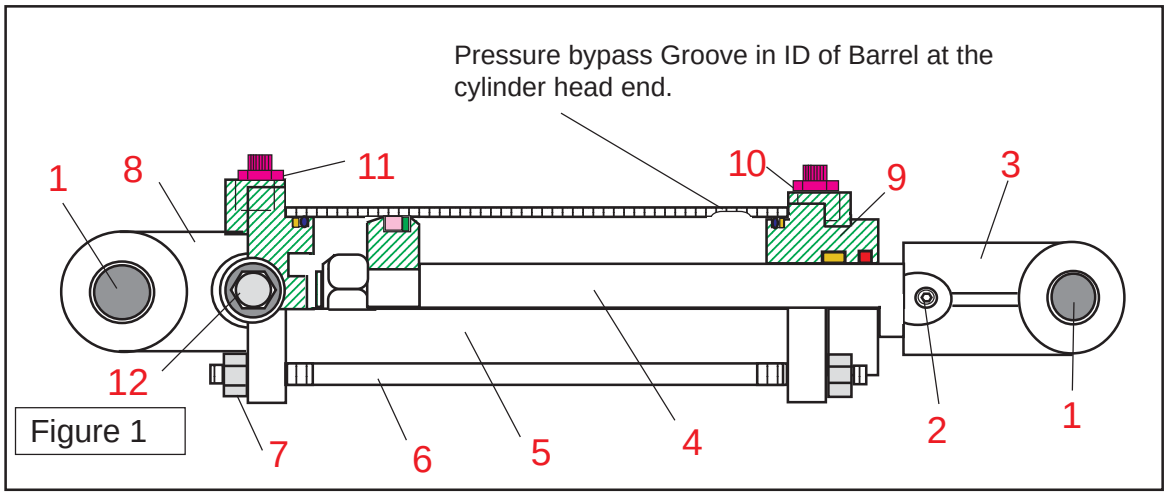


Figure 1

Cylinder Dis-Assembly: (Axle Level Lift Cylinders Optional)

1. This is a Tie-Rod construction type cylinder, the four tie-rods (figure 1 item 6) and the 8 hex nuts (figure 1 item 7) bolt the cylinder together. When these tie-rods are unbolted the cylinder will come apart with minimum effort but DO NOT unbolt tie-rods until later. It is a must that the barrel of the cylinder be marked as to which end is the cylinder rod end and which is the cylinder base clevis end and the barrel reassembled on the same end as removed.
2. Place the cylinder in a bench vise (figure 2), use pieces of wood or other soft material between vise jaws and cylinder barrel. DO NOT over tighten vise and distort the shape of the barrel, vise only needs to be tightened enough to hold cylinder.

OPTIONAL AXLE LEVEL LIFT CYLINDER REPAIR

3. Place drain pans under cylinder to catch hydraulic oil that may still be in cylinder (figure 2 Drain Pans). Using ratchet w/ sockets or boxed end wrenches (repair technicians choice) remove the tie-rod hex nuts (figure 2 item 7). The tie-rods have a hex nut on each end (figure 2 item 7), not all the hex nuts will screw off on the same side. The hex nut with the least amount of resistance is going to screw off. This is OK as the tie-rods can be pulled out from either direction.
4. When a hex nut has been removed from each tie-rod (it will not matter which end of tie-rod) pull the tie rods out from the cylinder base and cylinder head (figure 2 item 6). There are a total of 4 tie-rods that will need to be removed (see figure 3).

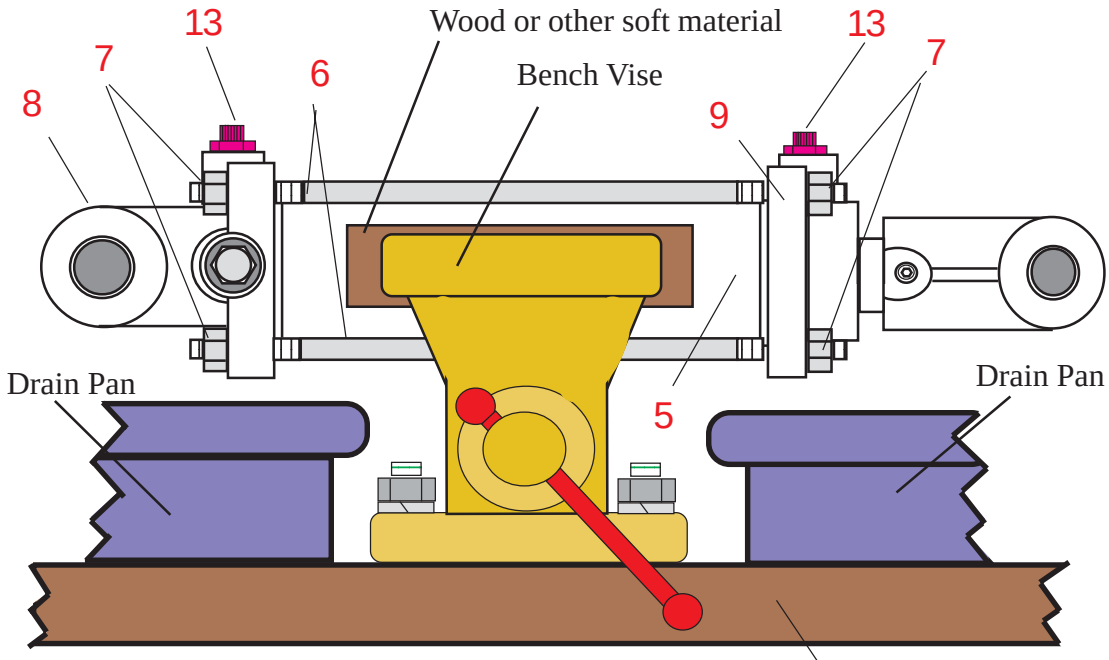


Figure 2

5. Remove the cylinder Base end cap (figure 2 Item 8). To remove the cylinder base end cap use a small brass (soft metal hammer) tap the base end cap until it slide out of the cylinder barrel (figure 2 item 5). The base end of the cylinder will now be open (See figure 3).
6. Remove the cylinder head (figure 3 item 9). Pull the cylinder rod out from inside barrel approx 2 inches by pulling on the cylinder rod clevis (figure 3 item 3). Using a brass (soft metal) hammer tap the barrel side of the cylinder head (figure 3 item 9). Cylinder head will slide out of barrel, when the shoulder of the cylinder head comes out of the barrel, pull the cylinder clevis (figure 3 item 3). The cylinder rod clevis, cylinder rod, cylinder head, piston and piston nut will all pull out as an assembly when pulled from the barrel (see figure 4).
7. Remove the plastic plug (figure 3 item 13) from the cylinder head. With cylinder head, piston, cylinder rod and cylinder rod clevis assembly removed from the barrel, the barrel can be removed from the vise, the drain pans can be set aside (see figure 3).
8. Clamp the cylinder rod, cylinder head and piston assembly into the vise (see figure 4). When clamping the cylinder rod clevis into the vise make certain to clamp it as shown (figure 4). the clevis must be clamped as shown or the clevis could be damaged by bending the ears of the clevis.
9. Slide a block of wood (figure 4 wood support block) between cylinder rod and work bench, insert a material between block (figure 4 soft non-scratching material) and the cylinder rod, this will protect the cylinder rod from damage. Use a strap wrench to hold the cylinder rod (figure 4 strap wrench) to hold the cylinder rod from turning while screwing the piston nut (figure 4 piston nut) off the piston nut is RH Thread locknut.

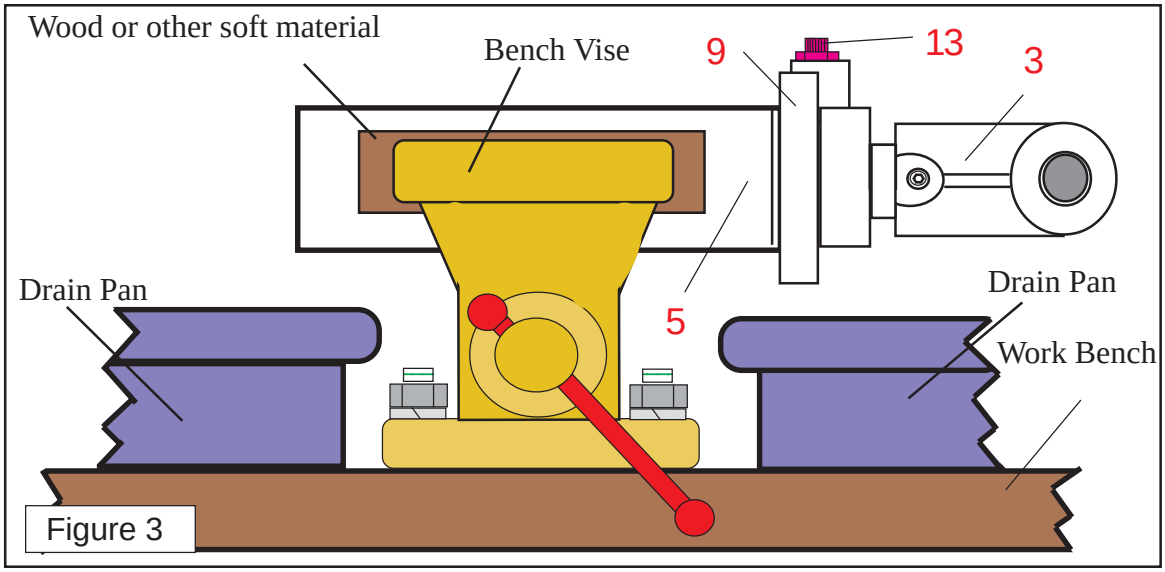


Figure 3

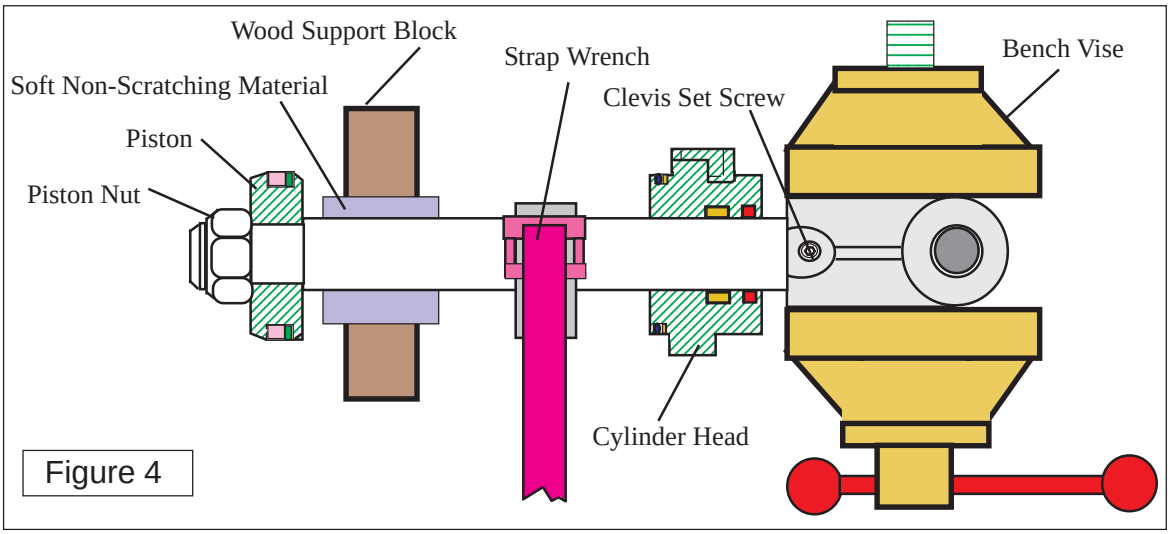


Figure 4

10. Remove piston nut (figure 4 & 5), the Piston from the cylinder rod. Move the support block and the strap wrench (figure 4 & 5) Slide the cylinder head down the cylinder rod and off (figure 5)

11 remove the setscrew from the cylinder rod clevis (figure 4 clevis set screw). There is a nylon thread protector under the setscrew to protect the thread on the cylinder rod, it will most likely stay in the threaded hole (see figure 5). The cylinder rod will screw out of clevis, it has RH threads, if it cannot be turned by hand DO NOT use any type of tool that will damage the cylinder rod. Use a strap wrench that only uses the strap to grab the rod (see figure 4& 5). Screw the cylinder rod completely out of the clevis.

Clean & Inspect Cylinder Components: (Axle Level Lift Cylinder Optional)

1. Clean and inspect parts (figure 6), check cylinder components, for wear, operation damages, condition of materials. Make certain the piston, cylinder rod, barrel, base clevis, cyl head, rod clevis, tie-rods and nuts, clevis set screw, cylinder rod. Remove the old seals and seal components (figure 4, 5 & 6). Inspect the tie-rods and the tie-rod hex nuts. The tie-rods may need the threads cleaned and/or straightened.

OPTIONAL AXLE LEVEL LIFT CYLINDER REPAIR

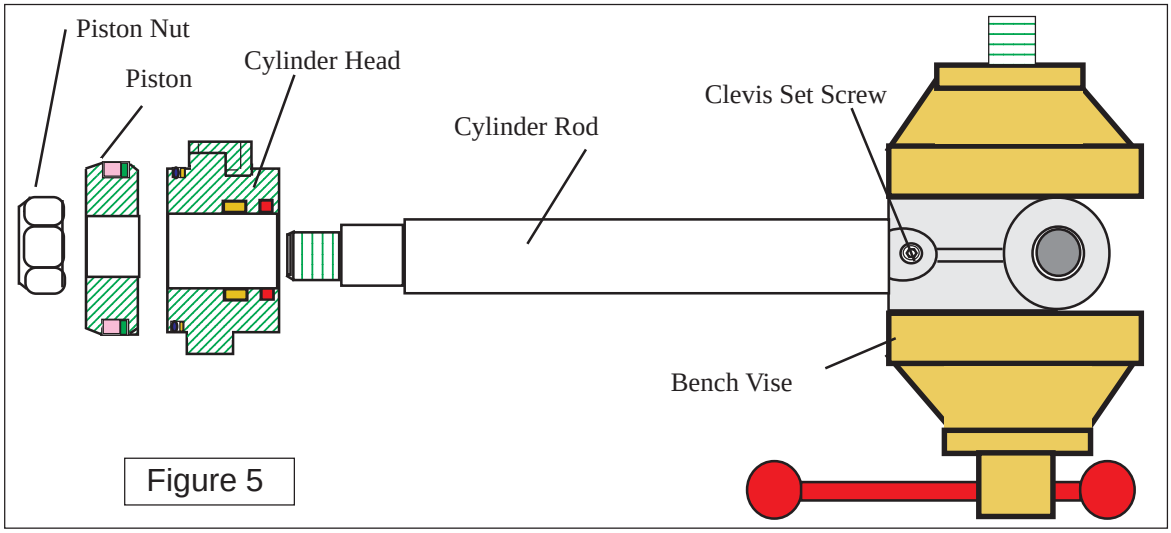


Figure 5

2. After components have been cleaned and inspected, replace any damaged parts. The Piston Locknut (figure 6 item 14) is recommended that it be replaced with new locknut of same rating. Make a note of which way the seals are installed and in what order. Remove all old seals and replace them with new ones (see figure 6), The nylon thread protector will need to be removed from the rod clevis and replaced (figure 6 item 2).
3. After the seals have been removed inspect all of the grooves where seal seat for condition, make certain none are bent or distorted, they should not have any damage or wear severe enough to damage seals. Check for wear, the ID of the barrel (figure 6 item 5), OD of the piston (figure 6 item 15), ID of the cylinder head (figure 6 item 9).
4. Make certain to inspect the ID of the cylinder barrel, the will be a groove machend into the rod end of the barrel that will allow the hydraulic oil to bypass from the 1 st cyl to the 2nd cyl and onto the 3 rd cyl, the rod end of the 3 rd cylinder has a goove machined into the rod end which allows the hydraulic oil to bypass and return thr hydraulic resrvoir of the tractor.

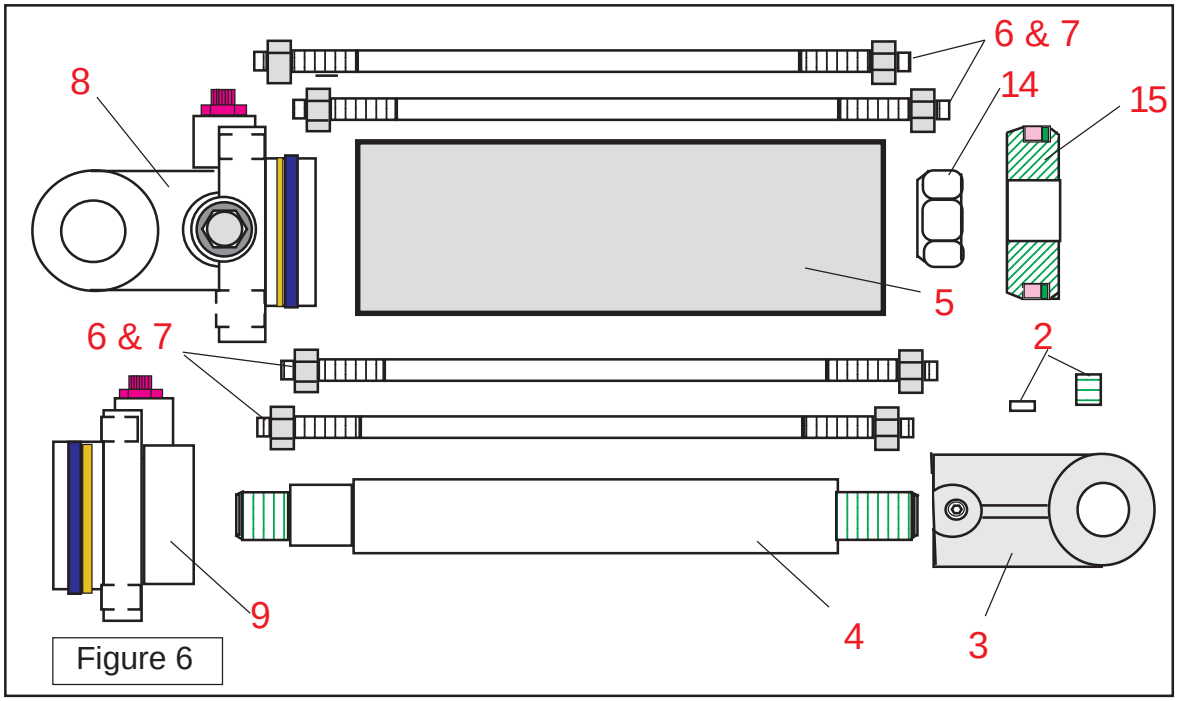


Figure 6

OPTIONAL AXLE LEVEL LIFT CYLINDER REPAIR

Cylinder Re-Assembly: (Axle Level Lift Cylinders, Optional)

1. Clamp cylinder rod clevis into bench vise (figure 6 item 3 see figure 7). Make certain the old nylon seal protector has been removed before attempting to screw cylinder rod into clevis. (figure 6 item 2). Using a strap wrench if needed screw the cylinder rod (figure 6 item 4) into the clevis (figure 6 item 3), tighten rod until it is screwed in flush with cylinder rod (see figure 7). Important! DO NOT install nylon thread protector or setscrew (figure 6 item 2) into clevis at this time, it is best to do this later after piston and piston nut has been installed.
2. Replace the seals in the cylinder head (figure 6 item 9), base clevis (figure 6 item 8) and piston (figure 6 item 15) . Make certain to put the seal on in the correct order (figure 6 & 7).
3 Installing the Piston on the cylinder rod (figure 6 & 7 item 15) may require a press, DO NOT try to press piston onto cylinder rod with the piston nut. Use Locktite 271 or equivalent when pressing piston onto cylinder rod. Make certain piston and rod are in alignment when pressing piston, make certain piston and rod are protected from damage.
4. Install the new Piston retaining locknut (figure 6 & 7 item 14) onto the cylinder rod. (Note it is not recommended that old locknut be reused). Before tightening the locknut down make certain that piston is seated onto cylinder rod completely, this can be done by visually inspecting back side of piston against shoulder of cylinder rod. Torque Piston Locknut 300 ft lbs (based on 1" locknut). When tightening piston locknut if support for cylinder rod is needed (see figure 4).

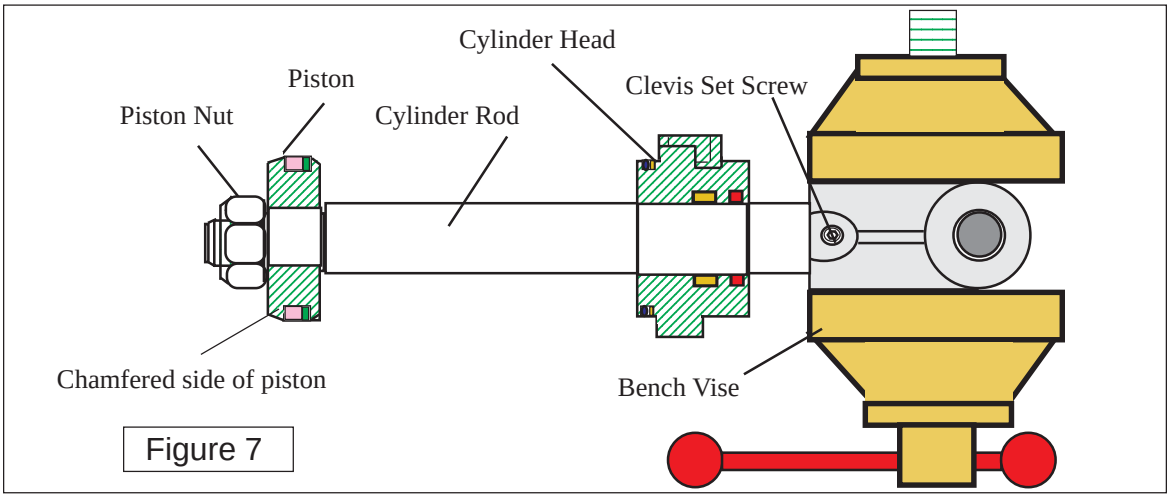


Figure 7

5. Install the new nylon thread protector (figure 6 item 2) into the cylinder rod clevis (figure 6 item 2), Make certain the nylon thread protector is laying flat in the bottom of the threaded hole in the clevis. Insert the setscrew (figure 6 item 2) into the clevis (figure 6 item 3). Tighten the clevis setscrew to 20 ft. lbs.
6. Clamp the barrel (figure 8 item 5) in vise using wood or other soft material to protect barrel (see figure 8), DO NOT tighten vise so tight that the barrel becomes distorted. Make note that the mark that was made to identify which end of the barrel was the rod end is verified. Coat the inside of the barrel with hydraulic oil.
7 Coat the piston, cylinder rod, cylinder head seals with hydraulic oil. Holding the rod, clevis, cylinder head and piston as an assembly. (see figure 7) slide the assembly into the barrel. Make certain that the insertion is on the same end as when it was removed (Not required only recommended). Make certain the port of the cylinder head (figure 8 item 9) is pointing up as shown this will make certain of port alignment when base end of cylinder is installed.
8. Install the new nylon thread protector (figure 6 item 2) into the cylinder rod clevis (figure 6 item 3), Make certain the nylon thread protector is laying flat in the bottom of the threaded hole in the clevis. Insert the setscrew (figure 6 item 2) into the clevis (figure 6 item 3). Tighten the clevis setscrew to 20 ft. lbs (base on 3/8" setscrew).

OPTIONAL AXLE LEVEL LIFT CYLINDER REPAIR

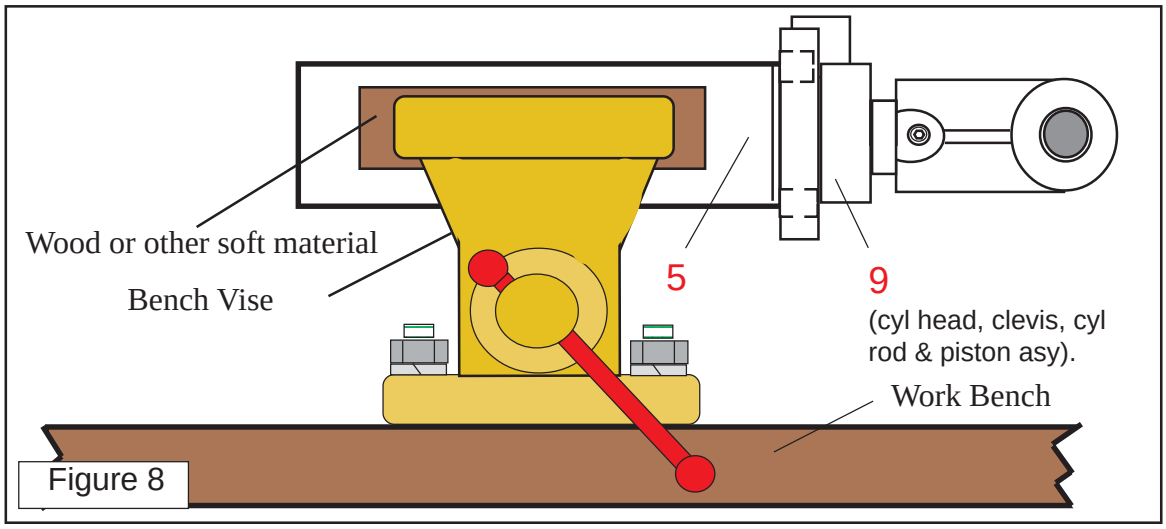


Figure 8

9. Coat the cylinder base barrel seals (figure 6 & 9 item 8) with coat of hydraulic oil. Install the cylinder base end into the barrel (see figure 9). If plastic plug is installed in base end as shown (see figure 9) it will allow the insertion of the base end into the barrel if plug is removed. Make certain that the ports on the base end are aligned with thew cylinder head as shown (see figure 9 item 8 & 9), the ports must be aligned this way.

10 Install cylinder tie-rods (figure 9 item 6 & 7), make certain that the hex nuts that were left on the tie-rod is loose. Insert the tie- rods (qty 4) and the hex nuts (qty 8) onto the tie-rods. The hex nuts must be screwed on at the same rate and on each end, try to keep the same amount of threads sticking out the nuts on both ends of the tie-rods. Snug the nuts down an all 4 tie rod evenly and alternating as to keep the same torque evenly. Torque tie-Rod nuts to 80 ft. lbs. (based on 1/2" tie-rod).

11. Install theHydraulic Elbow Adapters into the cylinder head ports (figure 9 item 8 & 9).

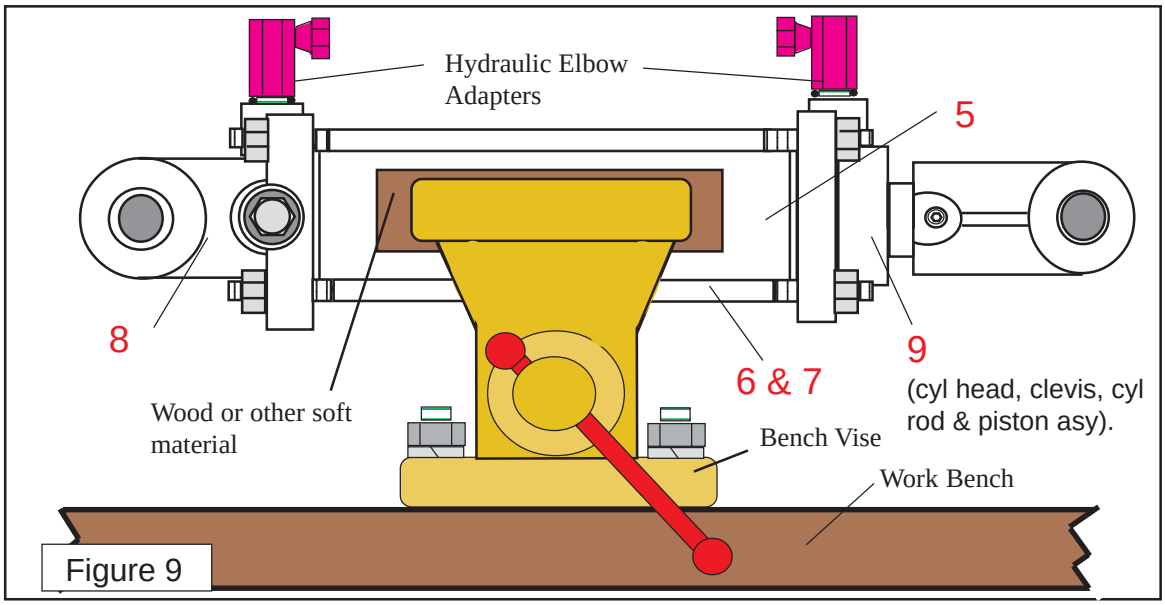


Figure 9

12. Install the cylinder on mower, Mount cylinder with the base end (figure 9 item 8) to the deck lug. Mount cylinder head / rod end (figure 9 item 9) to the axle lug.

OPTIONAL AXLE LEVEL LIFT CYLINDER REPAIR

Cylinder Connections on Mower: (Axle Level Lift Cylinders, Optional)

1. The re-phasing cylinders are connected together starting with the largest and going to the smallest (10 ft model will not use a 3" bore cylinder). These cylinders **MUST** be connected in this order. The cylinders will need to be purged of all air, this can be done by powering cylinder to the full extend position and hold them there until the oil flows through the first cyl to the second cyl, second cyl to the third cyl and third cyl back to the optional remote control valve or tractor reservoir.

These cylinder do not work well as a double action system by connecting the return into the tractor remote return. If connected this way they will work but tend ti get air in them as used over a period of time and may require the air to be purged from system ocasionally., if wings cylinders start to droop chances are they have air in them and need to be purged. Cylinder work best when return to where return line has a constant supply of non-pressere hydraulic oil to allow the cylinder to draw the oil back into the cylinder as the cylinder is collapsed. The return side of the remote three spool valve work very well for this.

If phasing cylinder will not work, check that the cylinders are connected in the correct series (hose routing) according to cylinder bore diameter. Make certain the cylinder were re-assembled correctly with the machined groove in the ID of barrel at the rod end of cylinder, this can be checked by pulling the return line loose and putting it into a clean bucket to catch the oil, run the cylinder all the way to the top. Always keep control of hoses during testing to keep them in something to prevent the oil form spraying. DO NOT test if oil is excessively hot, if you cannot touch the hoses, the oil is to hot. Oil will come out of hose when cylinder is until cylinder is fully extended and keep coming out as long as the control valve is open.

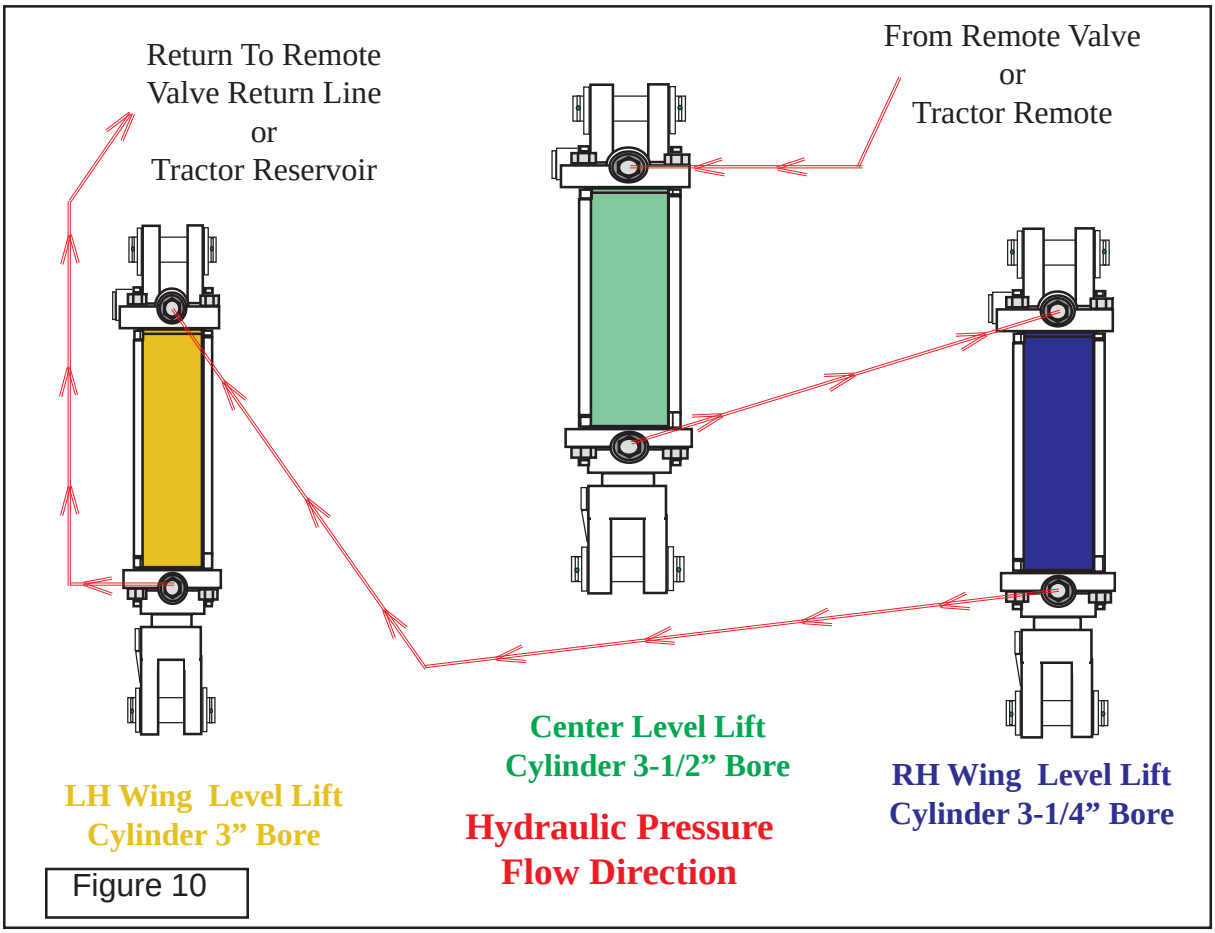


Figure 10

Section 6

HYDRO 15

Hydraulic Tank Repair, Fill & Service

Fill Hydraulic Tank Inspection - Service & Repair

Hydraulic Fluid:

Maintaining the proper level and cleanliness of the oil is very important for the continued trouble-free operation of the mower and should be checked each morning before the mower is started. Check for any leaks and tighten any fittings which may be loose.

1. Clean The Machine - The deck should be cleaned off at least once a day. Remove all foreign material from the deck and structural members. Never allow collected grass and dirt to remain in the deck. This material will decompose forming ammonia compounds which will erode the paint and metal deck. This material is also a source of contamination any time the hydraulic system is opened or service. Keep the deck area clean and always clean before starting any service or repairs..

2. Proper Oil Level - Maintain the oil level within the sight gauge located on the front of the reservoir. Never fill the tank above the sight gauge level. A space is maintained above this sight gauge to allow for the expansion of the oil. (figure 1). Oil is added through the breather cap pressure valve located in the top of the tank. Stand off to one side when removing the breather cap element to prevent possible injury. Remove the breather cap slowly to release any excess air. (figure 2). Remove the pressure cap and add oil. Use one of the following oils: Exxon NUTO H-100; Gulf Harmony 100 AW; or Shell Tellus 100.

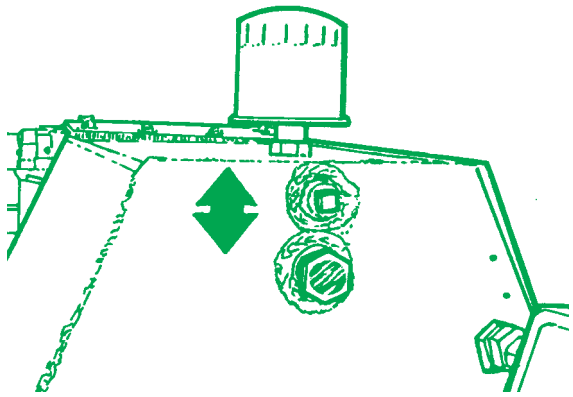


FIGURE 1

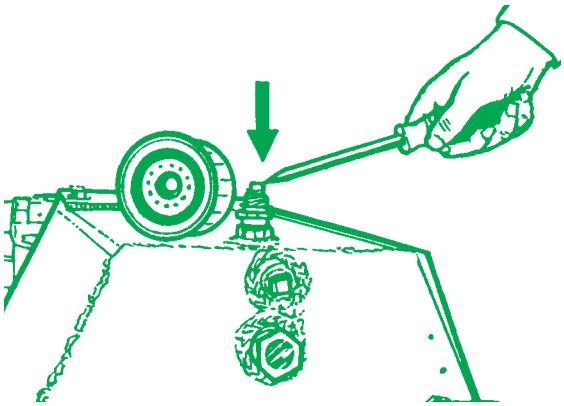


FIGURE 2

3. Oil Level Low - Low oil level in the reservoir is caused by leakage of oil. Locate the area of the leak and repair the leak at once. Loss of fluid can cause severe damage to the hydraulic pump and motors (figure 1).

   NOTE: After the first day of operation the mower may require more oil to bring the oil level back into the sight gauge. This is normal. Air trapped in the lines and tanks was displaced by the oil, causing the oil level to go down (figure 2)

4. Filter Change - After the first 25 hours of operation change the oil filters. Replace the oil filters with a new one Thereafter, replace these filters every 500 hours. The return gauges should always be in the green color of gauge (figure 3)

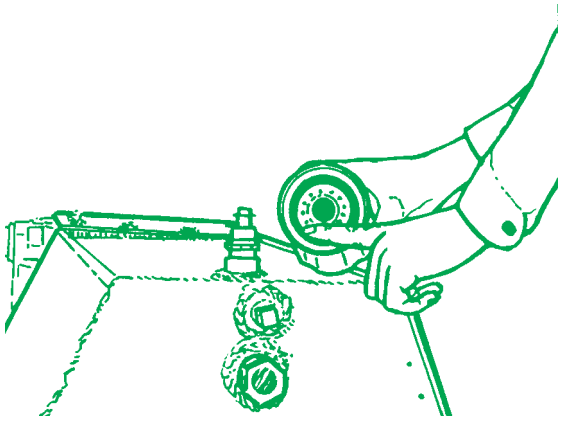


FIGURE 3

Fill Hydraulic Tank Return Filters - Service & Repair

Hydraulic Tank:

Hydraulic tank is bolt on assembly, hydraulic tank houses return filters (figure 4 & 6), oil level sight glass and two return oil pressure gauges. The filler cap is a breather type. The center section returns through the back filter and the wings return through the front filter. Each filter will have a return pressure gauge (figure 4 & 5).

1. Clean The Machine - The deck and hydraulic tank should be cleaned off at least once a day. Remove all foreign material from the deck, Tank and structural members. Never allow collected grass and dirt to remain in the deck or around the hydraulic tank. This material will decompose forming ammonia compounds which will erode the paint and metal deck it will also prevent the tank & oil cooling tubes from dissipating heat efficiently. This material is also a source of contamination any time the hydraulic system is opened or service. Keep the deck area clean and always clean before starting any service or repairs.

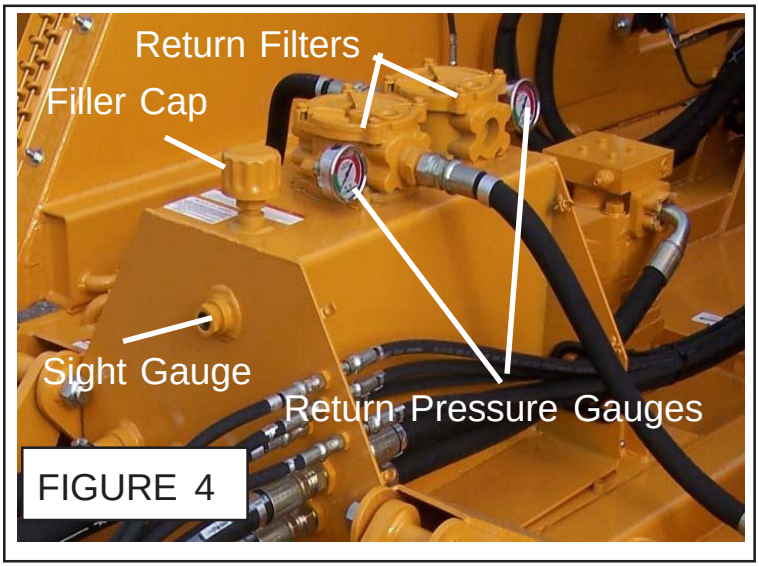


FIGURE 4

2. To change filter cartridge it is not required to unbolt filter assembly from tap. It will require the removal of the filter housing cover (figure 6) by unbolting the filter cover bolts (figure 6). There is a spring under the cover that presses down against the filter cartridge, hold down on the filter cover as you unbolt it. Lift the cover off and the spring under it. Hold a small drain pan as close to the filter housing as possible, this will allow you to pull the filter cartridge straight up out of housing and move it over the drain pan as quickly as possible. This will limit the amount oil leaking down on tank and deck.

3. Return filter gauge is low pressure gauge. It will read high (in the red) when oil is cold and unit is first started. Run unit at lower RPM until oil reaches normal operating temperature. Recheck gauge, the return should be reading in the green, if it is not check system for blockage or other problem restricting the return flow. NEVER connect the pressure side direct to the colling tubes on deck, this will damage them.

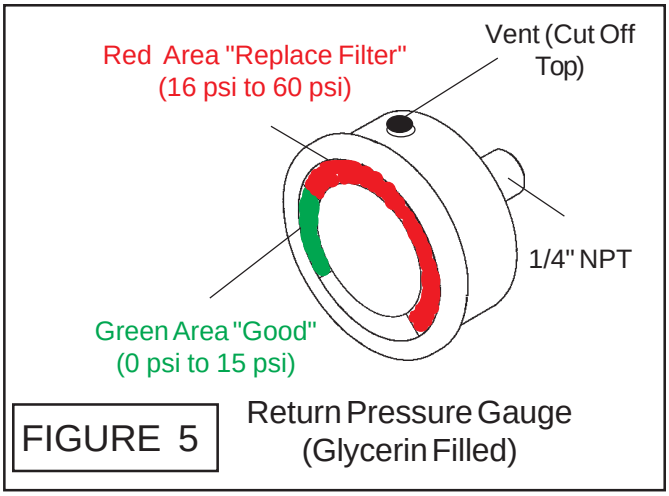


FIGURE 5 Return Pressure Gauge (Glycerin Filled)

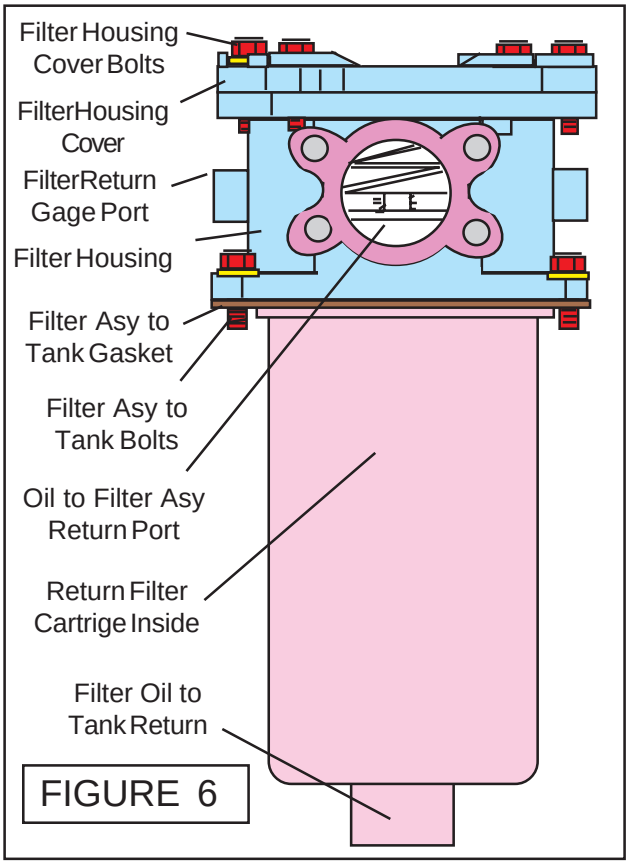


FIGURE 6

Fill Hydraulic Tank

Fill Hydraulic Tank with Oil:

1. DO NOT START TRACTOR until you have filled Hyd Oil Tank to a level as shown in Sight Glass gauge. DO NOT perform any maintenance service or repairs to hyd system until the mower has been cleaned of all debris. If new or rebuilt pump has been installed, fill the Suction Hose to Pump with Oil.

2. Remove Filler Cap. Remove Filler cap only when ready to fill hydraulic Tank with Oil. Do Not leave the Cap off and the system Open, always keep sytem closed when possible. Avoid any oil contamiantion (figure 4).

3. Avoid Hydraulic Contamination by filtering the Hyd Oil while filling the Hydraulic Tank. Filter buggies or carts are commercially available for Hydraulic system clean-up and Oil transfer. These consist of high capacity filter, a Circulating Pump, a Drive Motor and hoses for connecting to the units hydraulic system. When adding Oil always use Clean new Oil from a sealed container, If you suspect the Oil of being contaminated don't use it. (figure 5 & 6). It is best to always use a filter system when adding even new oil.

4. When adding Oil in the field keeping it clean is critical, do not use dirting funnels or hoses. Do Not open Hydraulic tank or any contaners unless the openings have been cleaned first. The outside of the containers must be clean. If a windy dusty day do not fill and allow dirt to blow into oil. Always add Oil using a pump systemwith at least a 10 Micron filter system. (figure 7)

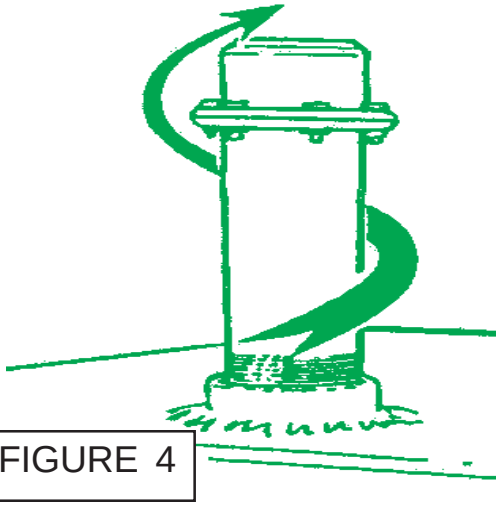


FIGURE 4

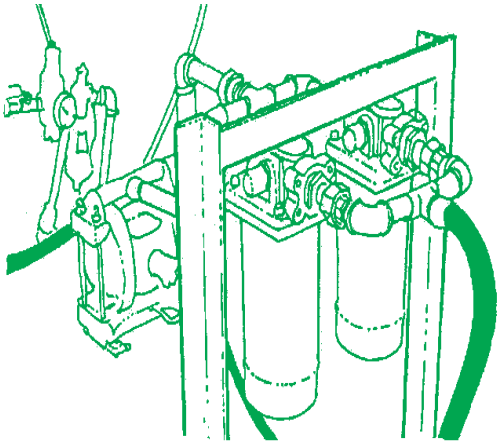


FIGURE 5

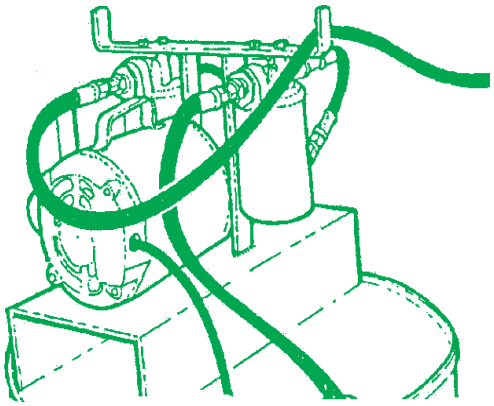


FIGURE 6

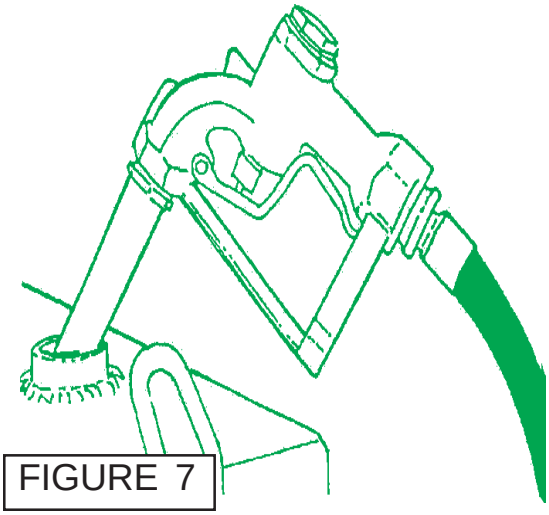


FIGURE 7

Fill Hydraulic Tank

Fill Hydraulic Tank with Oil:

5. Fill Tank. Fill the Hydraulic Tank (figure 7) Fill tank till the Oil is visable in the sight Gauge (figure 8, 9 & 11). This will fill tank for the start but it will have to filled again later.

6. Fill Suction Hose with Oil. Remove the Suction Hose at the Tank (figure 9) and fill the hose with clean oil, THIS IS A MUST DO. The Suction Hose must be filled with Oil to prevent Dry strat up of Pump. Dry start up of PUMP will damage the Pump. After filling suction Hose reinstall it and tighten down Hose Clamp. (figure 10)

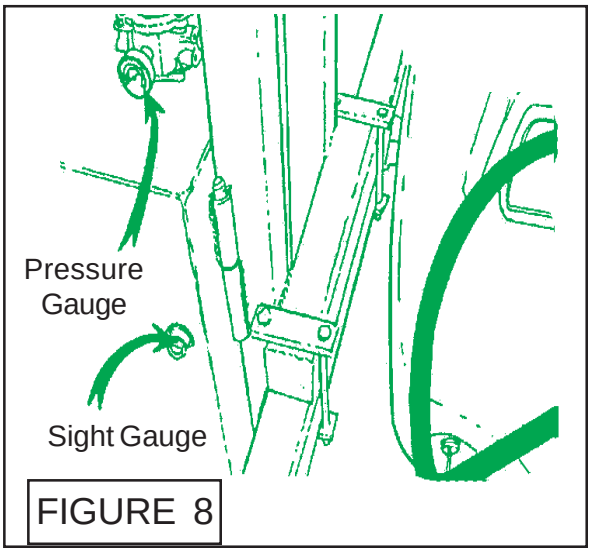


FIGURE 8

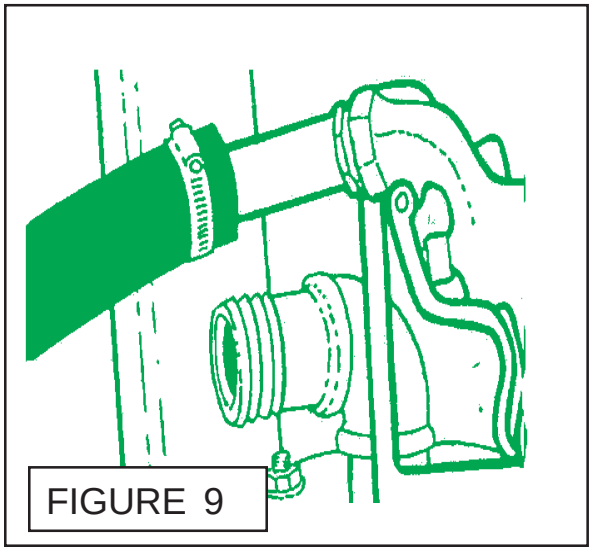


FIGURE 9

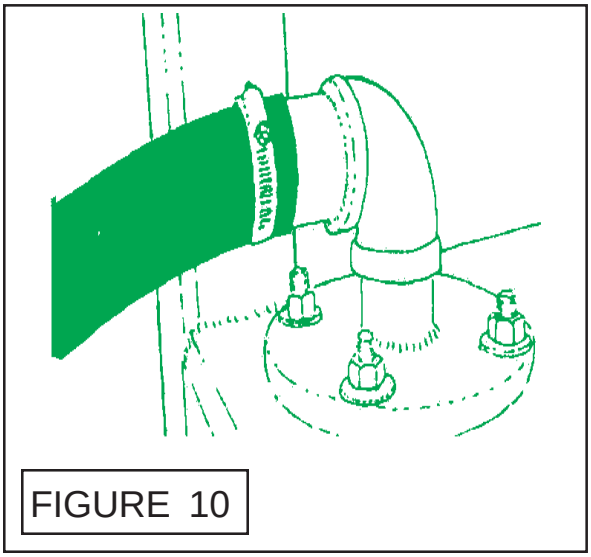


FIGURE 10

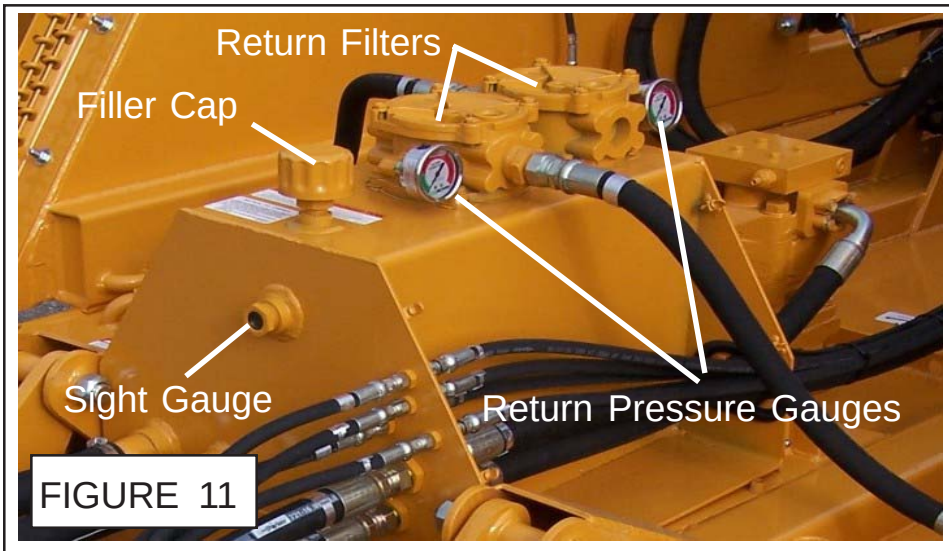


FIGURE 11

NOTES

Section 7

HYDRO 15

Speed Increaser Service & Repair

Attach Mount Plate, Speed Increase and Pump To Tractor:

Important!

To attach the Speed Increaser and pump to the tractor will require a mount kit designed for the type tractor that unit is being connected to, There is a universal mount kit available that will need to be modified to fit a particular tractor. These modifications will require the service technician to determine what modifications are needed. Modifications to the universal kit will be at customers expense and design. Shown in this section are the general instructions to mount the speed increaser to the tractor, some of the tractor specific mount kits may need modification because of tractor accessories or options. When making any modifications to the speed increaser mount kit the speed increaser must be kept in alignment with the PTO shaft of the tractor.

1. Secure tractor in a safe area and secure tractor in a safe parked position (see Tractor manufactures instructions for safely parking the tractor). NEVER work on tractor with it running or any hydraulic components in the unsupported lifted position.

2. Read through the entire instruction section before attempting to install speed increaser or mounts.

3. The speed increaser mount plate needs to be mounted so that the existing bolts holes are centered around PTO Shaft. Remove any existing shield, support plates and center linkage arms or supports that are in the way. Be sure and save all of these parts that are removed in case they are needed on the tractor in the future.

4. The mount plate should be mounted directly to the tractor using existing bolt holes or studs on the rear of the tractor. These bolts or studs should be at least 1/2" in diameter in order to give full support. Mount the speed increaser to the mount plate with the bolts and spacer provided. Slip the assembly onto the PTO shaft. Make certain the pump mount bracket of the speed changer is up and facing away from the tractor. IF using a universal mount Kit, Use transfer punches screwed into the mounting holes in the tractor to locate center of holes in mount plate. A specific mount kit the mount plate should have a set of holes that align with the holes in the tractor.

   This procedure will insure that the speed changer is centered around the PTO shaft. If drilling holes the holes should be 1/32" larger than the bolt or stud size to maintain concentricity. DO NOT oversize holes more than 1/32". Over size holes will allow plate to slip off center to the degree it will not function properly and if ran this way will most likely damage the PTO or other components.

5. The mount plate can be altered if need be to fit tractor. The use of a cutting torch to enlarge the center hole or remove excess plate from the sides or the bottom can be done. BUT the technician must make the decision when cutting as to the amount that is cut off, the technician must also make certain to leave enough material on the mountplate to allow it to maintain strength to support the pump and speed increaser. It is recommended that the technician contact Alamo Industrial if the amount of material being removed is in question or severe enough to weaken mount plate.

6. If you can not mount the mount plate directly to the tractor use the spacer tubes (figure 1 - mount plate to tractor spacers). These tubes should already be to length if a specific tractor mount kit has been ordered, a universal mount kit will require modification, which will be at a later time. Check the ends of the spacer tubes to make certain the ends are cut square, if they are not don't use them replace them with tubes that are square and to length. The spacer tubes must be square cut to keep the speed increaser perpendicular to the PTO shaft. Use a lathe to cut or square the ends of the spacer if necessary. Tubes MUST be of sufficient length when mounted between tractor and mounting plate that the PTO shaft will have a minimum of 2 inches of engagement into speed increaser. This can be checked by performing measurements of spacers, plate and speed increaser splined sleeve then calculating the distance required.

7. The bolts to install the mount plate to the tractor must be grade 8, they must be long enough to allow at least 1" thread engagement into tractor housing and make certain to use lockwashers on these bolts.. DO not tighten these bolts at this time on snug them. When time to torque these bolts they are most likely 1/2"-NC Gr8 bolts, Torque them to 100 to 110 ft.lbs. in increments use in an X pattern.

8. Install the speed increaser to the mount plate using four 1/2" Gr5 bolts. There are 4 short spacers that are used to mount between the speed increaser and the mount plate. The mount plate will have thread holes in ti to screw these 4 bolts into, use lockwashers on these bolts. These 1/2 " Gr 5 bolts will torque 65 to 75 ft. lbs using an X pattern in increments as being torqued.

9. Check to make certain the speed increaser has at least 2" of engagement on the PTO Shaft. If not the spacers will have to cut to increase engagement of PTO shaft. Make certain the PTO shaft is not bottomed out in speed increaser, if it is the spacers are to short.

10. Check the grease level in the speed changer before operating the tractor PTO. Use a recommended grade of oil. A recommended grade is SAE 90W oil with E.P. Additive. Most speed increaser are installed where the pump will mount above the PTO (figure 1) but in some case it may require the pump be mounted below the PTO shaft height. If this is the case the breather plug will need to be installed in a different location on one of the side plugs. Normal fill level is the setscrew plug about 1/3 of the way up on the side of the housing. If Speed increaser is turned to the bottom opposite what is shown in figure 1 the level plug will be the one that was on the bottom before and would be just below the center line of the bearings (figure 3)

11. Run the speed increaser on the unit prior to mounting the pump on the speed increaser. Make certain the speed changer runs smoothly and is not binding in any areas. The bearings located around the PTO shaft should be cool and free of any noise. If vibration or noise exist, shut tractor off. Loosen the mount plate bolts to tractor slightly to allow speed increaser to seek its on center line, do the same with the four bolts mounting the speed increaser to the mounting plate. Retighten bolts snugly and run PTO again to see if vibration and/or noise has gone.. If no noise or vibration re torque the bolts as stated in step 7 & 8. Rerun PTO one more time to check alignments.

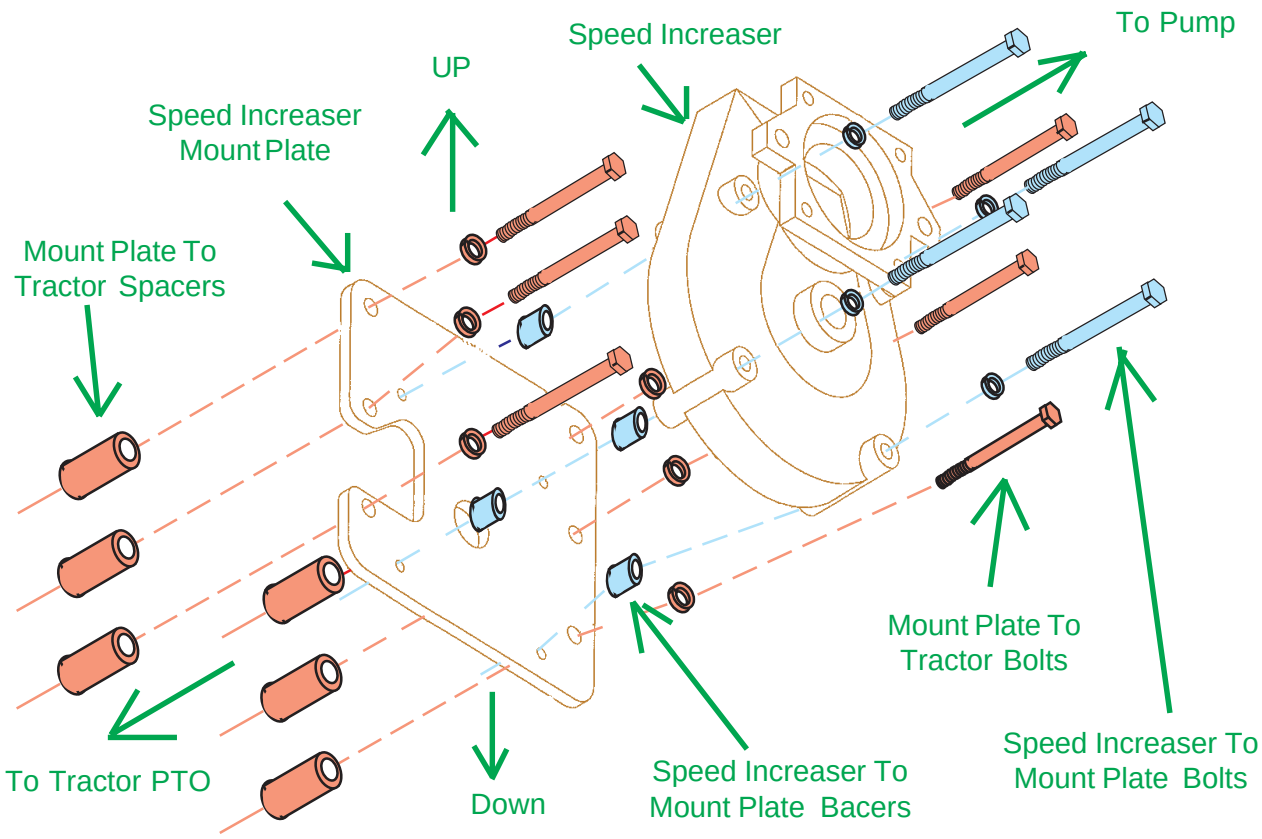


FIGURE 1 Generic Speed Increaser Mount To Tractor Illustration

12. The pump mounts to the speed increaser with a four bolt flange. There is a splined adapter required to mate pump shaft splines to the internal splines of the speed increaser shaft (figure 2). There have been two types, Old Style & new Style. Either style will work or can be replaced with the other, but at least one style has to be installed complete. Always make a note of which type is used when removing pump from speed increaser. Sometimes the splined adapter will stay in the speed increaser and sometime it will slide out with the pump shaft. When installing the spline adapter make certain to put a good coat of grease on the splined adater and on the internal splines before inserting it into the speed increaser. Make certain at least one of these styles is used to mount the pump.

"A" Old Style Splined adapter: See figure 1 drawing "A". The old style splined adapter has a snap ring groove on the OD of it and a snap ring, This splined adapter pushes into the speed increaser before the pump is bolted on, the snap ring prevents the splined adapter from sliding inward and outward inside speed increaser is in operation. DO NOT use without the snap ring on splined adapter, failure will occur (figure 2).

"B" New Style Splined Adapter: See figure 1 drawing "B". The new style splined adapter WILL NOT have a snap ring groove and WILL NOT use a snap ring to keep adapter stationary during operation. The new style used a tube type spacer that is slid into the speed increaser splined adapter is inserted. This tube spacer will keep the splined adapter from sliding. DO NOT use without the tube spacer installed, failure will occur (figure 2).

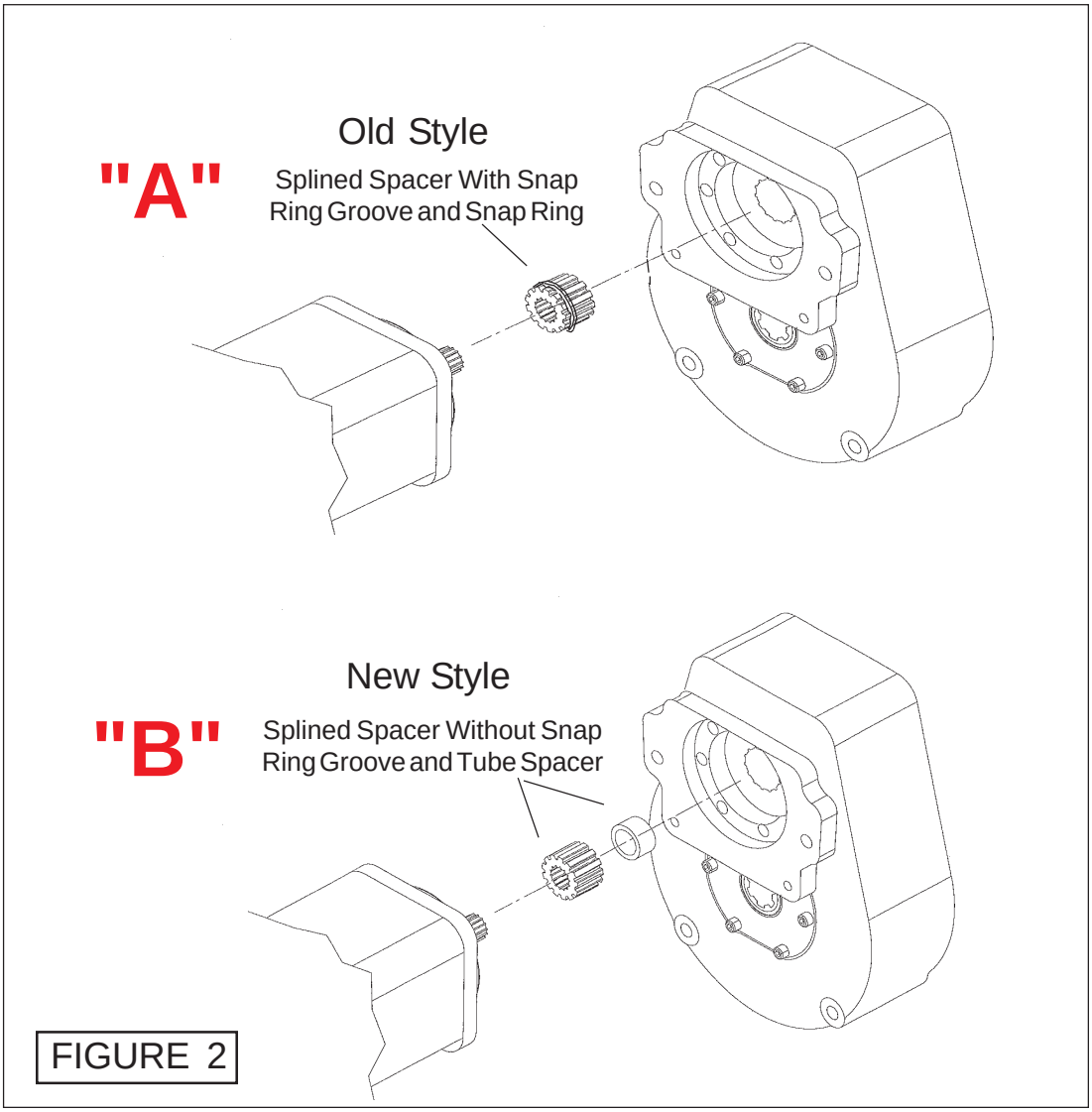


FIGURE 2

13. Grease the splined shaft of the pump, insert it into the splined adapter in the speed increaser. The pump should slide into the speed increaser up to the machined flange on the pump. The ridge on pump will slide into speed increaser with out excessive force. If it will not slide together by pushing it in when the pump is aligned with the speed increaser, DO NOT use the pump mount bolts to force the pump into speed increaser, check to find what is wrong preventing it from sliding together. If pump is force into speed increaser something will be damaged.

14. If pump is just being reconnected to speed increaser and pump has not been removed the hydraulic connections should already be connected to the pump. If the pump is being replaced and the hydraulic lines need to be connected see the pump service repair section for hydraulic line connection instructions. NOTE: once the pump and hydraulic lines are connected do not start tractor until assembly has been completed, DO NOT start tractor and engage PTO unless all hydraulic system has been connected and check. Make certain Oil level is full and etc. SEE START UP PROCEDURE IN PUMP SERVICE REPAIR SECTION.

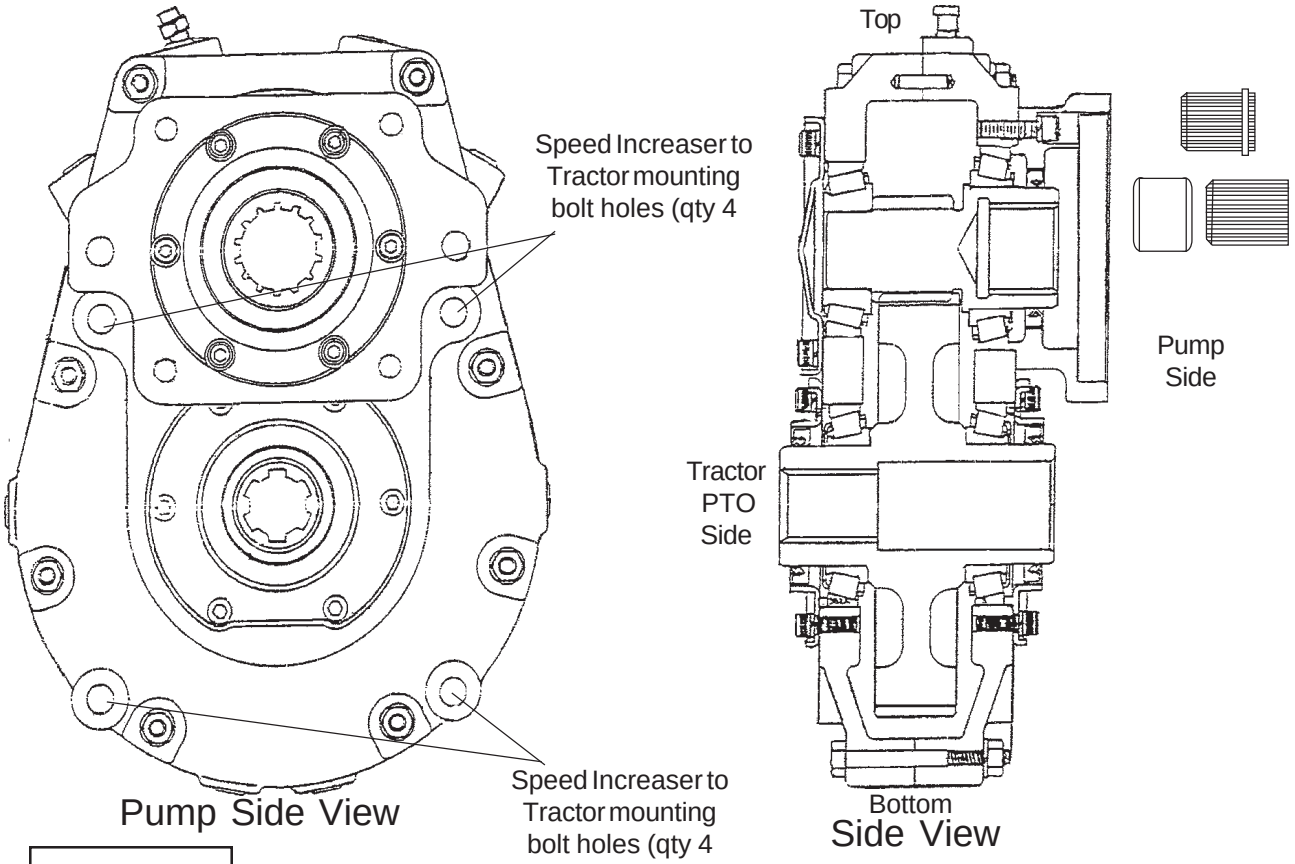


FIGURE 3

Speed Increaser Service & Repair

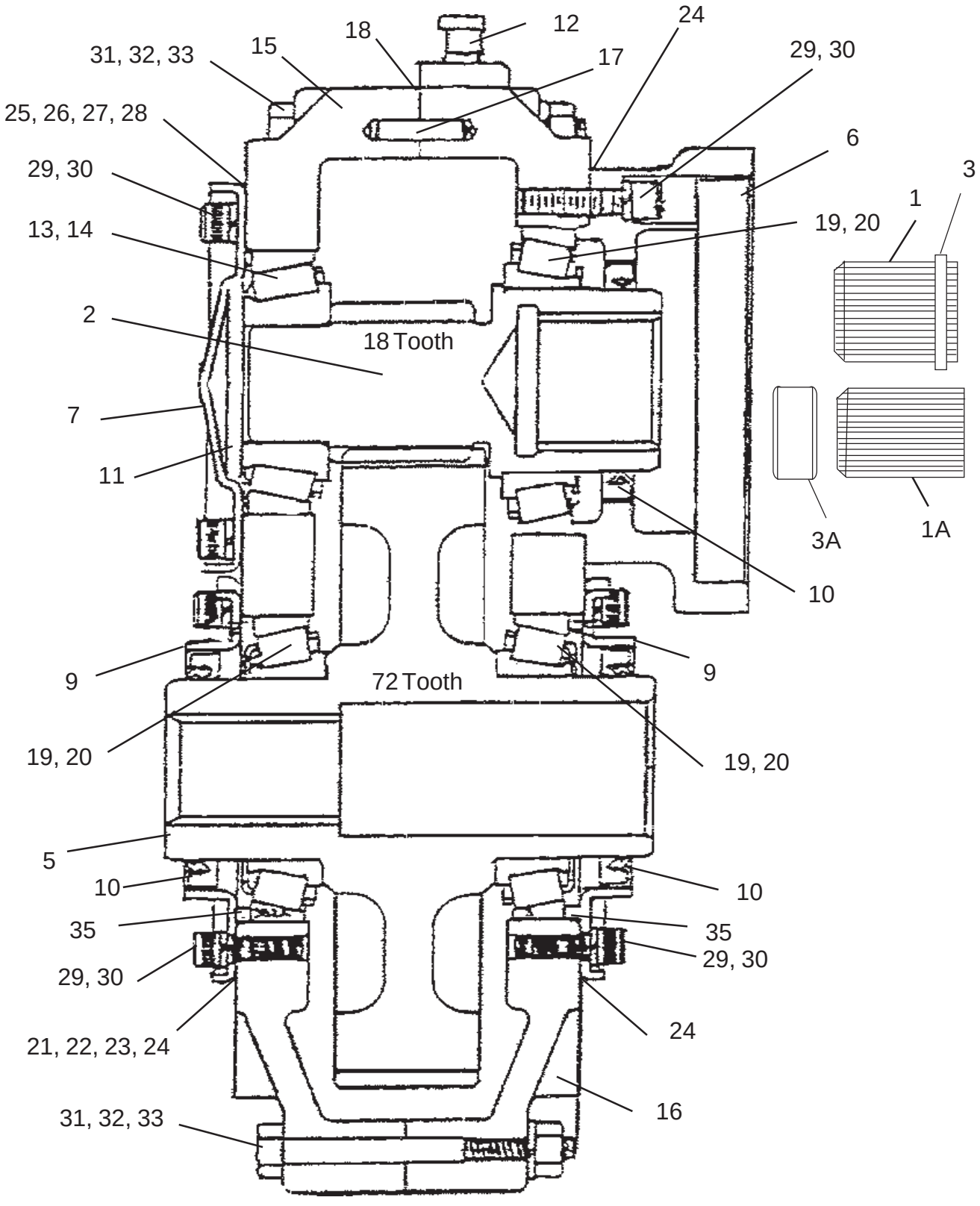


FIGURE 4

Speed Increaser (1:4 Increase)
(See Figure 4)

Item	Qty	Description
1	1	Splined Shaft Adapter w/ Snap Ring Groove (use w/ item 3)
1A	1	Splined Shaft Adapter w/o Snap Ring Groove (use w/ item 3A)
2	1	Pinion Gear, High Speed 18 Tooth
3	1	External Snap Ring (use w/ item 1)
3A	1	Splined Shaft Adapter Spacer (use w/ item 1A)
5	1	Shaft & Gear, Low Speed 72 Tooth
6	1	Pump Flange
7	1	Cover, Closed
9	2	Cover, Open
10	3	Seal
11	1	Spacer Ring
12	1	Breather Plug
13	1	Bearing Cup
14	1	Bearing Cone
15	1	Housing Half, Non Breather Side
16	1	Housing Half, Breather Side
17	2	Dowel Pin, Upper or Lower
18	1	Gasket, F/ Housing Halves
19	3	Bearing Cup
20	3	Bearing Cone
21	AR	Shim, Aluminum .005
22	AR	Shim, Aluminum .007
23	AR	Shim, Aluminum .020
24	3	Shim, Fibre .005
25	AR	Shim, Aluminum .005
26	AR	Shim, Fibre .005
27	1	Shim, Aluminum .007
28	AR	Shim, Aluminum .020
29	24	Bolt, Allen Head 5/16"-NC X 3-1/4" Gr 5
30	24	Lockwasher, 5/16"
31	8	Bolt, Hex Head 3/8"-NC X 3-1/4" Gr 5
32	8	Nut, 3/8" NC
33	8	Lockwasher, 3/8"
34	8	Pipe Plug (1 plug is removed to install Breather)
35	2	Spacer Ring

Dis-Assembly Prodedure:

Important!

It is assumed that the pump has been disconnected from speed increaser, the speed increaser has been disconnected from the tractor mount plate. If not see the step previously instructing the mounting of speed increaser and pump. The speed increaser has been cleaned and drained of oil.

Dis-assemble & Re-assemble for Inspection Only!

1. There are different ways to dis-assemble the speed increaser, If the purpose is to only inspect the components the housing halves can be unbolted (figure 4 item 31, 32 & 33) allowing the two halve to come apart leaving the components in one housing half. This will allow the inspection of the gears and the bearings. The gears can be lifted up out of the housing to allow the inspection of the other side bearings. If every thing is OK the two halves cane be bolted back together. It is recommended that the gasket (figure 4 item 18) be replaced. The end play on the bearings should not change and if they were correct before they should be correct now.

2. Check the end play on the shafts (figure 4 item 2 & 5) it should be from .007 to .011. If not the shims will need to be added or removed to adjust the end play, this will be done on the PTO side closed top cover (figure 4 item 7) and the PTO side open cover (figure 4 item 9). Add or remove shims to adjust shaft end play as needed (figure 4 item 21, 22, 23 & 24 for open cover and items 25, 26, 277 28 for closed cover).

3 Refill speed increaser with oil, Check the Oil level in the speed changer Use a recommended grade of oil. A recommended grade is SAE 90W oil with E.P. Additive. Most speed increaser are installed where the pump will mount above the PTO (figure 1) but in some case it may require the pump be mounted below the PTO shaft height. If this is the case the breather plug will need to be installed in a different location on one of the side plugs. Normal fill level is the setscrew plug about 1/3 of the way up on the side of the housing. If Speed increaser is turned to the bottom opposite what is shown in figure 1 the level plug will be the one that was on the bottom before and would be just below the center line of the bearings (figure 3)

Dis-assemble for Replacement of Components!

1. Check to make certain the splined adapter (figure 2) has been removed so it does not fall out during moving the speed increaser, if the new style without the snap ring is used make certain to get the tube spacer that goes with the splined adapter. If the old style with snap ring the snap ring will stay on the splined adapter.

2. Move the speed increaser to a wash area and clean the exterior of unit. Set speed increaser above a drain pan, remove the lower drain plug, the upper vent breather and allow the speed increasers oil to drain out into catch pan.

3. Lay the speed increaser on bench with the tractor PTO side down against the bench (figure 3). Remove Pump flange (figure 4 item 6) by removing the 6 bolts and lockwashers (figure 4 item 29 & 30). Remove the pump flange by pulling straight up and away from speed increaser, if need be use a screw driver to pry pump flange up being careful not to scratch the machined surfaces. After remove inspect the pump flange and remove the seal (figure 4 item 10) from pump flange. There will be fibre gasket (figure 4 item 24) between pump flange and speed increaser housing half (figure 4 item 16), check to see if it stayed with pump flange or housing half.

4. Remove open cover (figure 4 item 9) on the pump flange side by removing the 6 bolts & lockwashers (figure 4 item 29 & 30). Pull the open cover up away from speed increaser. The open cover will have a seal (figure 4 item 10) in it, remove the seal. Inspect the cover and the seal OD for damage that may have been caused by cover being damaged. There is a gasket that should be on this cover (figure 4 item 24) check to see if on cover or housing half. There is a spacer ring (figure 4 item 35) under cover and against bearing cup.

5. To split the housing halves remove the 8 bolts, lockwashers and nuts (figure 4 item 31, 32 & 33). This will allow the two housing halves (figure 4 item 15 & 16) to be separated. If it is necessary to pry the housing halves apart use extreme caution not to damage the machined surface of the housing halves. Pry in alternating areas so the halves are separated as evenly around as possible. There are two dowel pins (figure 4 item 17) used to align the housing halves, this usually where the housing are the most difficult to pull apart.

6. With the gears and shafts (figure 4 item 2 & 5) exposed pull them up and out of the housing half (figure 4 item 15 & 16). The bearing cones (figure 4 item 14 & 20) should stay on the gear shafts, the bearing cups (figure 4 item 13 & 19) should stay in the housing halves. The bearing cups will be rather simple to remove from the pump side housing half, remove any snap rings (figure 4 items 35) and the bearing cups can be pressed out. Make certain to support the housing half while pressing out bearing cup.

7. Turn the PTO housing halve over to remove the closed cover (Figure 4 item 7) and the open cover (figure 4 item 9) from the PTO side housing half (figure 4 item 15). Remove the closed cover and the open cover by removing the 6 bolts and lockwasher that retain them. Make a note as the amount of shims that are installed behind closed cover and open cover, this will give fair indication of what is need during re-assembly. Remove bearing spacer (figure 4 item 11 & 35) and press bearing cups out of housing half. Remove the seal (figure 4 item 10) from the open cover (figure 4 item 9).

8. Remove bearing cones (figure 4 items 14 & 20) from gear shafts (figure 4 items 2 & 5), the removal of the bearing cones will require a bearing puller. When removing the bearing cones from the gear shafts use caution not to damage the bearing cone or the shaft surface.

9. Inspect and clean all components that have been dis-assembled from speed increaser. Inspect the seals that were removed. Clean both housing halves. Inspect all machine surfaces of housing for scratches and damage. Wash all parts, clean old gaskets off and air dry (DO NOT SPIN DRY BEARING CONES WITH COMPRESSED AIR, this will damage bearing cones).

10. Inspect old seals and seal openings (Figure 5) for damage to old seals that may have been caused by covers and or plates. One of the most common problems is damaged sone when the original seal or when a replacement was installed previously. When installing seal there are a number of ways the damage can occur, hitting opening with seal driver, hitting opening with hammer or hitting opening when removing old seal. The top opening is not chamfered and the metal will mash down and lay over the side, this can usually be identified by scratches that run across the OD of the seal as shown in figure 5. This can be and should be fixed by using emery cloth and carefully removing these burrs on the outer edge, only the burrs on the outer edge should be removed, not material inside the ID of the opening.

11. Inspect bearings, cups and cones, housing halves, gears and shafts, covers, bolts, nuts and washers. Replace any components that are not serviceable. DO NOT mix old worn parts with new parts, the worn parts will decrease the life of the repair parts.

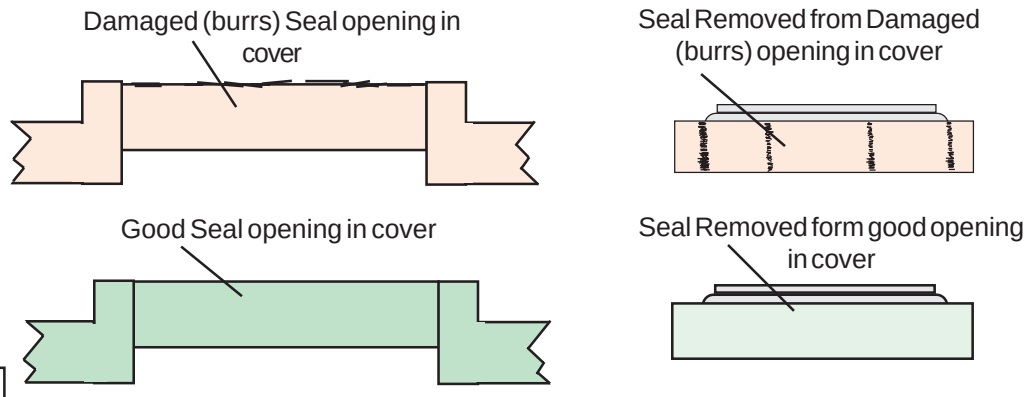


FIGURE 5

Re-Assembly for Replacement of Components!

IMPORTANT! Make certain all components have been cleaned, inspected and replaced as required. All parts must be dry of any cleaning agents. All covers should be cleaned of oil and/or grease.

1. Make certain the covers (figure 4 items 6, 7 & 9) are completely cleaned around the gasket / shim area. Make certain the mounting surface is flat and undamaged. This is important to assure the covers seal when installed later.

2. Install seals into covers, there are three seals (figure 4 item 10), these seal are all the same and can be install in either of the two open covers (figure 4 item 9) or in the pump mount flange (figure 4 item 6). The seals will install (figure 6) with the flat side outward. The hollowed side will install inward toward the gears. Coat the ID of the seal with clean light coat of grease. Coat the OD (side figure 6) of seal with Locktite ™ 801 sealer or equal, this will help keep seal from leaking (figure 6). Use the proper dia seal driver to install the seal. Set the covers with the seals installed aside for now.

3. Install Bearing Flange Mount (figure 7) with new seal already installed to the housing half with the Allen head 5/16" -NC X 3-1/4" Gr. 5 bolts & lockwasher (figure 4 item 29 & 30) There are total of 24 of these bolts used on speed increaser, they are the same size and length bolts. Make certain the housing half, the one open cover and the pump mount flange are clean and free of the old gasket. Install new gaskets (figure 4 item 24) to the covers, use light gasket sealer when installing the covers. Only the one open cover and the pump cover flange can be installed and torqued to the housinf half (figure 4 item 16) at this time (figure 9). Coat the bolt threads with a thread light sealer The 5/16" bolts will torque 12 to 15 ft. lbs. These are to be torqued in a criss cross pattern (figure 8). Do this in increments to keep the flange and cover m mounted square and prevent warpage. The pump mount flange and the open cover mount and toque the same 12 to 15 ft. lbs. After tightening the open cove and the pump mount flange make certain the ID of the seals are coated with light coat of grease.

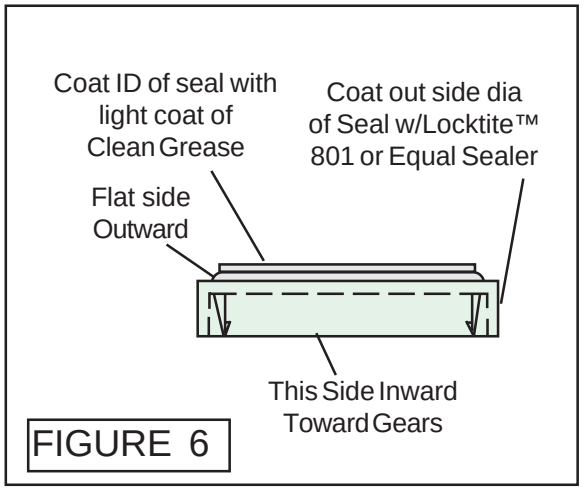


FIGURE 6

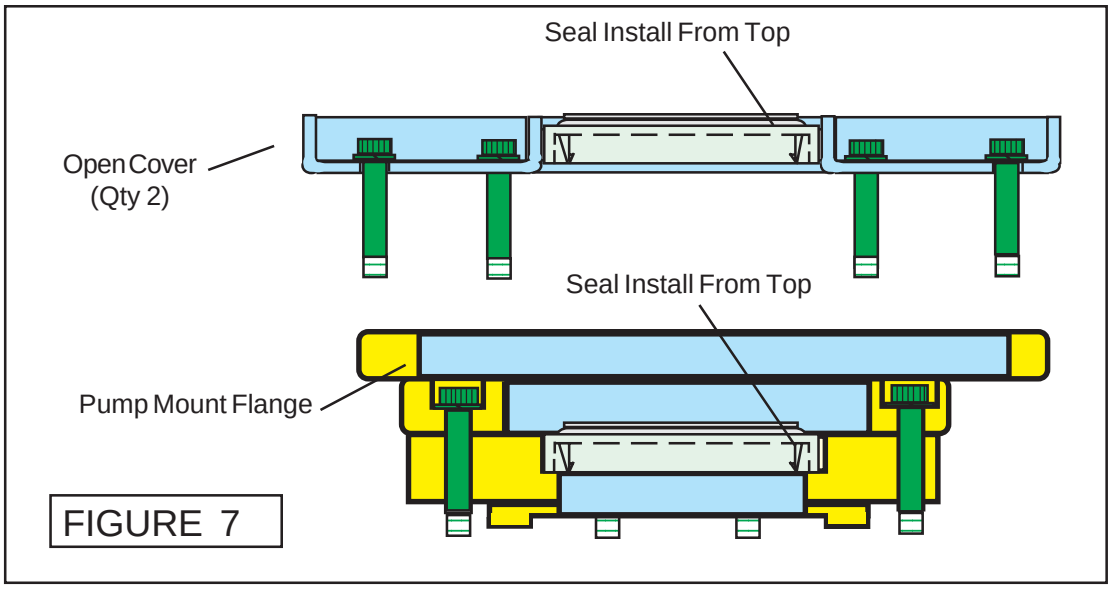


FIGURE 7

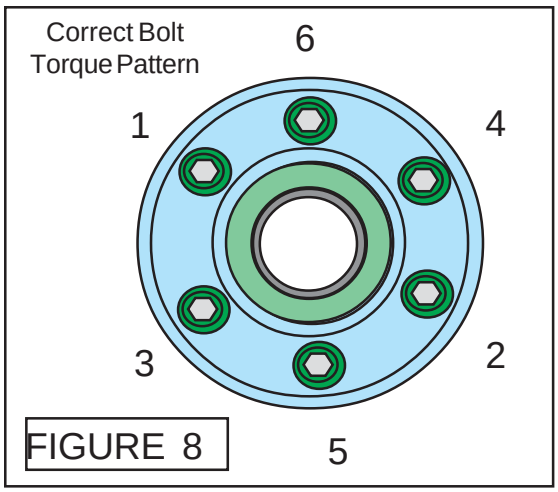


FIGURE 8

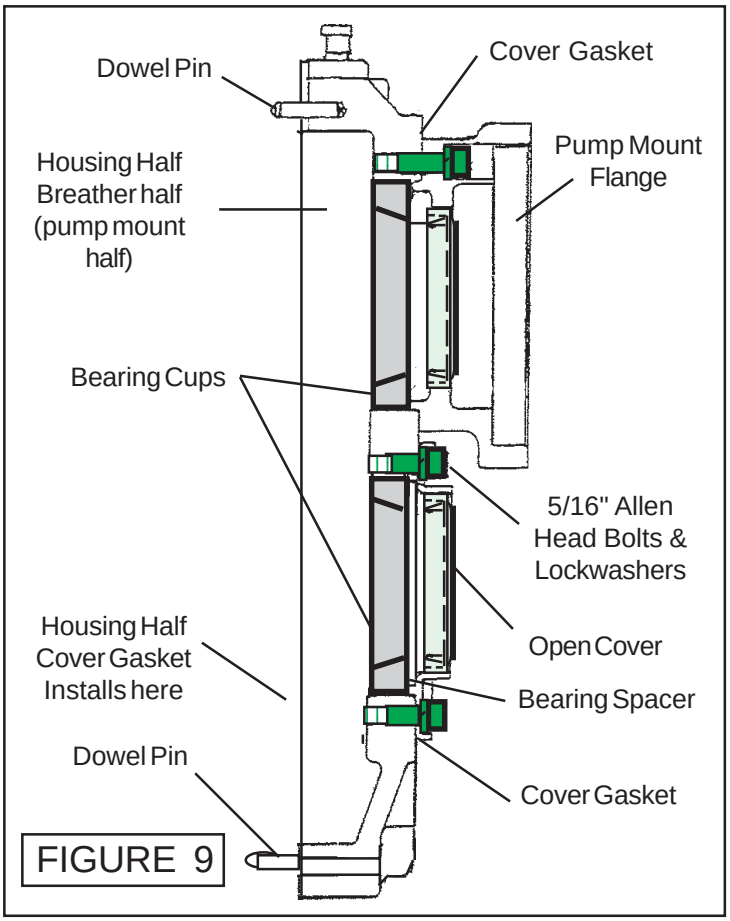


FIGURE 9

4. Install the bearing spacer. (figure 4 item 35). Install the bearing spacer (figure 9) now in the open cover end of the housing, The bearing spacer is installed into the opening befor the bearing cup is installed. Make certain the bearing spacer is installed flat and seated against the open cover.

5. Install the Bearing Cups into the housing half. Use a bearing driver to install bearing cups (figure 4 item 19). Install the bearing cup from the inside of the bearing housing until it is seated against the bearing spacer in the open cover end. The other bearing cup is seated against the pump mounting flange (figure 9). DO not drive bearing in so far the open cover is damaged. NOTE: the bearing cups for the pump mount flange and the open cover side are the same size.

6. Install the bearing Cones (figure 4 items 14 & 20) the bearing cone item 14 is smaller than the other 3 and will only fit the PTO side of the small gear shaft. Bearing cones will be seated against shoulder at gear (figure 10). Make certain seal ID is coated with light coat of grease. Insert the shafts into the housing and through the seals (figure 10). Install the housing gasket onto the housing half.

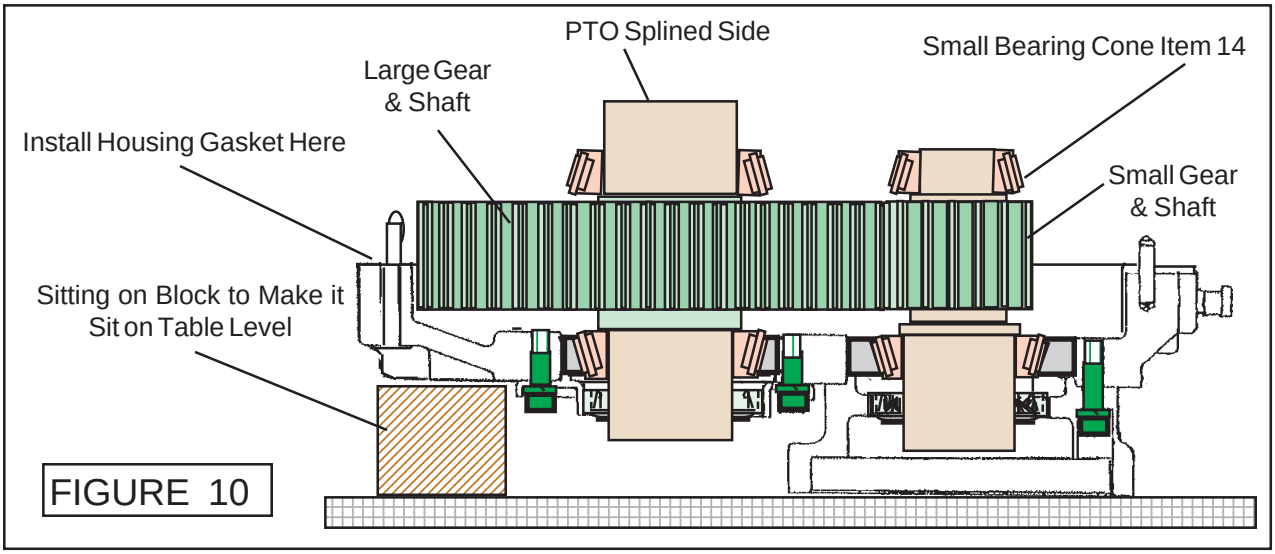


FIGURE 10

7. Install the PTO side of housing half (figure 4 item 15). Male certain old gasket has been removed and gasket face of housing is clean. Aligning the dowel pins (figure 4 item 17) between the two housing halves the PTO side Housing half down over the pump side housing half. It make require a soft hammer to tap the two halves together. When two halves are together check to make certain gasket has not slipped out. Insert the 8 hex bolts (figure 4 item 31) into the 8 holes in the housing halves from the PTO side (figure 11). Install the Lockwashers and Hex Nuts (figure 4 item 32 & 33) onto the 3/8" bolts. Tighten the bolts and nuts in an alternating pattern and in increments until bolts are snug. Torque the bolts in the same pattern until they are torqued to 21 to 25 ft lbs.

8. Install the bearing Cups (figure 4 items 13 & 19) the bearing cone item 13 is smaller than the other 1 and will only fit the PTO side of the small gear shaft. Bearing cups should be seated against bearing cone at gear (figure 11). Use only soft hammer and light force to install bearing cups in housing half.

9. Install the bearing Spacer (figure 4 item 11 & 35). The smaller bearing spacer ring goes on the small gear shaft (figure 11). The larger bearing spacer ring goes on the large gear shaft (figure 11).

10. Install the second open cover (figure 4 item 9) and the closed cover (figure 4 item 7). Make certain the ID of the seal in the open cover is coated with a light coat of grease. The closed cover and the open cover will require that the shims (figure 4 items 21, 22, 23, 24, 25, 26, 27 & 28). The amount of shims required will vary. It is recommended to try to start with the amount that was removed during dis-assembly. The purpose of the shims is to set the end play in the bearings and gear shafts. Add or remove shims as required until the end play in the gear shaft (Large and Small) is from .007" to .011". The open cover and the closed cover retaining bolts will need to be torqued 12 to 15 ft lbs. Torque these in an alternating pattern (figure 11).

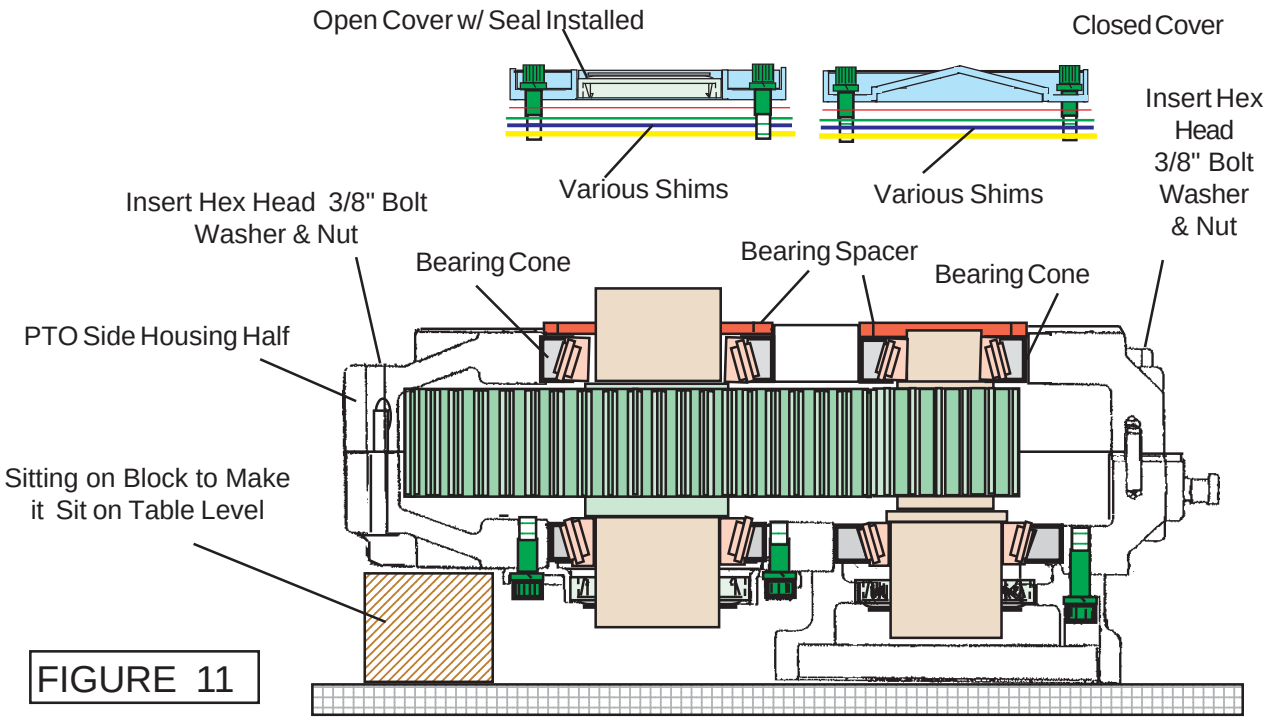


FIGURE 11

11. Reinstall the plugs bag into the correct holes that they were removed from (see Part Manual for holes to be plugged) Use pipe sealer for plug, DO NOT use teflon tape.

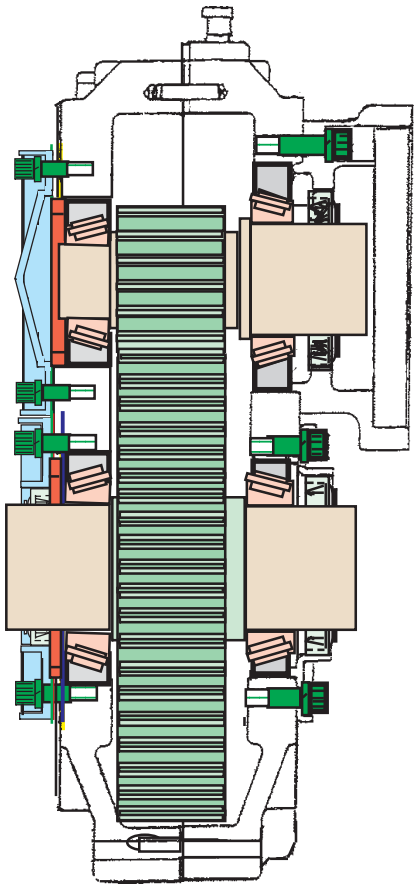
12 Refill speed increaser with oil, Check the Oil level in the speed changer Use a recommended grade of oil. A recommended grade is SAE 90W oil with E.P. Additive. Most speed increaser are installed where the pump will mount above the PTO (figure 1) but in some case it may require the pump be mounted below the PTO shaft height. If this is the case the breather plug will need to be installed in a different location on one of the side plugs. Normal fill level is the setscrew plug about 1/3 of the way up on the side of the housing. If Speed in creaser is turned to the bottom opposite what is shown in figure 1 the level plug will be the one that was on the bottom before and would be just below the center line of the bearings (figure 3)

13. Install the splined pump shaft adapter. There are two types of splined pump adapters that were used. While either style can be used the components of each style can not be mixed or left out. Make note of which style that is being used.

"A" = Old Style Splined adapter: See figure 1 drawing "A". The old style splined adapter has a snap ring groove on the OD of it and a snap ring, This splined adapter pushes into the speed increaser before the pump is bolted on, the snap ring prevents the splined adapter from sliding inward and outward inside speed increaser is in operation. DO NOT use with out the snap ring on splined adapter, failure will occur (figure 2 & 13). This will only fit with the snap ring outward.

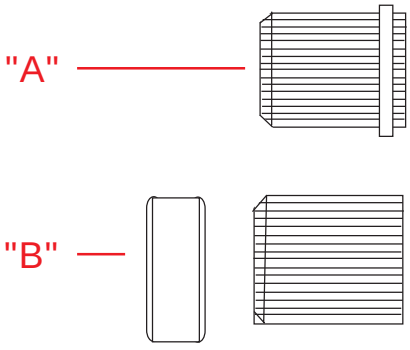
"B" = New Style Splined Adapter: See figure 1 drawing "B". The new style splined adapter WILL NOT have a snap ring groove and WILL NOT use a snap ring to keep adapter stationary during operation. The new style used a tube type spacer that is slid into the speed increaser and then the splined adapter is inserted. This tube spacer will keep the splined adapter from sliding. DO NOT use without the tube spacer installed, failure will occur (figure 2 &13). This must be installed with the spacer tube insert first and then the splined adapter to work properly.

14. Connect Pump to Speed increaser, See pump repair service section. DO NOT start pump until looking at pump installation service repair start-up instructions. NEVER use Teflon tape on any hose or fittings connections, only thresd sealer on pipe connections.



Re-Assembled Speed Increaser

FIGURE 12



Splined Pump Shaft Adapters, Old & New Style

FIGURE 13

NOTES

Section 8

HYDRO 15

Tire - Wheel - Hub
Service & Repair

Tires & Wheels:

1. When Removing wheels and/or Hubs the mower should be supported under the main as well as the axles. The deck and the wings in the lowered to the ground position. There are options as the type wheel that may be on the mower,

   "A" Laminated (Sectional) Tire and wheel = Very heavy with small OD, tire is made up of sections cut out of tires and is flat proof. These tires and wheels are very heavy. Use caution when lifting these tires and wheels

   "B". Pneumatic Tires and Wheels, there are different tires available as an option on this model, Phnuematic tires with 15 in. Wheels. The customer can purchase tires and wheels or wheels only and furnish his own tires, so the type pneumatic tires and wheels may not have been the manufacturers part. The Used Airplane tire and wheel is offered as pneumatic, foam filled and as recapped Pneumatic tires. These tires and wheels are also heavy, use caution if lifting them. Most Airplane tires are a different size. This will make it difficult to replace some of these wheels and tires as they may not be the same dia around.

   "C" Pneumatic Tires that are mounted on two piece Wheels. Two piece wheels bolt together two halves to make the wheel. The air MUST be removed form these wheels before they are unbolted, completely remove the stem valve from the wheel and wait until all air has evacuated tire and wheel before attempting to work on this wheel. Air pressure must not exceed the rating listed on the decal on used air craft tires and wheel. On standard Phnuematic tires do not exceed tire manufacturers pressure rating.

2. The wheels should be checked to see if wheel bearings are out of adjustment or damaged. The tires, wheels and hubs need to be inspected for broken or lost components. Best way to check the wheel bearing adjustment is to Jack the wheel off the ground. Grab the wheel and try to move it in or out (figure 1). If any movement exists, remove the wheel and inspect the bearings and repair and/or readjust the wheel. If the wheel is operated for only a few hours with it out of adjustment the bearings and hub could be worn to the point that they would need to be replaced. Readjustment and repacking of the wheel bearings is considered a maintenance requirement, check the operators manual for the unit for recommended intervals.

3. Most common problems with wheel hubs is the loss of the dust cap. If run without dust cap for any time at all the wheel hub should be removed, cleaned and components inspected. DO NOT just replace dust cap and keep running, the hub, bearings and spindle can be damaged.

IMPORTANT INFORMATION FOR ! Laminated Tire and Wheels:

Attach the wheels to the hubs. If puncture-proof, Laminated (Sectional) Tires and Wheels are used, be sure the flat side of the nut is against the Wheel. Tighten wheel bolts to 85 ft/lbs (This will apply only when using laminated tires and the lug nuts are installed with flat side against wheel). Note direction of travel and curvature of rubber segments in tire and install as shown to give longest tire life (See figure 2). If tires are mount to roll in the wrong direction the segments of the tire tend to open allowing dirt and mud to be wedged in between segments forcing the segments apart and making tire loose. These are not high speed tires and should nut be run faster than 10 to 15 MPH max. nor for long distances on hard ground.

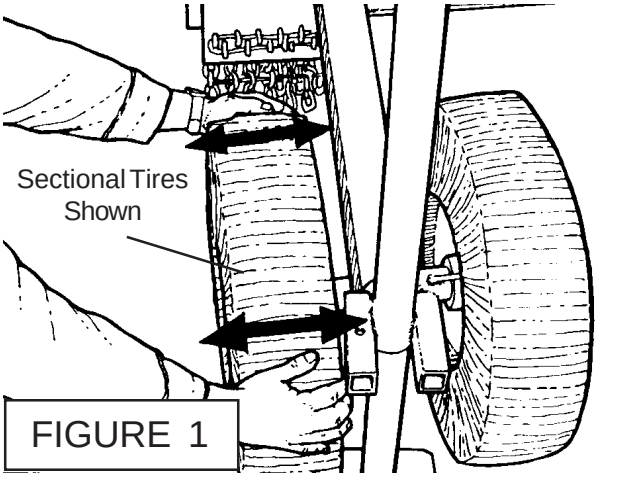


FIGURE 1

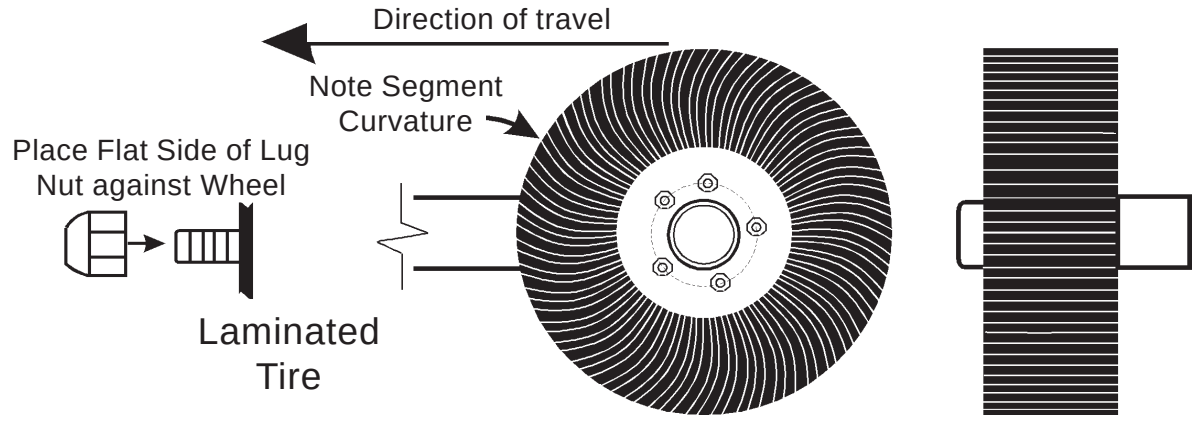


FIGURE 2

IMPORTANT INFORMATION !
For Laminated Tire and Wheels:

Wheel Hub Dis-Assembly:

Important Note: There are **two types of hubs (figure 3 & 4)** that have been used, these are best Identified by the seal type. The earlier type has a one piece seal **(figure 3)**. The later type has a three piece seal (seal, inner seal adapter and outer seal protector). If the hub you are working on has a one piece seal it must be re-assembled using the components of the one piece seal hub. If it is a three piece seal **(figure 4)** it must use components for three piece seal hub. The parts for the two different hubs will not interchange. Check which you have before ordering parts. See figure 3 & 4 for items reference in dis-assembly steps.

NOTE: Axle Spindles shown removed from axle as illustration only, the spindles are actually welded to the axle arms and are not removable.

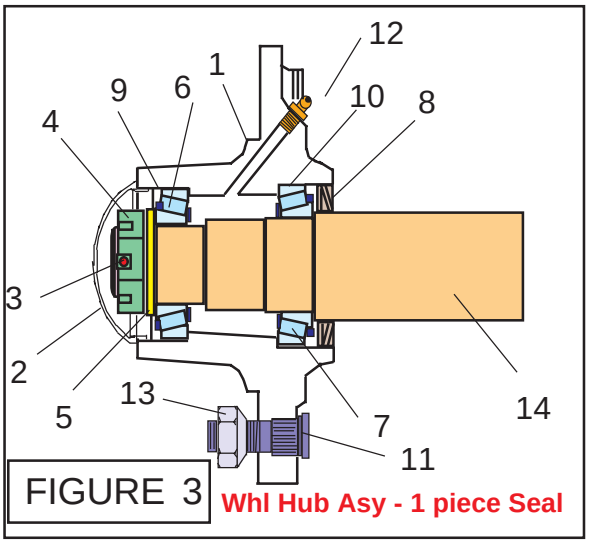


FIGURE 3 **Whl Hub Asy - 1 piece Seal**

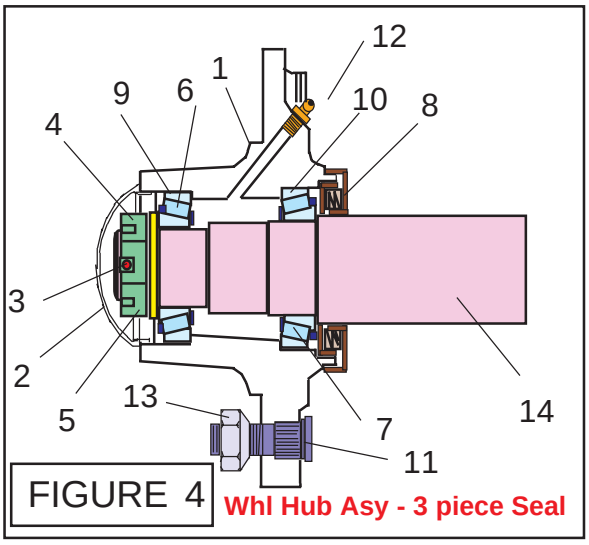


FIGURE 4 **Whl Hub Asy - 3 piece Seal**

1. Before removing the wheel from the hub (item 1) make note of which way lug nuts are installed. The laminated tire lug nut MUST be installed different than the other wheels. (see previous page if using laminated tires and wheels)

2. Clean all dirt and debris from dust cap and hub before attempting to remove dust cap. Use a small wedge type tool to dislodge the dust cap (item 2) from the hub, dust cap will pry off usually with ease.

3. Remove the cotter pin (item 3). It will require the cotter pin be un-bent to remove it, dis-card the old cotter pin and replace it with new one during re-assembly.

4 Remove the slotted retaining nut (item 4) from the spindle (it has RH threads). Slide the retaining nut washer (item 5) off axle spindle shaft.

5. Pull the hub (item 1) out slightly while holding your hand against end of spindle at attaching nut end, this will allow you to catch the outer bearing cone (Item 6).

6. Continued to pull outward on the hub and the hub (item 1) will slide off with inner bearing cone (item 7) and wheel seal (figure 3 & 4 item 8) staying in hub.

7. Wheel Seals, there are two different types. Old type 1 piece seal (figure 3 item 8) which consist of the standard type seal as shown in figure 3 & 5. New style 3 piece seal (figure 4 item 8) consist of, 1 - inner seal adapter, 1 - inner seal and a outer seal protector which drives onto the spindle (figure 4 & 6). The same type seal that is removed from the hub must be the type that is replaced. Parts between these two hubs will not interchange, identify which hub you have by the type seal in it before ordering replacement parts. The 3 piece seal components, seal adapter, seal and seal protector are not available as individual pieces, they can only be ordered as part of the replacement seal assembly.

   Remove Seal from Hub, seal use a soft pin (wood or plastic) to drive into the hub from the front side and against the inner bearing cone, this will drive the inner bearing cone and seal out. If working with the three piece seal, the seal adapter should come out with the bearing cone.

8. Bearing Cups, the bearing cups (items 9 & 10) can be inspected while still in the hub. If bearing cups are serviceable and bearing cones are serviceable, then there is no reason to remove the bearing cups from the hub. If the bearing cup or bearing cone is un-serviceable and either needs replacing then both should be replaced at the same time, do not use used bearing cups or bearing cones against new bearing cups or bearing cones.

9. Grease fitting, it is not required to remove the grease fitting (item 12) unless it is damaged or grease cannot be pumped through it. Some grease fittings are the drive in type and some are the screw in type. You will be able to ID these by looking at area where grease fittings enter wheel hub. Drive in grease fittingswill pull out by clamping them and pulling upward on them.

10. Clean all components bearings, nut, washer and hub itself. Inspect all components including the wheel studs (item 11) in hub. If wheel studs need to be replace it is recommended that the old stud bepressed out and the new one pressed in.

11. Inspect the bearing cups (item 9 & 10), they should not have noticeable wear, scratches, pitting or any other damage that will make them un-serviceable. If the bearing cups need to be replace the old ones should be pressed out and new ones pressed in. If the bearing cones are damaged and should be replaced, the bearing cups should be replaced also or vice versa. It is not recommended that old and new bearing cups and cones be mixed.

12. If hub and components are washed with solvent (or similar substance). The component should be dried with clean filtered compressed air. DO NOT spin bearing with compressed air to dry them as this damages the bearing surface. The inside of the hub must be cleaned, after cleaning hub pump small amount of grease grease through grease fitting and make certain it is clean and free of solvent when it comes out. Dry all solvent and clean all grease from hub ID. Lay all the components out as inspected, replace components as need (figure 5).

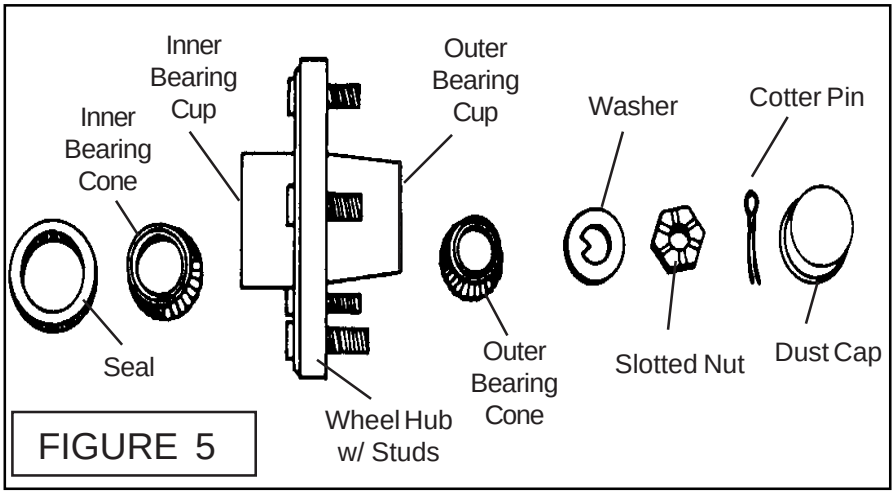


FIGURE 5

Wheel Hub Re-Assembly:

Important Note: There are two types of hubs (figure 3 & 4) that have been used, these are best Identified by the seal type. The earlier type has a one piece seal (figure 3). The later type has a three piece seal (seal, inner seal adapter and outer seal protector). If the hub you are working on has a one piece seal it must be re-assembled using the components of the one piece seal hub. If it is a three piece seal (figure 4) it must use components for three piece seal hub. The parts for the two different hubs (bearings or seals) won't interchange. Check which you have before ordering parts. See figure 3 & 4 for items referenced in the steps of dis-assembly.

1. Inspect the wheel hub and hub components (figure 3 & 4 item 1 through 14), they should not have noticeable wear or wear that in any way would make them un-serviceable. Bearing Cones and cups must be replace together, do not use a used bearing part against a new bearing part, the bearings will fail as bearings wear on the cones and cups to match each other. Lay all the new and/or serviceable parts out on a clean surface (figure 5) .

2. Install new bearing cups (items 9 & 10) into hub if needed. If the cups need to be replace they should be pressed in or installed with a driver designed for bearing cup installation (figure 3 & 4). <ake certain the bearing cups are fully seated into the hub squarely and completely (figure 8).

3. Pack Wheel bearing Cones (items 6 & 7). This can be done with a bearing packing tool or it can be done by hand. Grease must be pushed through the roller cage (figure 7) all the way around and completely. If grease is not pushed in to bearings around rollers and out the top and around rollers of bearing cones, they are not properly packed with grease, this is important! Lay the Hub with the outer bearing opening down and insert the inner bearing cone that has been properly packed with grease (figure 8).

4. Install wheel seal, Now is when the correct seal must chosen and installed.

   If old style 1 piece seal (figure 5 & 6) is used, drive the seal in to the wheel hub using the correct seal driver. Make certain the seal ID has light coat of grease on it.

   If new style 3 piece seal (figure 6 & 8) is used, coat the OD of seal adapter with a Locktite type sealer. Drive the seal adapter into the hub with the open side up, this open side is the recess for the seal. Make certain seal adapter is seated into hub completely. Insert the seal into the seal adapter and drive it into the adapter until it is seated (figure 8). Coat the ID of the seal with light coat of grease.

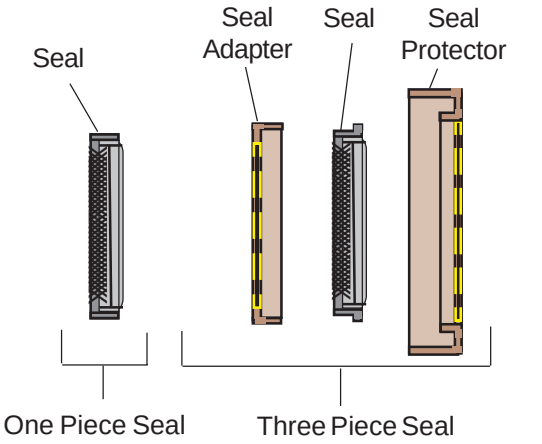


FIGURE 6

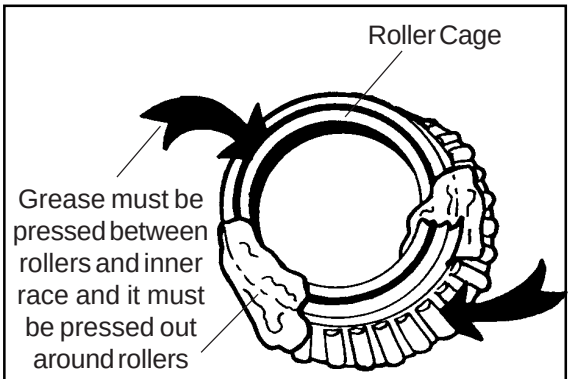


FIGURE 7

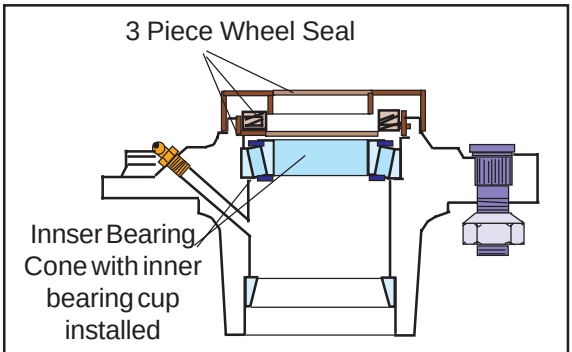
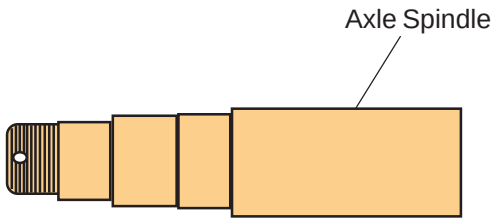


FIGURE 8

5 Install wheel seal protector (item 8). **This will only apply to units with the new style three piece seal.** The three piece seal has a seal protector that drives onto the axle spindle (figure 9 & 11). An easy way to install the seal protector on to the spindle is with a driver that is hollow ID and has the correct diameter to drive it on. Another way is to heat the seal protector in an oven to about 250° to 300° then while still hot, drive it on. Use caution because it is hot, make certain to drive it on straight while it is still hot. The seal protector allows the hub seal and seal adapter to be covered by the seal protector when completely assembled.

6. Make certain ID of seal has light coat of grease. Slide Hub (w/ Inner Bearing cone and seal installed into hub) onto spindle. Slide Hub up until the hub inner bearing cone is against the machined area of the axle spindle (figure 10 & 10A)

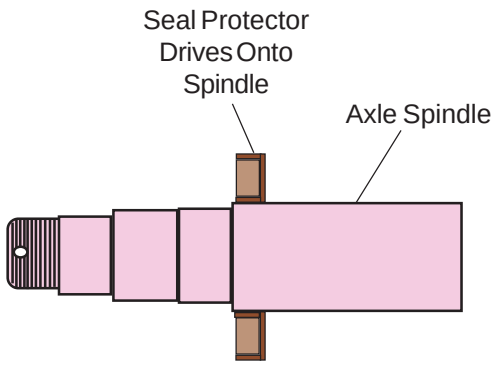


Axle Spindle for the 1 piece Seal

FIGURE 9

7. Insert outer bearing cone (item 6) (that has been packed with grease) into the outer part of hub. Support hub with your hand or the weight of the hub could push the outer bearing cone back out. Insert the bearing adjusting nut washer (item 5) onto the shaft. Screw the bearing adjusting nut (item 4) onto spindle, once the adjusting nut is started you will not have to support the hub as the outer bearing cone cannot slide out.

8. Adjusting wheel bearing. The wheel bearing are a cup and cone type, these type bearings require a preload setting. Tighten adjusting nut (item 4) until all end play (in and out) is eliminated on bearings. (DO NOT tighten adjusting nut so tight the bearings are damaged). Back off on adjusting nut 1/6 turn (one flat spot of hex shape of nut). When turning hub you should feel a drag on it but hub should turn with little effort. Adjusting nut 1/6 turn at a time until adjusted and bearings have no end play..



Axle Spindle for the 3 piece Seal

FIGURE 9A

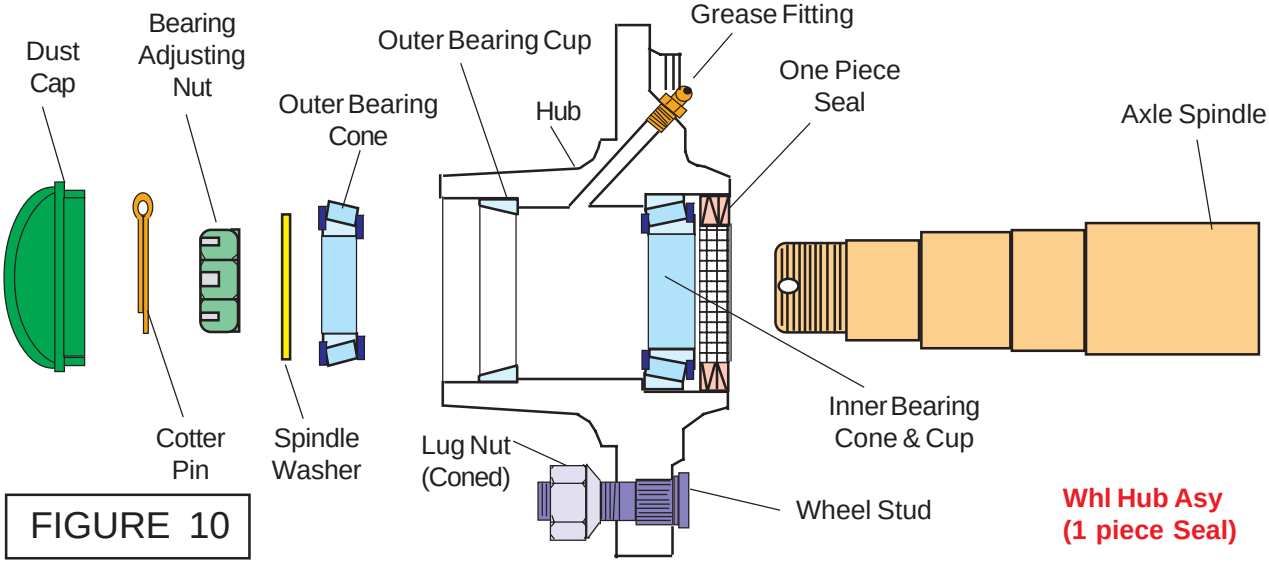


FIGURE 10

Whl Hub Asy (1 piece Seal)

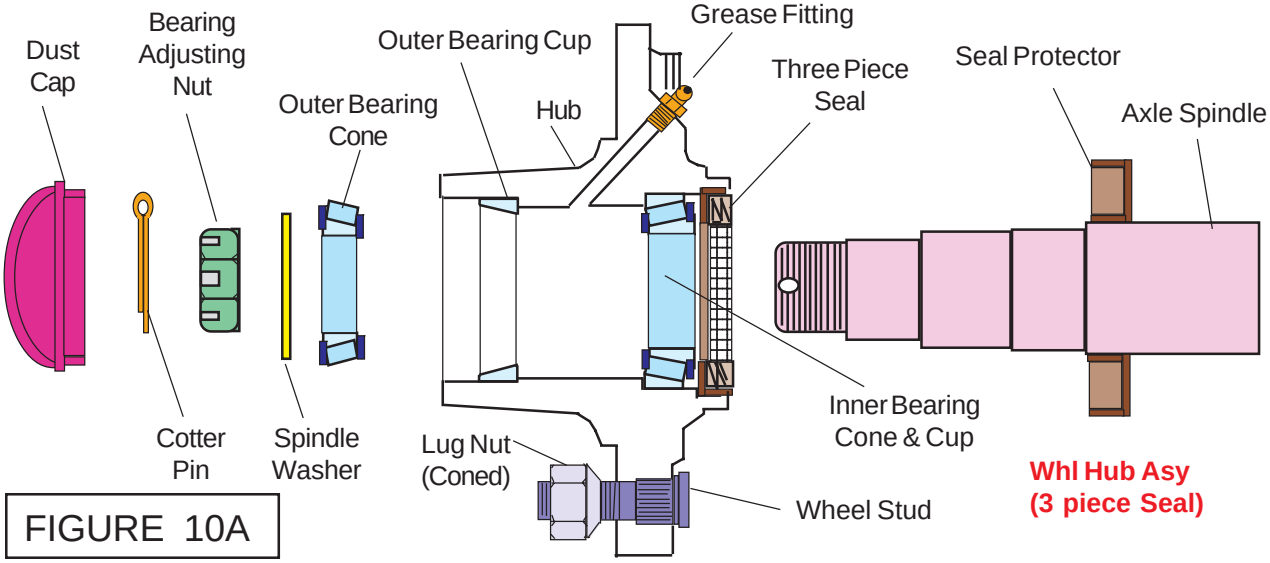


FIGURE 10A

9. Install cotter pin (item 3), Push Cotter Pin into hole until the head (loop in cotter pin) is no higher that the washer (figure 11). Bend the cotter pin outward (figure 11), it may require the ends of the cotter pin to be cut, if so use a pair of diagonal cutters. DO NOT Cut cotter pin so short the ends can not be bent over (figure 11). Make certain the cotter pin doesn't stick outward so far that it rubs the dust cap that is to be installed.

10. Install dust cap (item 2). The Hub can be greased now if wanted, Pump grease in through fitting until grease comes out the front between rollers of outer bearing cone. Carefully drive dust cap (item 2) onto up aligning the dust cap rim with the edge of hub. Carefully drive the dust cap onto hub until it is seated into the recess of the hub (figure 12 & 13). Caution dust cap must be installed squarely and driven on until they are fully seated. When Assembled look at figure 12 & 13, this is what it should look like.

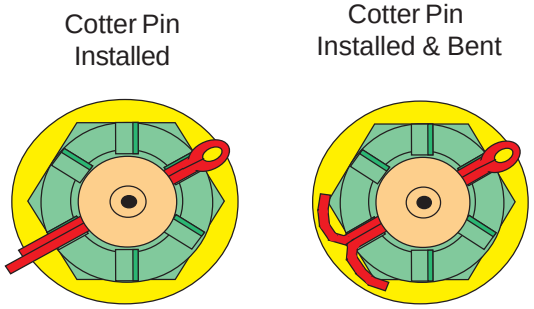


FIGURE 11

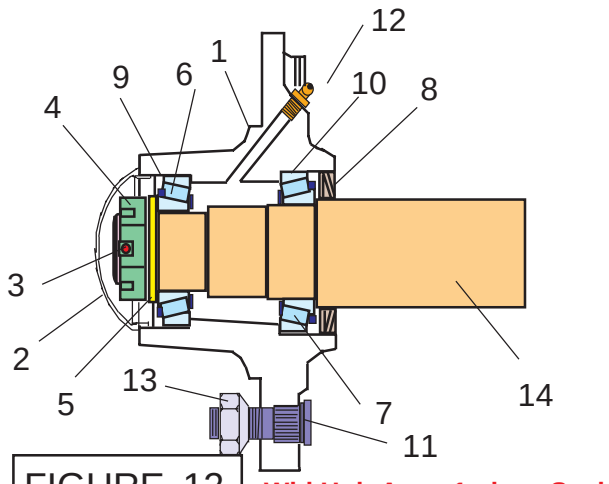


FIGURE 12 Whl Hub Asy - 1 piece Seal

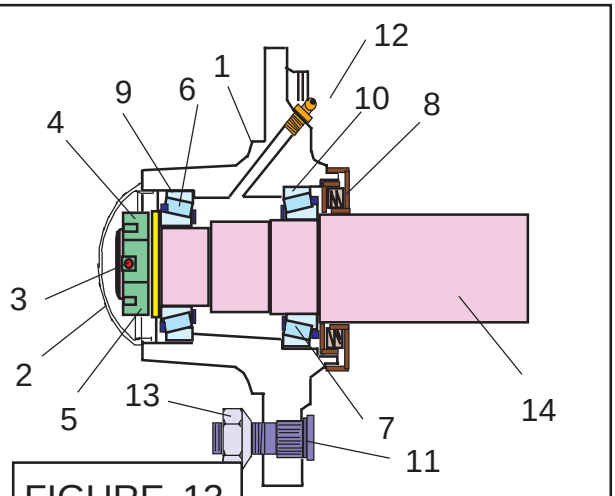


FIGURE 13 Whl Hub Asy - 3 piece Seal

NOTES

Section 9

HYDRO 15

Blades & Blade Carrier Service & Repair

Blade & Blade Carriers Service & Repair

1. Make certain the mower and tractor are secured in a safe and proper parked position, hydraulic (axle and wings) lowered or secured by the transport bars. Make certain that tractor is safely parked according to tractor manufacturers recommendations. Tractor should be secured (or dis-abled) in a way that it cannot be started unless the serviceing technician is ready for it to be started. **Never** get under any equipment unless it is secured and supported by sufficent jackstands, **DO NOT** depend on hydraulics or brackets to support equipment if you are going to be under it, this is important! See the Operators Manual for recommended Maintance schedules and recommendations.

2. There are blade carriers option of bar carrier or pan carrier (figure 1). The basic mounting design of the connecting blade carriers to the spindles are the same, and will follow the same directions even with the fact some of the components are different.

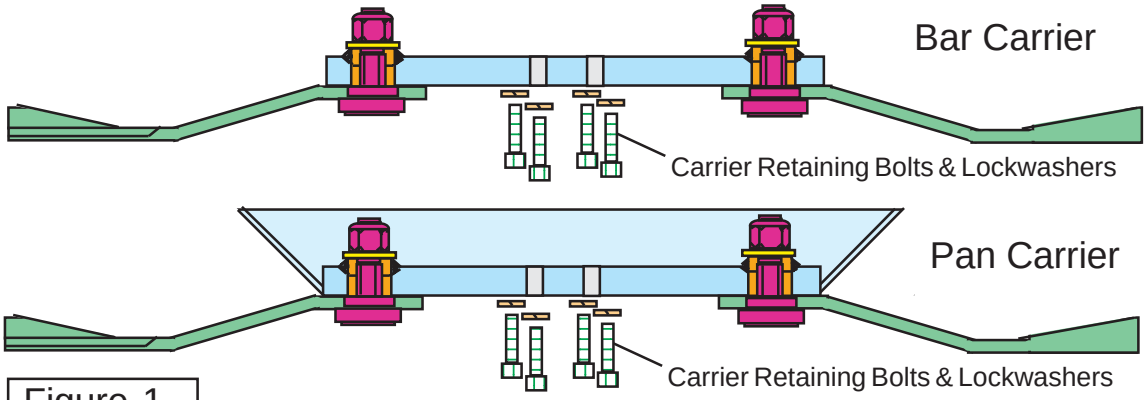


Figure 1

3. Blade Carrier Spindle Mounting Bolts, These bolts hold the blade bar onto the spindle and must be torqued when being installed. These are high strength Allen head bolts (figure 2) and should be replaced with the proper length of bolt, never install a longer bolt than was removed. If longer bolts are installed damage will occur . Always replace the lockwasher (figure 2) when reinstalling the bolts, it is not recommended to use the lockwashers twice. When changing or installing a blade bar, place one drop of Loctite on threads of each bolt before installing it in place. Tighten the bolts diagonally (in an X pattern) to assure that the blade bar pulls up evenly.

Torque the bolts to 400 ft./lbs.(figure 3) in increments, example 300 ft lbs then 350 ft lbs, then the last to 400 ft lbs. This will help to make certain the blade carrier is pulled up evenly to the spindle..

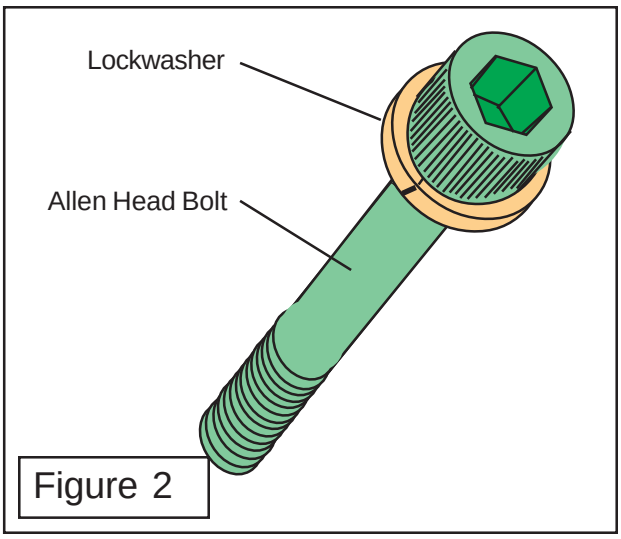


Figure 2

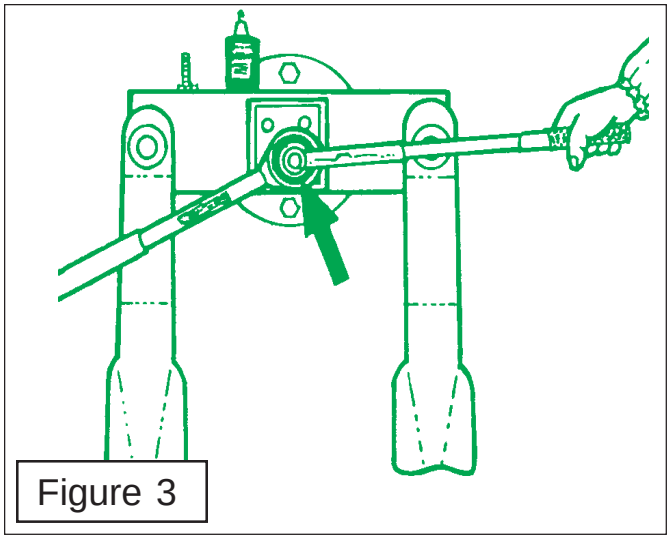


Figure 3

4. Blade Bolts. There is the square shanked blade bolt that is currently being used (figure 4) and the round keyed shanked bolt that was used in earlier production (figure 4). Both bolts will have the same torque rating. Both bolts need to be lined up with the blade bolt hole when being installed and tightened. The Keyed blade bolt is very critical that the key be aligned with the keyway in the hole. If keyed bolt is not aligned it will damage the bolts and/or the hole. The Sq. shanked bolt is important that it be aligned with the hole when tightening. Changing the blades is usually a two man job. Access to the blade bolt Nut is through the access hole (that is covered) on top of the deck. The easier method is to use an air impact. It will usually require you to turn the blade carrier to align bolt with hole (figure 5). Torque Blade Bolts to 300 ft. lbs.

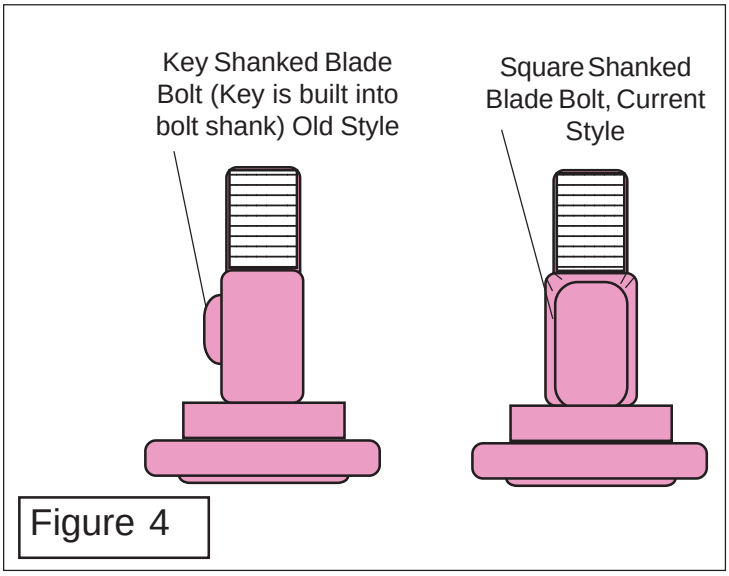


Figure 4

5. Blade Condition. The condition of the blades, blade bolts and other blade carrier components are very critical. Never mix new and used blades on same carrier, blades on the same carrier must be closely matched for weight or they will cause a un-balance vibration. If the mower has a vibration do not run the mower until the cause of the vibration has been corrected. A vibration in a mower will cause metal fatigue and welds to crack. The amount of time it takes to show up depends on the severity of the vibration.

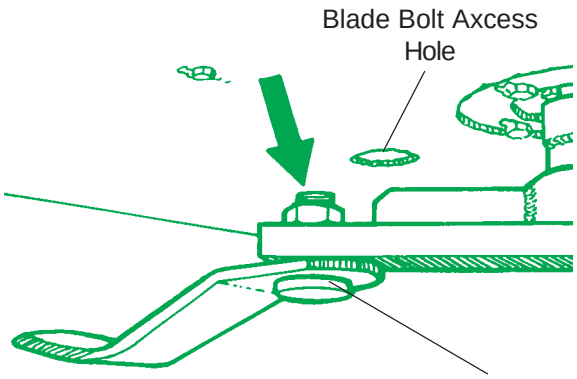


Figure 5

6. Blade Inspections, the blades should be closely examined each morning before start up (figure 5). The Blade should be free of deep chips, cracks or abnormal bends. If the blades are sharp they will require less power while moving. Blades should be replaced when they become excessively worn, bent, or deformed. Blade are designed to turn the direction of cut as according which way the blade carrier turns as decided by the hydraulic motors direction of travel, CW or CCW. Make certain that the blades are i nstalled on the correct blade carrier to match the direction of rotation. Make certain the holes in the blade carrier are not deformed or damaged. If any holes in carrier are not in serviceable condition, bolts will not stay tightened. DO NOT operate the mower with damaged holes in blade carriers.

CAUTION!

Blades should always be replaced in pairs. Blades of different weights can cause serious imbalance and damage to the machine and personnel. When replacing the blades, also replace the blade bolt, nuts and washers. Once the nut has been removed from the blade bolt, it will not fasten tightly on the bolt again. Never weld or modify the blades. The blades are made of a high strength steel and heat treated to give maximum strength and resistance to chipping and wear. Any welding or surfacing applied to the blades can severely reduce its strength. A blade failure could result in a blade segment being thrown at high speeds out from under the machine.

This is a good time to check the spindle to make sure it is properly tight. To do this, grab the blade bar and pull outward and push inward. See Figure 6. There should be no noticeable movement. If the spindle is loose, refer to assembly and disassembly of Spindle in previous Service & Repair section.

NOTES

Section 10

HYDRO 15

Leveling Mower
Service & Repair

Leveling Control Rods Service & Repair

Tongue Clevis & Leveling Control Rods Components:

1. Make certain the mower and tractor are secured in a safe and proper parked position, hydraulic (axle and wings) lowered or secured by the transport bars. Make certain that tractor is safely parked according to tractor manufacturers recommendations. Tractor should be secured (or dis-abled) in a way that it cannot be started unless the servicing technician is ready for it to be started. **Never** get under any equipment unless it is secured and supported by sufficient jack stands, **DO NOT** depend on hydraulics or brackets to support equipment if you are going to be under it, this is important! See the Operators Manual for recommended Maintenance schedules and recommendations.

2. Tractor Draw Bar connection, the mower must be connected to the tractor draw bar before the mowing height can be adjusted. This mower uses a swinging clevis that is designed to be bolted to the draw bar (figure 1), This Bolt, Washers and Locknut was supplied with mower and should be replaced with same components it required. The tongue clevis must be connected to the tractor draw bar using this bolt, washer and lock nut (figure 2). The tongue clevis will not operate correctly with using a drop pin (figure 3). The drop pin will cause damage to the clevis and draw bar. Some drawbars will have a hole that is larger than the bolt in the clevis, it is recommended these holes be fitted with a connex bushing to adapt the draw bar hole to the size of the bolt to hold the clevis as parallel to draw bar as possible (figure 2). The spring washers also act as wear washers, the qty of washers will vary from tractor to tractor but all need to have washers between clevis and draw bar for wear. (figure 1 & 2). Tighten the Nut onto the Bolt (150ft./lbs.) so that it holds the Clevis parallel with the draw bar (figure 2)..

3. Control rod options, single or dual control rods (item 1). The components are the same for the LH or RH control rod. Shown here is the RH control Rod (figure 4). The single control rod is longer (112 inches) than the control rod used on the dual control rod (110 inches) mowers, these cannot be mixed on mowers.

4. To set the Mower cutting height and/or level the Mower from front to rear, position it on level ground. Attach the Mower to the tractor with the Bolt, Nut, and Washers provided with the tongue (see Step 2) and (figure 1, 2 & 3). Make certain to tighten the locknut onto the Bolt (150 ft. lbs.) so that it holds the Clevis parallel with the draw bar. (figure 2)

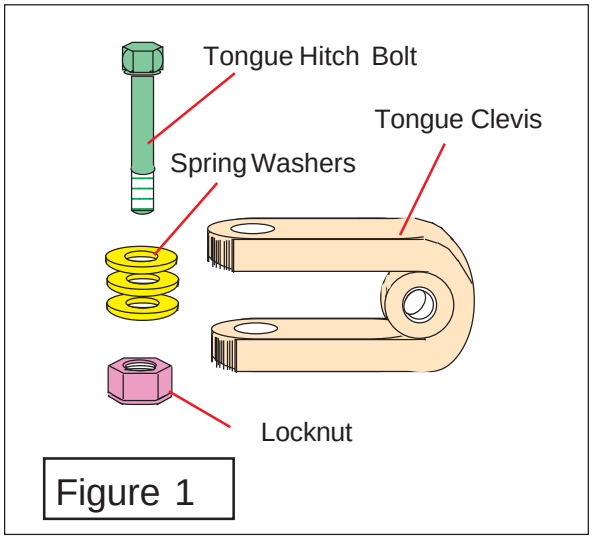


Figure 1

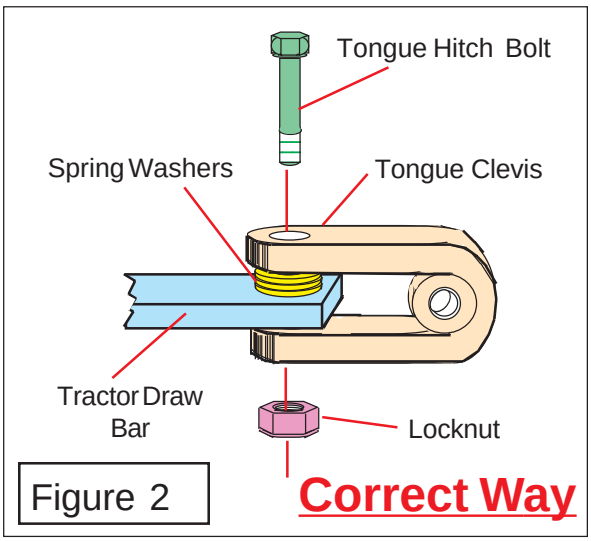


Figure 2 **Correct Way**

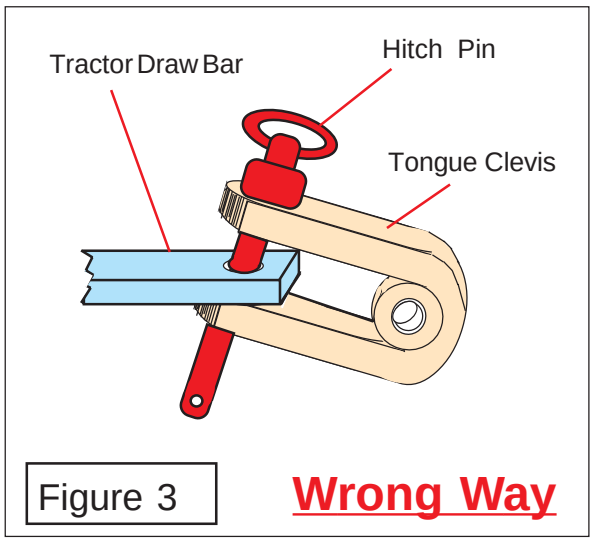
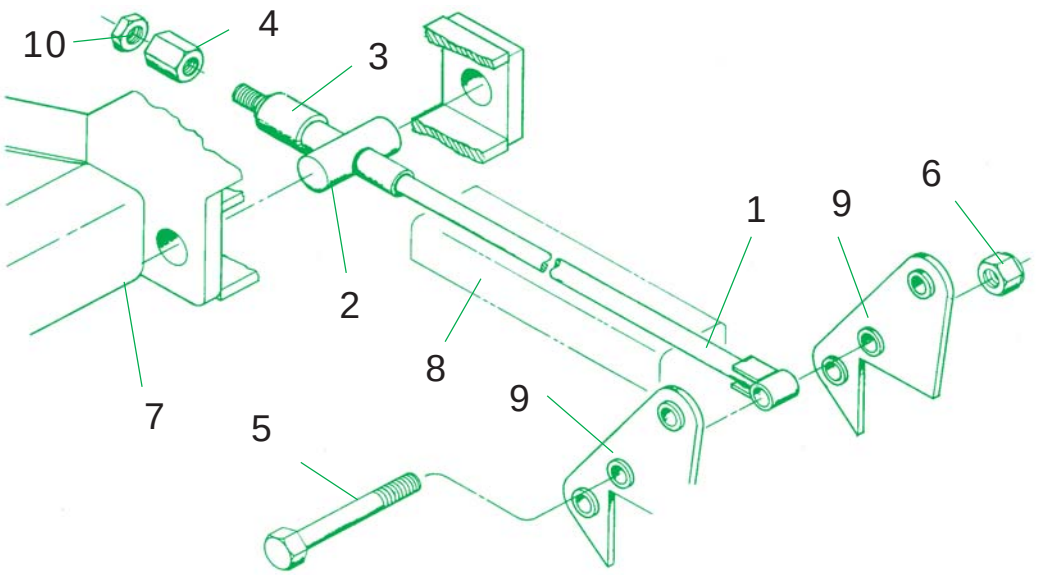


Figure 3 **Wrong Way**

Leveling Control Rods Service & Repair



Item	Qty Sng	Qty Dbl	Description
1	1	0	Level Rod Weldment (112" Long) Single Control Rod
	0	2	Level Rod Weldment (110" Long) Dual Control Rod
2	1	2	Swivel Bar
3	1-ar	2-ar	Bushing Weldment (A - Dim. 2-1/2" Long) See Figure 5
	1-ar	2-ar	Bushing Weldment (A - Dim. 1/2" Long) See Figure 5
4	1	2	Hex Adjusting Nut
5	1	2	Bolt, Hex Head
6	1	2	Locknut, Top Lock
7	ref	ref	Tongue Weldment
8	ref	ref	Center Section Weldment
9	ref	ref	Axle Wedment
10	1	1	Jam Nut

Figure 4

The single control rod is shown or the RH side control rod, the LH control rod when dual control rods are used will be the same components as the RH

5. Under stand the Control Rod (s) from rear axle to tongue, quantity of parts will depend on single or double control rods. The control rod connects to the rear axle weldment (item 9) with a bolt and locknut (item 6), connects to the tongue with swivel bar (item 2) and bushing weldment (item 3). There have been two bushing weldments used, the same type that is removed is the type that should be replaced (figure 4 & 5 item 3). The function of these control rods is to keep the mower leveled from front to rear.

6. Inspect the tongue clevis (figure 1 through 3) and the control rod components (figure 4 & 5) to make certain the components are correct and the mower is connected to the tractor draw bar correctly (figure 2).

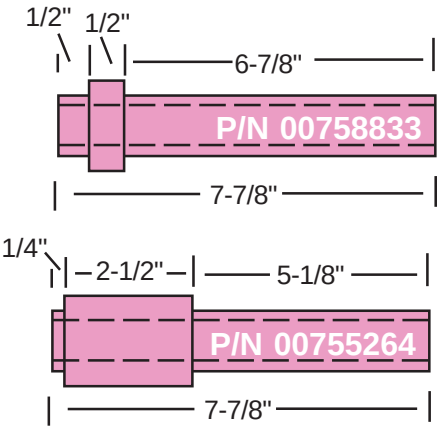


Figure 5

Figure 4 Item 3

Leveling Control Rods Service & Repair

Leveling Control Rods - Assembly & Adjusting:

Using the drawing in figure 4 locate and identify the control rod components. The control rods will require the proper assembly order in order to be assembled to the mower. The following step are to be used if the control rods need to be assembled to mower, the reverse of this procedure will be used to dis-assemble the control rod(s) of the mower. DO NOT REMOVE OR INSTALL ANY CONTROL ROD COMPONENTS unless you first support the mower on Jack Stands in the front and rear. When replacing any parts the new parts must be compared to the old existing part for comparison and should be the same. (MOWER & TRACTOR MUST BE ON LEVEL AREA (concrete or pavement preferred) BEFORE LEVELING CAN BE DONE!

1. From the front side of the center section deck slide eye end of the control rod (item 1) into the hole of the channel on the deck, the threaded end will be to the front.

2. Install the swivel bar (figure 4 item 2) into the tongue, if dual control rods there is one on the LH side also that should be installed now (figure 6).

3. From the back side slide the control rod (item 1) forwar toward tonge and into the hole of the swivel bar (item 2), this will mot likely require two people. The hole in the swivel block will be larger than the control rod diameter (figure 4 & 6).

4 Select the correct bushing weldment (item 3 should be same as existing part), slide the bushing weldment (item 3) over the threaded end of the control rod (item 1) and through the hole of the swivel bar (item 2) until the shoulder in bushing weldment is against the swivel bar (figure 4, 5 & 6)

5. Start the adjusting nut (item 4) on to the threads of the control rod (item 1), only start the threads do not screw the adjusting nut on completely. Push the control rod back toward the rear of the mower.

6. Install the rear control rod anchor bolt (item 5) by aligning the eye on the control rod with the hole in the rear axle (item 9). install the locknut (item 6) onto the anchor bolt. Tighten the nut untill the slack is out and the bolt will not slide in or out. DO NOT over tighten the bolt and deform the plates on the axle or tighten bolts so tight the control rod is pinched between the plates of the axle (figure 7).

7. Tighten the adjusting nut (item 4) until the slack is out of the control rod and the previous components are seated against each other as explained in previous steps (figure 4 & 6). The LH and RH control rods (on dual control rods) should be assembled as explained above.

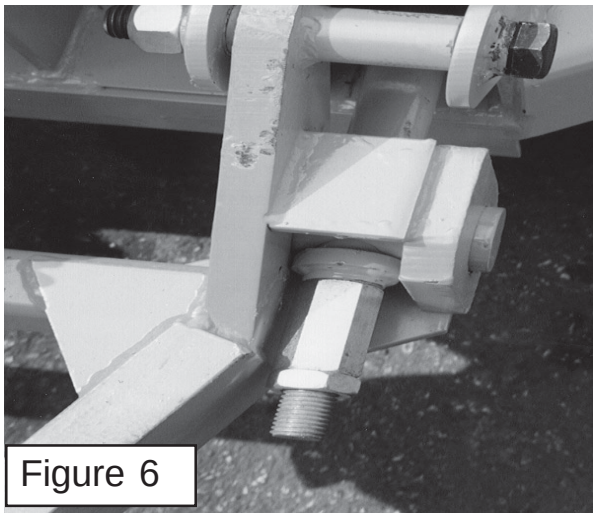


Figure 6

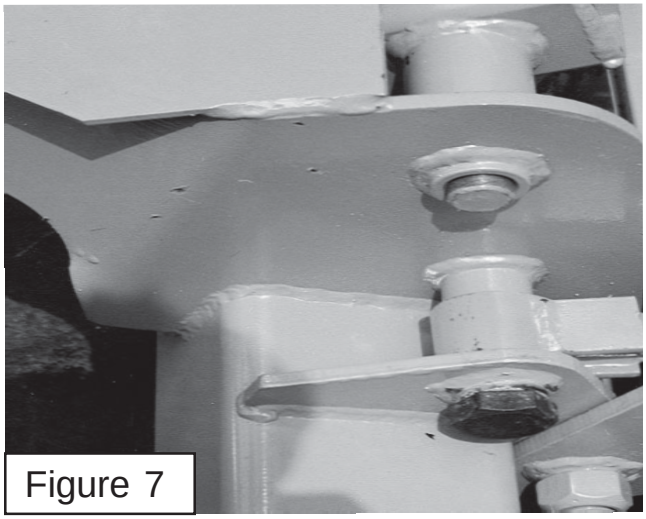


Figure 7

Leveling Control Rods Service & Repair

8. Using the height control spacer (figure 8) to set the center axle hydraulic cylinder at the height to begin adjusting. this height is not a fixed height, it may vary depending on the type tires that are on mower. This height will be measure from the center of the RH wing hinge pin in the rear to the ground, make note of distance. (figure 8). Go to the front of the mower and measure the distance to the ground (RH Side) and measure distance to the ground, make note of distance

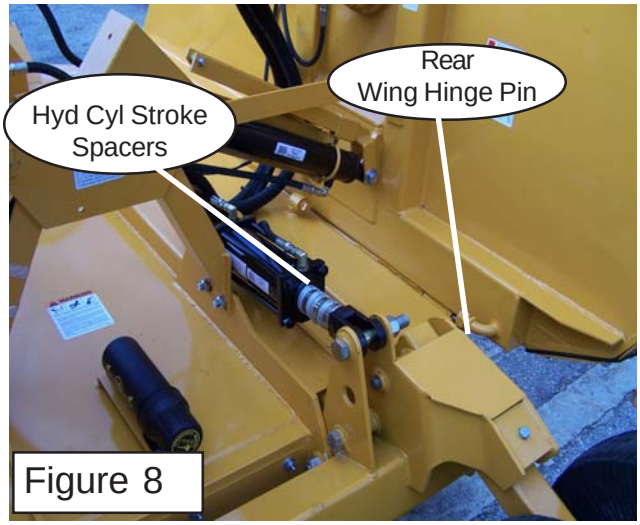


Figure 8

9. At this time the front of the control rod should have the adjusting nut (item 4) screwed on until it is touching the bushing weldment (figure 6). The jam nut (item 10) can be on control rod or not, if it is on it should be screwed out away from adjusting nut.

10. Use the measurements you got in step 7 to determine which way to turn adjusting nut. Using distance numbers that are as example only as the distance you got will be different. Rear mea surement was 17" from top of hinge pin to ground on rear. The front measurement was 15-1/2" from top of hinge pin to ground. This means the front is to low. The ideal measurement would be rear 17" and front 16" to 16-1/2", the front should be run at least 1/2 to 1" lower in the front than rear. Run lower in front will give cleaner cut and distribute cut grass better.

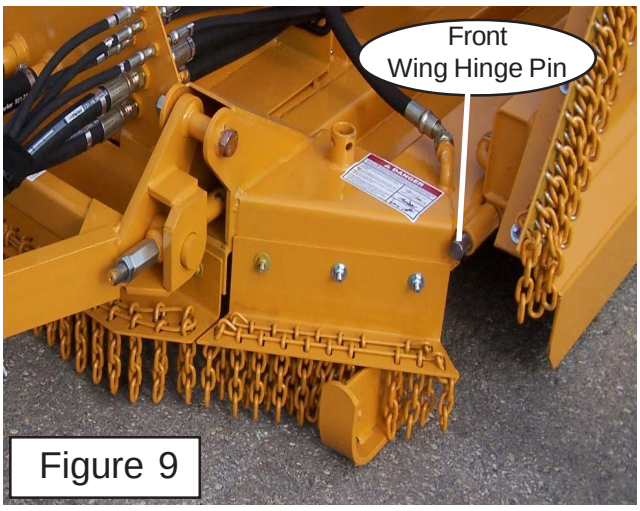


Figure 9

11 With 17" in rear and 15-1/2" in front means the mower needs to be raised in front. Raising the front means shortening the control rod, to do this screw the adjusting nut onto the control rod. The RH control rod will raise the mower. (Note, tightening the adjusting nut will raise the mower, it will make adjusting easier if a floor jack is placed under mower and jack the mower up to the desired height of 16 to 16-1/2"). Continue to raise mower until the desired height is reached. Adjust the LH control rod on dual control rod models until the mower starts to lift. Make certain the control rods have equal pressure on them, best way to do this is watch the mower, when the LH side adjustment starts to raise the mower it is starting to pick up the weight.

12. Install the jam nuts (item 10) onto the control rods. This will require two wrenches, one to hold the adjusting nut so it won't turn and one to tighten jamnut against adjusting nut (figure 6). Lock the adjusting nut securely with the jamnut to prevent the adjustment from changing.

13 This should keep the mower adjusted to the desired cutting height unless something changes. Some things that will affect this is changing tractors to a different draw bar height. The wear or distortion (bending) of the blades can change this. Changing type of tires & wheels used can change this. Any time any of these things are changed the mower will require re-adjusting

Leveling Wings L to R:

There are two different system for lifting of the wings, the standard mechanical turnbuckle and the optional level lift hydraulic cylinder system. leveling the wings should be done only after the mower has been leveled front to rear.

1. Leveling the mechanical turn buckle axle lift system. This is done by lengthening or shorting the mechanical turnbuckle (figure 10). Measure to the ground at the inner rear edge of the top deck of wing, and adjust the turn buckle until the top deck is the same height at the outer edge. Dos this on both wings and mower should be level across left to right.

2. Leveling the optional hydraulic level lift (figure 11) is done by the cylinders. The cylinders are connected together and move together. This system will level the wings themselves if they are connected and the air is bleed from them. See the hydraulic axle level lift in a previous section of the service manual for operating instructions.

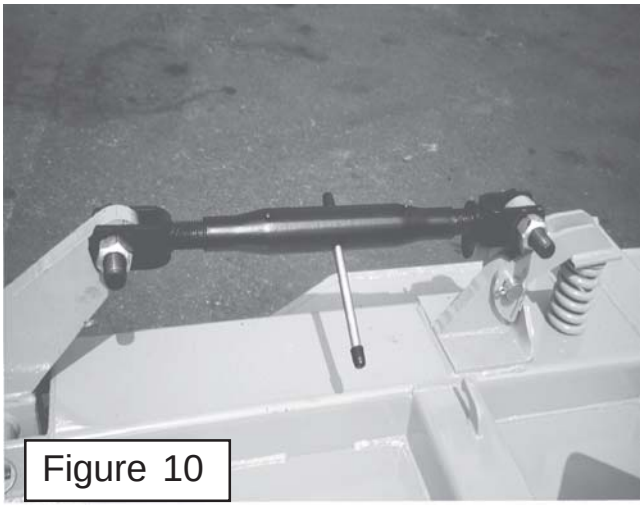


Figure 10

Figure 11

Section 11

HYDRO 15

Trouble Shooting Guide

Trouble Shooting Guide

TROUBLE SHOOTING GUIDE

INTRODUCTION : The following guides intended to help locate minor problems before they become major ones.

The basic procedures for maintaining the equipment properly are covered in the operators manual. However, any machine can have operating problems or need parts replacement under unusual conditions or severe use. The following guide will help identify the most common problems and presents possible causes and solutions.

PROBLEM	POSSIBLE CAUSE	SOLUTION
NOT CUTTING CLEAN	Blades dull.	Sharpen or replace blades
	Blade Bent or damaged	Replace with correct condition blades
	Blade rotation incorrect	Use correct blade for carrier rotation, check to make certain Hyd motors turning correct rotation
	Using flat blades	Use fan blades for down grass
	Carrier RPM too low	Use correct PTO speed and check for correct speed increaser ratio, Check for required hydraulic pressure through out hydraulic system
	Cutter not level	Adjust machine
	Tires mashing down grass	Check for correct rotation. Move tires out of cutter overlap area (to clear 72" cutting width)
	Ground speed too fast	Reduce ground speed
	Blades locked back	Free blades
	Blades riding up due to blade bolt wear.	Replace blade bolts
	Blades hitting deck	Blades Bent, Mower hitting ground and blade deflecting upwards
DISHPAN HITTING CUTTER DECK	Blade carrier bent.	Replace dishpan.Straighten dishpan.
	Nut that holds Blade Carrier on is loose.	Tighten Nut
	Deck bent down.	Straighten deck
	Output Shaft on Gearbox bent.	Replace Shaft.
BREAKING BLADE BOLTS	Operating mower w/ loose blade bolts	Keep blade bolts tightened to 350 ft lbs
	Worn blade bolts	Replace bolts
BLADE WEARS TOO FAST	Cutting in sandy condition	Increase cutting height or try to mower when more moisture in ground
	Cutting in rocky conditions	Increase cutting height
	Blades too soft	Replace blades with heat-treated blades from the manufacturer.

Trouble Shooting Guide

PROBLEM	POSSIBLE CAUSE	SOLUTION
BLADE BOLTS WORKING LOOSE	Bolts not tightened sufficiently	Tighten New Bolts to 350 ft/lb torque
	Bolt hole elongated or oversized	Replace blade carrier.
	Locknut worn out	Replace locknut
BLADES HITTING TOP DECK OR CUTTING TOO HIGH	Blades bent	Replace blades
	Blade bolt bushing broken loose.	Replace bushing
	Blade carrier bent	Straighten or replace blade carrier
	Blades hitting ground	Blades Bent, Mower hitting ground and blade deflecting upwards
	Blades on upside down	Change blades right side up
CUTTER VIBRATING	Blade broken	Replace blade--only in pairs
	Blade carrier bent	Replace carrier
	Blade hub not properly seated on shaft.	Remove hub, check key, and replace.
	New blade matched with worn blades	Replace blade--only in pairs
CUTTER WINDROWING	Rotation of blades incorrect.	Reverse rotation
	Cutting heavy material	Use guards on the rear to reduce windrowing
	Ground Speed to fast	Reduce ground speed
	Mower un-level	Check and re-level mower
NOISY SPEED CHANGER	Rough gears	Run in or change gears
	Worn bearing	Replace bearing
	Improper gear mesh	Change check, repair or replace
	Low on oil	Fill with oil and check for damage Repair or replace as needed
OIL BLOWING OUT OF SPEED CHANGER	Vent plug defective or broken	Replace with proper vent plug
	Oil level too high.	Lower oil level.
	Vent Plug inserted wrong place	Check & relocate vent plug
WING BLADES DO NOT CUT CLEAN ON OUTER EDGES	Ground speed too fast.	Slow forward speed.
	Reverse rotation of wing blades	Reverse rotation wing motor and blade carrier.NOTE: This rotation of wing blades may tend to streak behind tractor tires.

NOTES

HYDRO 15

Hydro 15 (Service Manual) 09/06)

Hydro 15
Service Manual
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