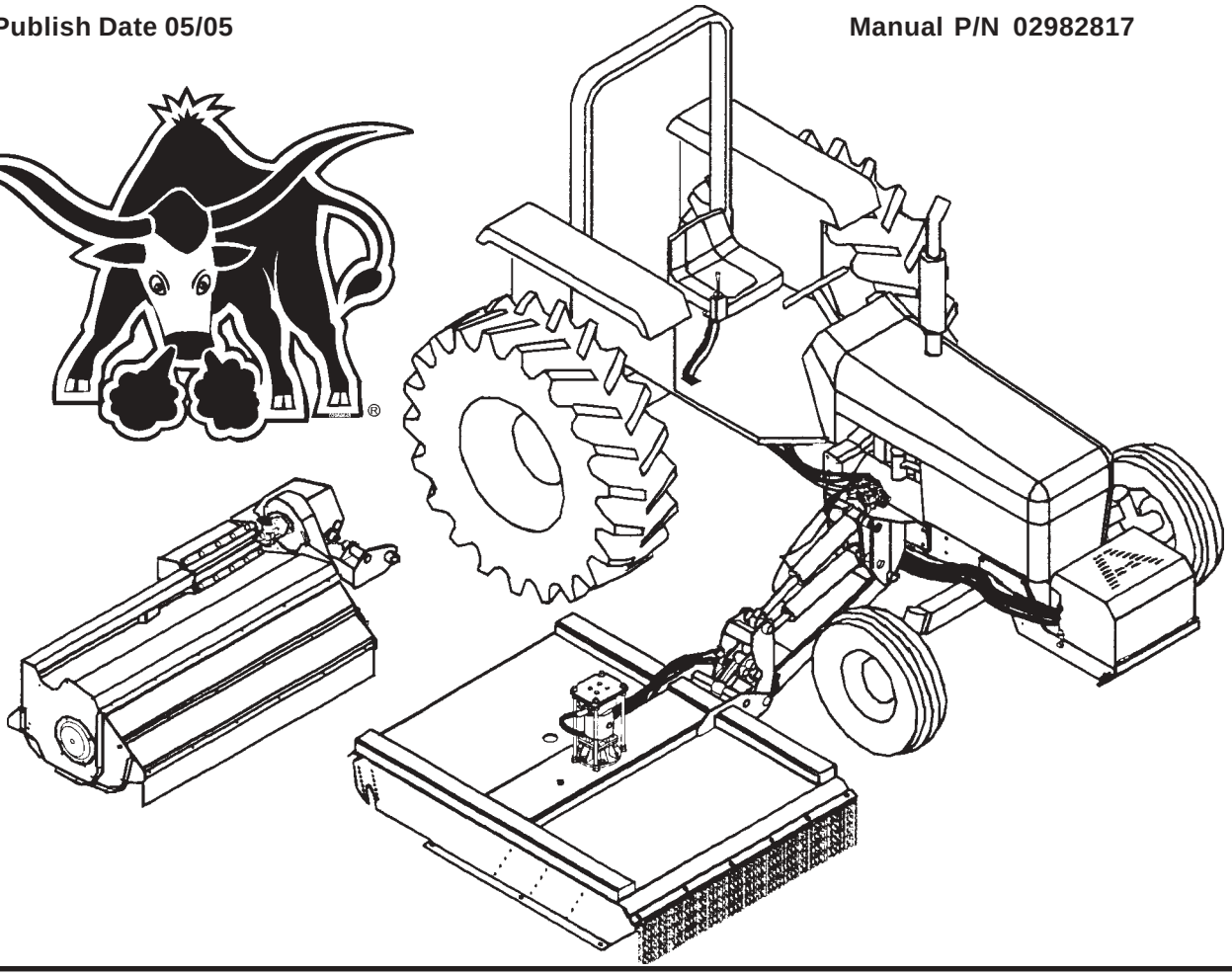
BRAHMA™

SIDE MOUNT MOWER

PRODUCT SERVICE MANUAL

Publish Date 05/05

Manual P/N 02982817



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 oar Alamo Industrial.

Alamo Industrial
1502 E. Walnut
Seguin, Texas 78155
830-372-1480

MEMBER OF THE ALAMO GROUP
ALWAYS ON THE CUTTING EDGE®

2005 Edition

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.

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: 830-372-2708

INDEX - REPAIRS

INDEX - REPAIRS

INDEX - REPAIRS

Section 1

Specifications Section

SPECIFICATIONS - BRAHMA

1. Cutting Circuit Specifications

Hyd. Pump Speed (Front Aux Pump).....1950 RPM
Hyd. Motor Speed..... 1220 RPM
Hyd. Motor Rated HP.....199 HP
Hyd. Motor Rotation (as viewed f/ Top of the Deck).....CW (Clockwise)
Relief Valve Setting At Motor..... 4000 PSI
Relief Valve Setting At Pump.....4500 PSI
Hyd. Pump Flow (Front Pump @ 1950 RPM).....25.3 GPM
Hyd. Oil Operating Temperature..... 95 Deg, (F) Above Ambient
Hyd. Oil Filtration, (Discharge f/ Charge Pump)..... 10 Micron
Hyd. Tank Capacity..... 17 Gal.
Hyd. Motor Circuit Oil Type *..... ISO AW 100 Hyd Oil
Hyd. Motor Start Stop Time (Approximate)..... 6 Seconds
Cutting Diameter, (Rotary Head).....58 Inch
Spindle..... 4.5 " by 9" Heat Treated Alloy
Blade Carrier..... Blade Bar / Pan Option (Rotary Head)
Blade Swing.....360 Deg Swing
Blade Material..... High Carbon Alloy Steel
Cutter Weight. (Approximate w/ Rotary Head).....950 lbs.

*** Older models recommended Universal Tractor Hydraulic Oil,** This was changed to ISO AW 100 Hyd. Oil, If changing Oil in Older units switch to New Oil, DO NOT Mix types of Oil.

2. FILTRATION

Control Valve Functions: Control functions include All Hydraulic Cylinders, These are powered by the Tractor Hydraulic System and are protected by the Tractors Filtration system. Maintenance and specification of this should be per Tractor Manufacturer instructions. Later Models Had an Inline Filter assembly (P/N 02976066) added to Filter Tractor System between Valve and Tractor. Change Filter every 200 to 250 hrs. Operation recommended maximum.

Mower Head Functions: Mower Head Functions are operated by Pump, which is mounted to the front of the Tractor Engine. This will have an inline Filter installed into hydraulic circuit, This filter should be changed on a regular maintenance schedule. Filter are rated by Micron size (10 Micron), Filter should be replaced with the same Micron and High Pressure rated Filter.

3. HYDRAULIC PUMP CIRCUIT

Pump Type..... Piston Type
Pump Speed (Front Engine Mounted).....1950 RPM
Relief Setting at the Pump.....4500 PSI
Pump Flow (Front Engine Mounted @ 1950 RPM).....25.3 GPM
Oil Operating Temperature..... 100 deg. (F) above Ambient Temp
Filter, Discharge from Charge Pump..... 10 Micron
Hydraulic Tank Capacity.....17 Gallons
Hydraulic Oil Type (Pump & Motor Circuit)..... ISO AW 100 HYD OIL
Motor Start / Stop Time (Approximate).....6 Seconds

4. HYDRAULIC HOSE CODES

Hydraulic Hose Band Mark Color Codes:

Hose's and/or fittings are marked with a Color Coded Plastic Band around it. Some Bands are a solid Color and some have a Colored Stripe. DO NOT remove these bands unless you replace them. All Bands with Solid Colors connect to Rod End of Cylinder. All Bands with Stripes connects to Butt End of Hydraulic Cylinder (or connections leading to them).

Always Check Hose Size & Color Code

Color Tie	Color Tie Abbreviation	Hose Size	Hydraulic Connection
Red	R	Large	Pressure Flow to Motor
Orange	OR	Large	Return Flow from Motor
Blue	B	Medium	Case Drain for Motor
Green	G	Medium	Base End Tilt Cyl.
Green / White Stripe	G / W	Medium	Rod End Tilt Cyl.
Blue	B	Medium	Base End Lift Cyl.
Blue / White Stripe	B / W	Medium	Rod End Lift Cyl.

5. HOSE END FITTING TORQUE SPECS:

Hose End Type: 37 Degree Angle End Steel Hose End Fittings*

Dash Size	Nominal Cyl. Size (in.)	Torque in. lbs.	Torque ft .lbs.
-4	1/4"	140	12
-6	3/8"	230	19
-8	1/2"	450	38
-10	5/8"	650	54
-12	3/4"	900	75
-16	1"	1200	100
-20	1-1/4"	1600	133
-24	1-1/2"	2000	167
-32	2"	2800	233

* Straight Threads do not always seal better when higher torques are used. Too much torque causes distortion and may lead to leakage. DO NOT over torque fittings and DO NOT allow any contaminants to enter system through fittings when installing them.

6. Special Torque Specifications (Rotary Heads)

Motor to Spindle Housing..... 100 ft. lbs.
Spindle to Deck..... 425 ft. lbs.
Spindle to Adjusting Nut (Bearing Preload).....25 in. lbs. Rolling Torque
Blade Bar to Spindle Bolts..... 400 ft. lbs.
Blade Bolts..... 400 ft. lbs.
Motor Plate..... See Set Up Instructions

7. TORQUE VALUES - BOLTS:

Recommended Torque, Ft. lbs. & (Nm)

IMPORTANT! Listed below IS BOLT TORQUE and NOT APPLICATION TORQUE, Component Application Torque will vary depending 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

Section 2

BRAHMA

Frame Mounting & Control Valve Installation

NOTE: Photos and/ or descriptions may not be the exact same as the type tractor you are working on. See the assembly Manual for the specfic Tractor.

Mounting Main Frame Asy. To Tractor

MOUNTING BRACKETS ATTACHMENT:

The Left and Right Mounting Brackets differ from tractor to tractor. Refer to your Mount Kit Bill of Material for more detailed information on proper hardware and attachment. Secure Tractor so that it cannot be started unless you want it started.

NOTE: This step may vary from tractor to tractor, see the detail Installation Drawing for specific information. General Frame Mounting Brackets are shown in some line drawings as an illustration and may not appear the same as the component for the model tractor you are mounting. These Drawings will be marked as general illustration shown (See Figure 1). DO NOT Mount any Brackets or components until instructed to do so. There are some components that will interfere with mounting others if mounted to soon.

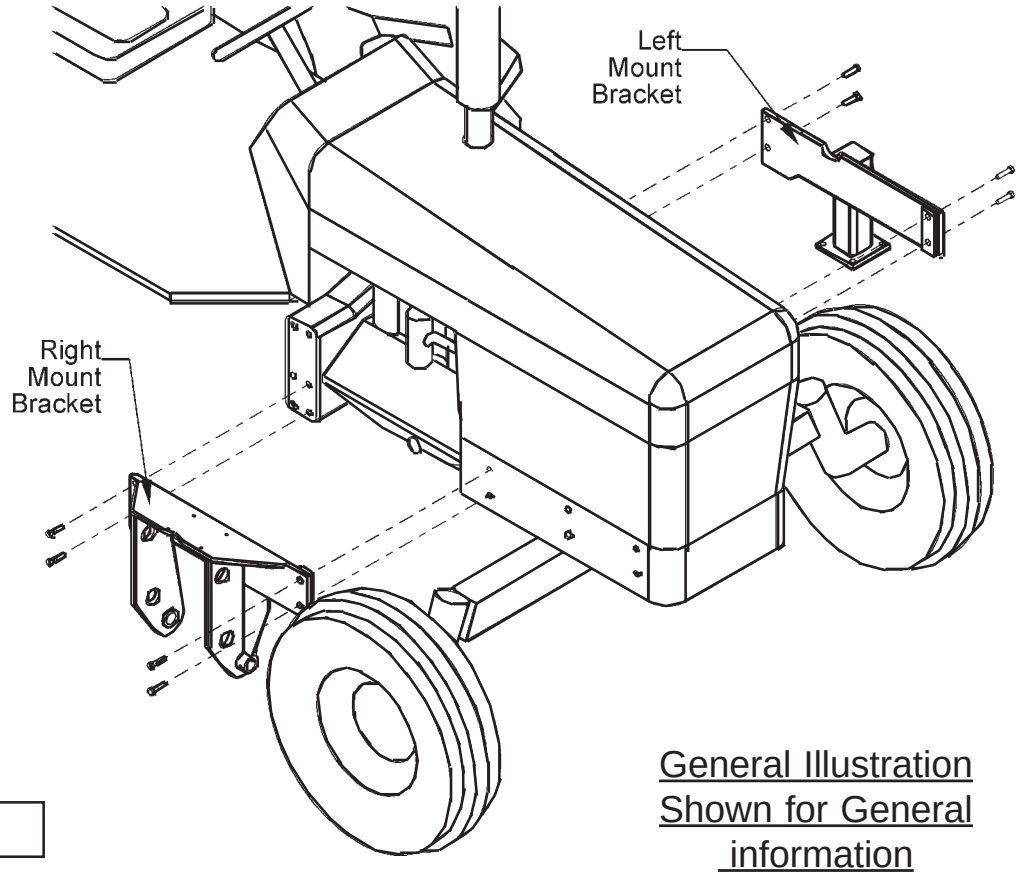


Figure 1

General Illustration Shown for General information

PINS AND TEFLON BEARINGS:

Teflon Bearings and Pins will last the lifetime of your machine, but only if properly installed.

1. Before assembling any points that have telfon bearings, check for any damage to the bearings, or any burrs on the pins. Replace the bearing if there is any damage to it, and remove any burrs on the pins.

2. DO NOT USE EXCESSIVE FORCE - Pins should slide into the bearing with just hand force. If they do not check each bearing and thru hole to make certain that the pin will go into them. It they do, realign and try again. Teflon bearings are not to be Force Fitted. The Holes for the pins are align bored, DO NOT use force to spread any components as you will misaligned the holes.

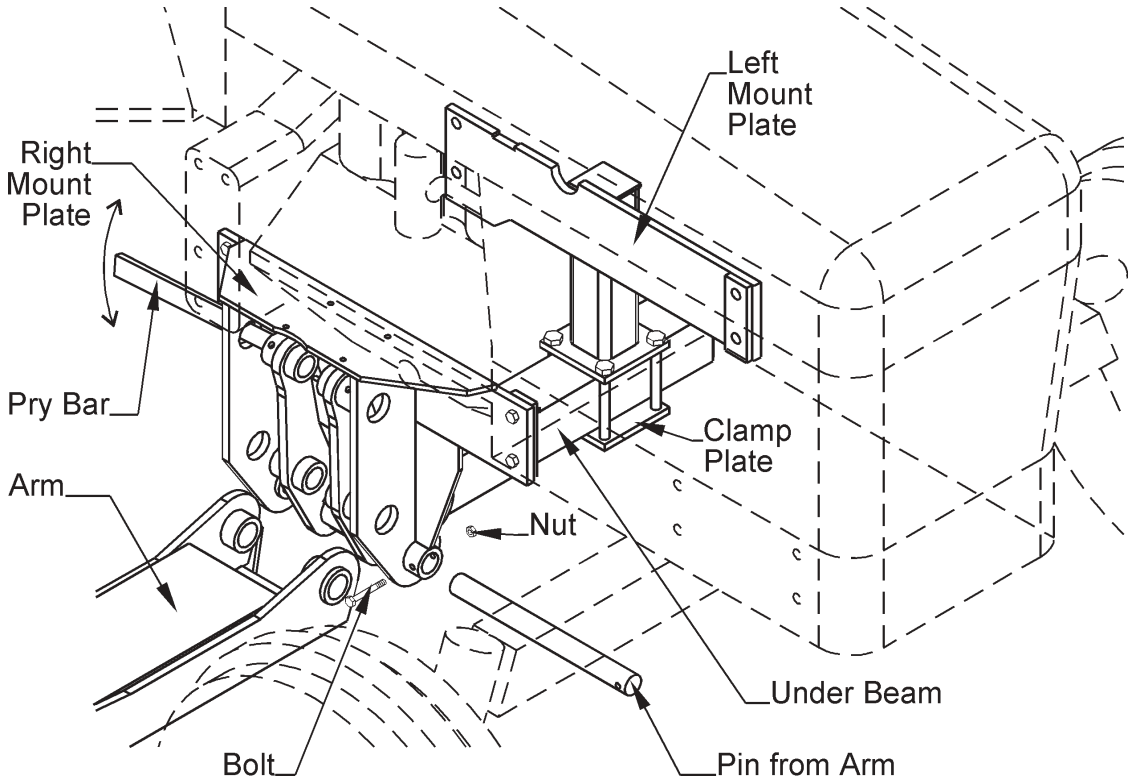
3. If the Teflon sheathing is pushed out by a pin, the bearing must be replaced immediately.

4. DO NOT USE ANY KIND OF LUBRICANT - If problems continue, do not use any kind of lubricant to aid the installation of the pin (it will only attract dirt, becoming liquid sandpaper, and definitely destroy the bearing) Contact your dealer, or Alamo Group Technical Services.

MOUNTING ARM, RH MOUNTING BRACKET & UNDER BEAM INSTALLATION:

These components will be assembled off the tractor and then installed as an assembly to the tractor. Show below as disassembled as reference only and as general location of parts.

The LH Frame Mounting bracket WILL NOT be assembled with the arm assembly, it will be installed after Arm, RH mounting bracket and under beam are installed. The Clamp plate to mount the under beam to the LH mounting bracket will be installed after the arm, bracket and under beam asy are installed. (See Figure 2)



General Illustration Shown for General information

Figure 2

***NOTE**: Shown in Figure 1 & 2 as disassembled as reference only, these components will be connected to tractor as an assembly.*

Mounting Main Frame Asy. To Tractor

MOUNTING FRAME COMPONENTS:

1. Locate Components. Locate Mounting Arm Assembly (See Figure 3). Locate the RH Frame Mounting Bracket (See Figure 4). Locate the underbeam weldment (See Figure 5). These component will be assembly together then mounted on to the tractor. These are heavy components you will need an overhead hoist to lift them into position.

2. Align components. The same pin will connect all three components. It works well to have the Mounting Arm Assembly up off the floor a few inches (See Figure 6). Align the under beam up with the mounting arm, using a hoist lower the RH Frame Bracket down on to the mounting arm (See Figure 7).

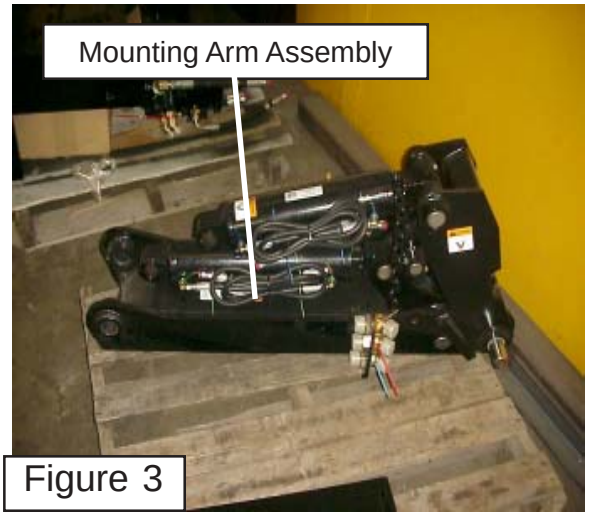


Figure 3

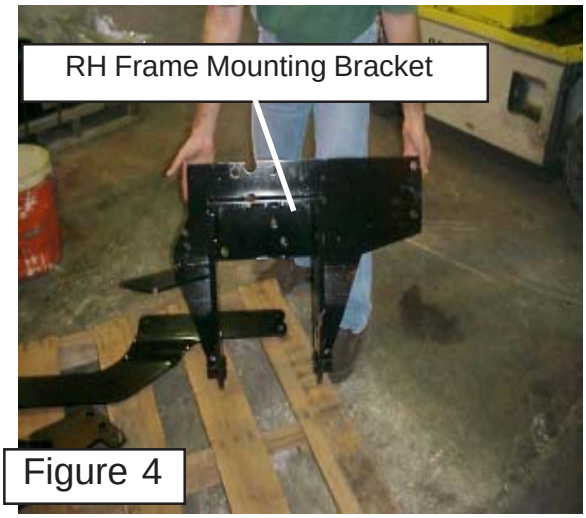


Figure 4

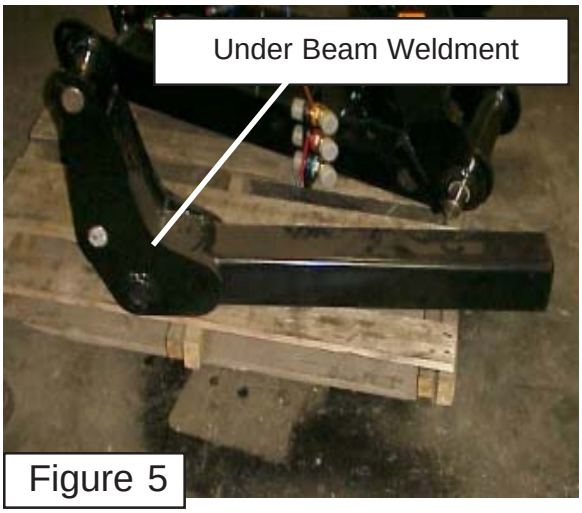


Figure 5

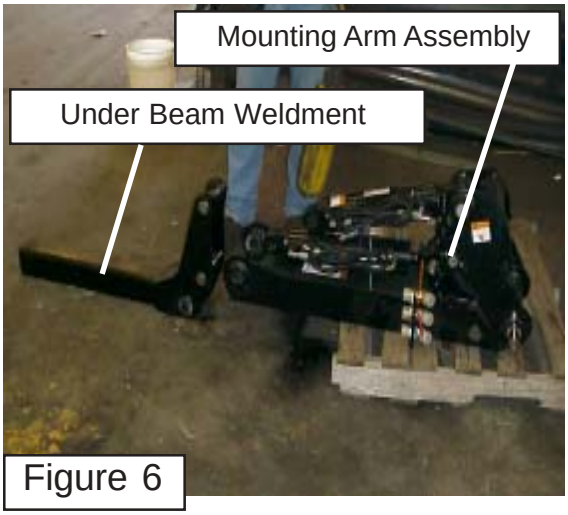


Figure 6

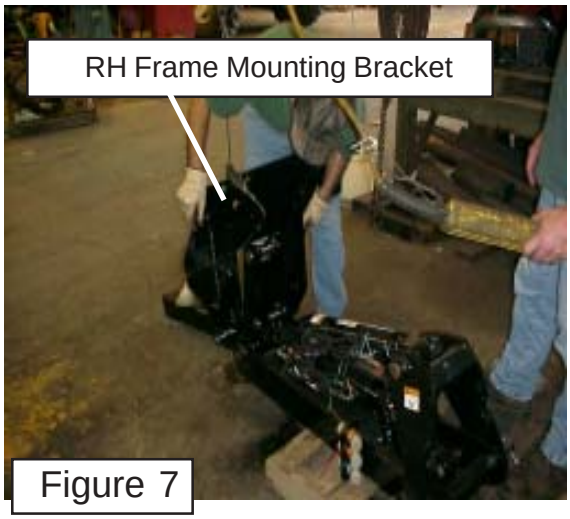


Figure 7

Mounting Main Frame Asy. To Tractor

MOUNTING FRAME COMPONENTS:

3. Install Mounting Arm Pivot Pin. Mounting Arm Pin and the Head Mounting Pin are the same size. There will be a pin shipped with Mounting Arm Assembly and one with the Head. It is easiest to remove the one on the head to install in Mounting Arm, Under Beam and RH Mounting bracket. This will leave the other Pin in the other end of the mounting arm to hold the cylinder mounting components together. Align the pin with the Frame mounting Bracket, using a rubber hammer tap the pivot pin into the Frame Mounting Bracket (DO NOT USE SEVERE FORCE TO INSTALL PIN, IT WILL DAMAGE THE TEFLON BUSHINGS), Align the frame mounting bracket with the Mounting arm assembly. Tap pin until it is through the Mounting arm bracket. Align the under beam with the inner are of the mounting bracket and tap pin through it. Next check the alignment on the ear of the second mounting arm hole and the second frame mounting bracket hole. Begin tapping pin through, check the pin retaining bolt hole in the pin to make certain it is aligned with the hole in the mounting bracket. If the hole is not aligned use a small punch (or bolt) stuck through the hole, tap the punch with a hammer and this will turn pin aligning bolt hole. Install and tighten retaining bolt (See Figure 8 & 9).

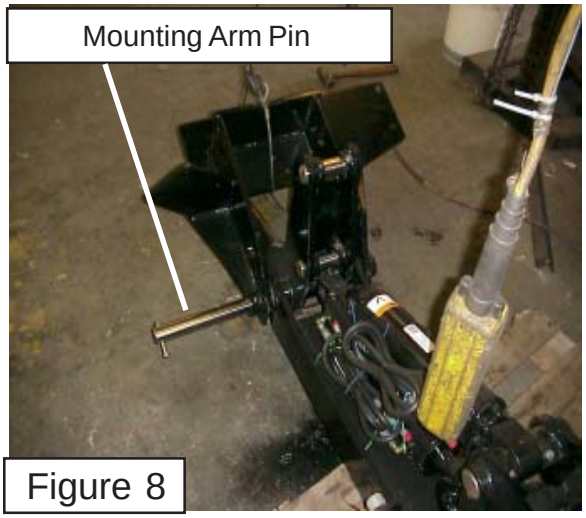


Figure 8

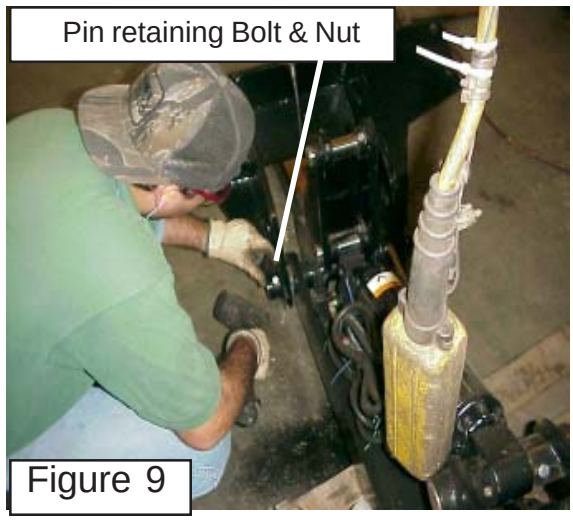


Figure 9

4. Move Assembly To The Tractor. Using a hoist move the assembly to the tractor (See Figure 10). Remove the 4 bolts that retain the steps on the RH side of the tractor, these steps will not be used with the Brahma Side Mount Mower (See Figure 11)


Figure 10

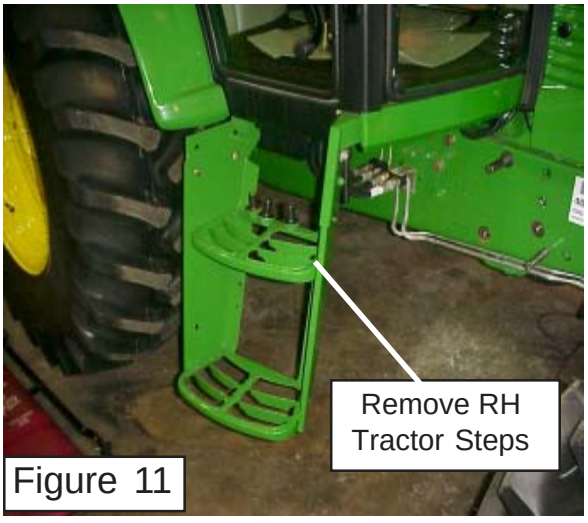


Figure 11

Mounting Main Frame Asy. To Tractor

MOUNTING FRAME COMPONENTS:

5. Prepare Tractor RH Frame Rail. The RH Tractor Frame Rail some of the holes are threaded and some will need a bolt with a nut installed on the inner side of frame rail.. You will need to remove the three factory bolts that are screwed into the three threaded holes as shown in figure 12. Make a guide pin by cutting the head off of a 3" long bolt and screw it into the frame, you can use 1 as shown (see Figure 12) or you can install 2. The second pin would be screwed in directly below the first.

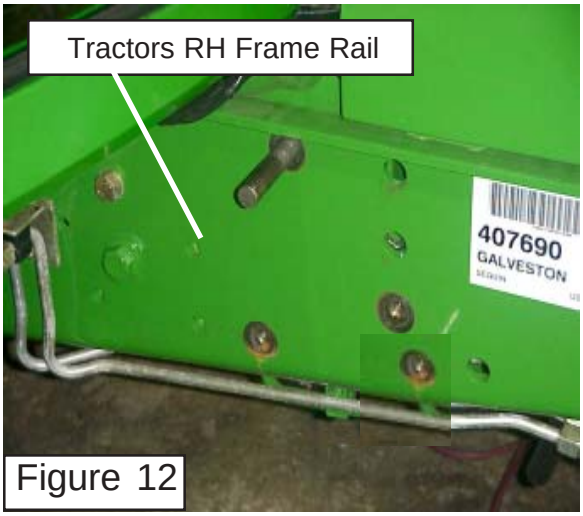


Figure 12

6. Install Mounting Arm & Bracket with Under Beam under Tractor . The mounting arm assembly will be slid under tractor (See Figure 13) while aligning the holes in the RH Mounting Bracket with the guide pin(s) that are installed into the tractor frame rail (See Figure 14) . Note it is best to use a cable to lift mounting bracket as it will allow you to slide the bracket closer to the tractor frame rail (See Figure 15). Supporting Mounting Arm Assembly with a floor Jack remove cable from frame bracket and reconnect a chain to frame bracket in the front cylinder pin access hole (See Figure 16). Install the mounting bolts into the mounting bracket and the tractor frame, remember some holes are pre threaded and some will need nuts installed behind tractor frame rails. These nuts can be installed from the top of frame rails for the top bolts and from the bottom on the bottom bolts. The bolts that are installed behind the under beam through mounting brackets and tractor frame rails can be made easier to install by putting a floor jack under the under beam and jacking it up but DO NOT jack it up so high it hits fuel tank (See Figure 18).


Figure 13


Figure 14

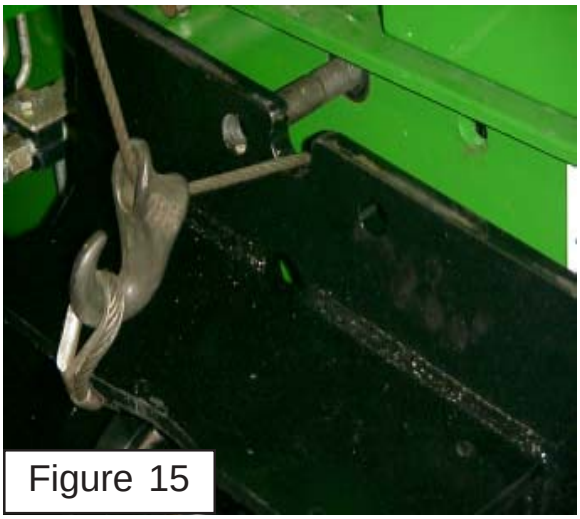


Figure 15

MOUNTING FRAME COMPONENTS:

7. Remove Guide Bolt(s) From Tractor Frame Rail RH Side. After the Bolts have been installed into the frame mounting bracket the guide bolt can be removed, it may be required to lift on the mounting arm to move the mounting frame enough to take pressure off of the guide bolt. You may also need to use a pair of pliers or pipe wrench to remove the guide bolt if you do not have stud removal tool (See Figure 19). Install the last bolt into the threaded hole you removed the stud from, tightened all the mounting bolts that connect the mounting bracket to the tractor frame rails.

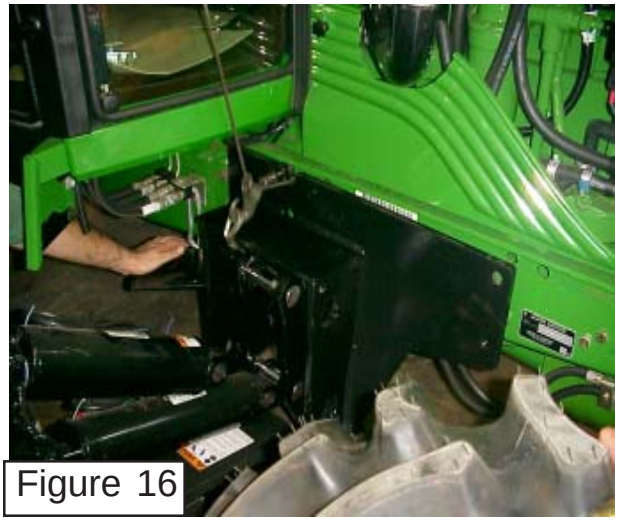


Figure 16

8. Install LH Frame Mounting Bracket. Make certain that you have lowered the floor jack that was holding the under frame up (See Figure 18). Install the Left Hand Frame Mounting Bracket. This side will also have some holes that are threaded and some that are not. The un-threaded holes will have nuts that are placed inside of the frame rail, the upper nuts can be reached from the top and the bottom nuts from the bottom of tractor frame (See Figure 20). When all the mounting bolts have been installed in LH Frame mounting bracket tighten them securely (See Figure 20 & 21).

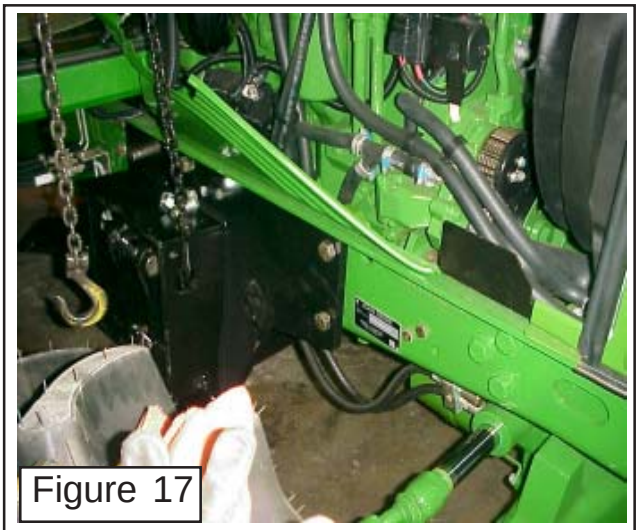


Figure 17


Figure 18


Figure 19

MOUNTING FRAME COMPONENTS:

9. Install Under Beam to LH Frame Mounting Bracket. Using the floor Jack (See Figure 21) jack the Under Beam up until it contacts the LH Frame mounting bracket. Locate the square plate with the 4 holes in it, this will bolt up under the under beam and the bolts will go through the square plate that is welded to the bottom of the LH mounting bracket. There will be one bolt that must be mounted with the nut on the top, this is because the fuel tank will not allow room to drop the bolt in from the top (See Figure 22). The other three bolts can be inserted from the top. Tighten these four bolts and nuts, they should be tightened in a sequence and equally so that they will keep the square plate flat (See Figure 22).


Figure 20

10. Install Rear Axle Frame Brace Bracket. The Rear axle frame brace bracket will connect the tractor rear axle to the mounting bracket bolted to the tractor frame rails (See Figure 23). You will need a C-Clamp and a floor jack for this installation. Locate the bolt holes in the tractor rear axle housing to mount support arm. Remove any plastic plugs that may be in the mounting holes. Align the support rail holes with the axle housing holes. Instal the support rail mounting bolts and tighten them, leave the floor jack under the support rail but do not apply any lift with jack.

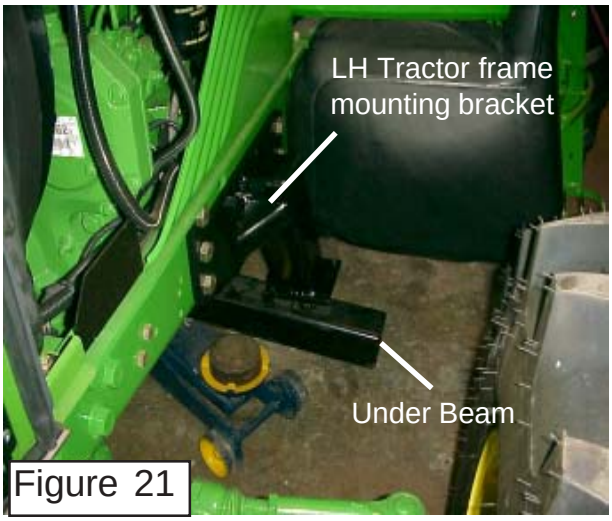


Figure 21

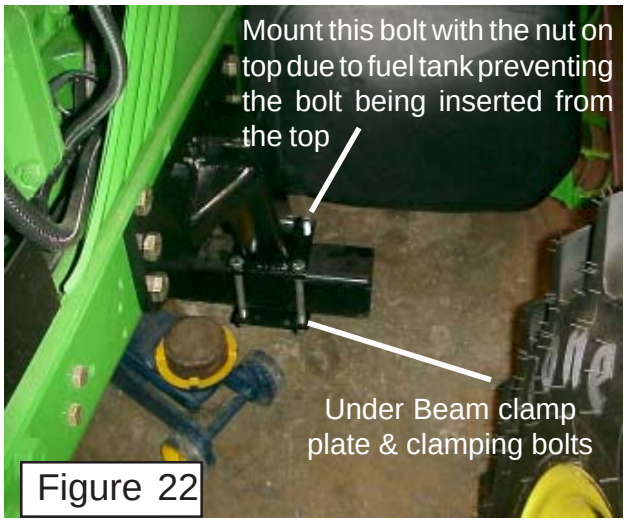


Figure 22

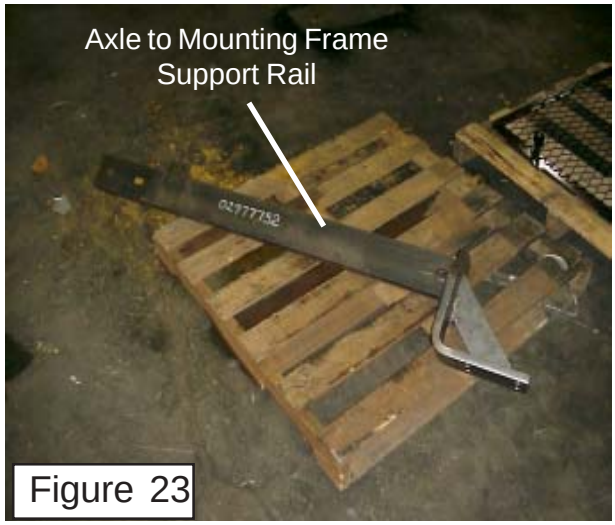


Figure 23

MOUNTING FRAME COMPONENTS:

11. Install L Shaped Bracket to RH Frame Mounting Bracket & Axle support rail. Locate the L Shaped bracket that will be bolted to the rear axle support beam and welded to the frame mounting bracket. To position this bracket it is done by bolting it to the axle support rail with two bolts. The two holes in the L shaped bracket are slotted to make it adjustable. Align the L Shaped bracket half circle (See Figure 24) with the Cylinder Pin Access hole in the Mounting frame. If needed Clamp the L shaped bracket to the mounting bracket and weld it in place (See Figure 24).

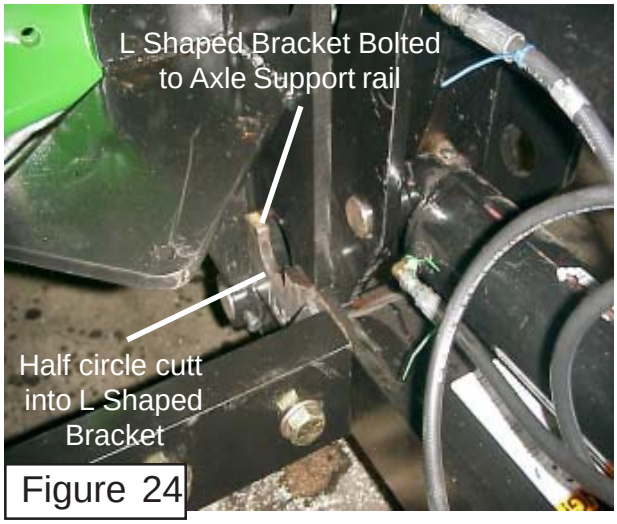


Figure 24

12. Connect Cylinders to Mounting Bracket. Connect the cylinders to the under beam. (See Figure 25). It is easiest to connect the bottom cylinder first, the pin can be removed or inserted through the holes in the mounting bracket. A hoist can be used to lift the mount arm, this will help to align the cylinder pin holes. After the lower (Tilt) cylinder is connected the upper (Lift) cylinder can be connected, this cylinder is connected to a lift arm on the other end and should allow it to reach the under arm without extending the cylinder. IF YOU NEED to extend any cylinders, unplug the hoses. Place the hoses in a clean container as some oil may have been left in the cylinders at the time of testing and /or assembling them at the factory. Once the cylinders are extended re-plug the hoses to keep contamination out, NEVER leave hoses, valves, pumps, motors or any hydraulic component open during assembly. ONLY unplug them when ready to assemble them.


Figure 25

13. Install Control Valve. The Control Valve will have colored coded plastic ties on the Adapters. The colored coded plastic ties will math the plastic ties on the hoses from the cylinders and the ties on the hoses from the tractor stack valve that you will install. DO NOT remove or change these plastic ties as this will allow the hoses to connected in the wrong order. (See Figure 26 & 27). There are three mounting bolts for the valve. The bolt under the relief cartridge will have to be inserted from the bottom.

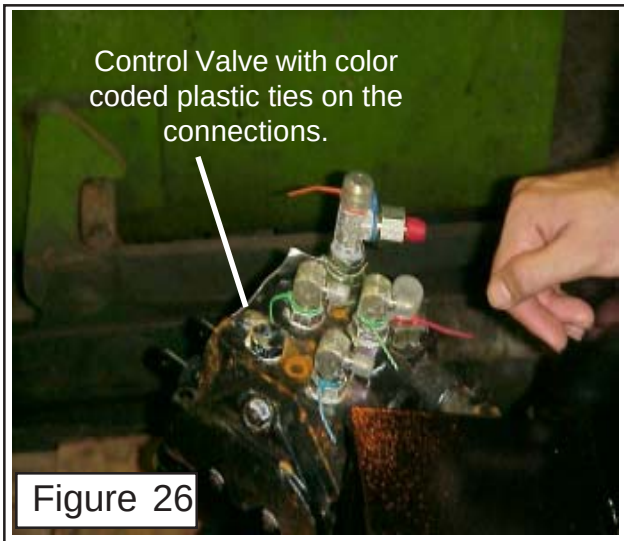


Figure 26

MOUNTING FRAME COMPONENTS:

14. Connect Cylinder hoses to Control Valve. The Control valve will be in the packing box and should already have the fittings installed into it with the color coded plastic ties installed. The Cylinder hoses are already installed to the cylinder. The Cylinder hoses must connect to the control valve correctly to function as designed (See Figure 27, 28 & 29). With the Valve mounted as shown in Figure 27 connect the cylinder hoses by following the schematic as shown in figure 28 and 29. Route hoses where they will not be pinched by any moving components and they are tied up to prevent them from be caught on any thing while traveling. If wanted hoses can be tied to the rear axle support rail.

Figure 27

15. Connect the Supply and Return Pressure Hose. There are two hoses that will need to be connected to the tractor control valve (stack Valve) at the rear of the tractor and the head control valve on the frame. The Pressure hose (Red Plastic Tie) will be connected into the spool valve and the return hose (orange Plastic Tie) will be tee'd into the stack valve return hose. (See Figure 29 & 30)

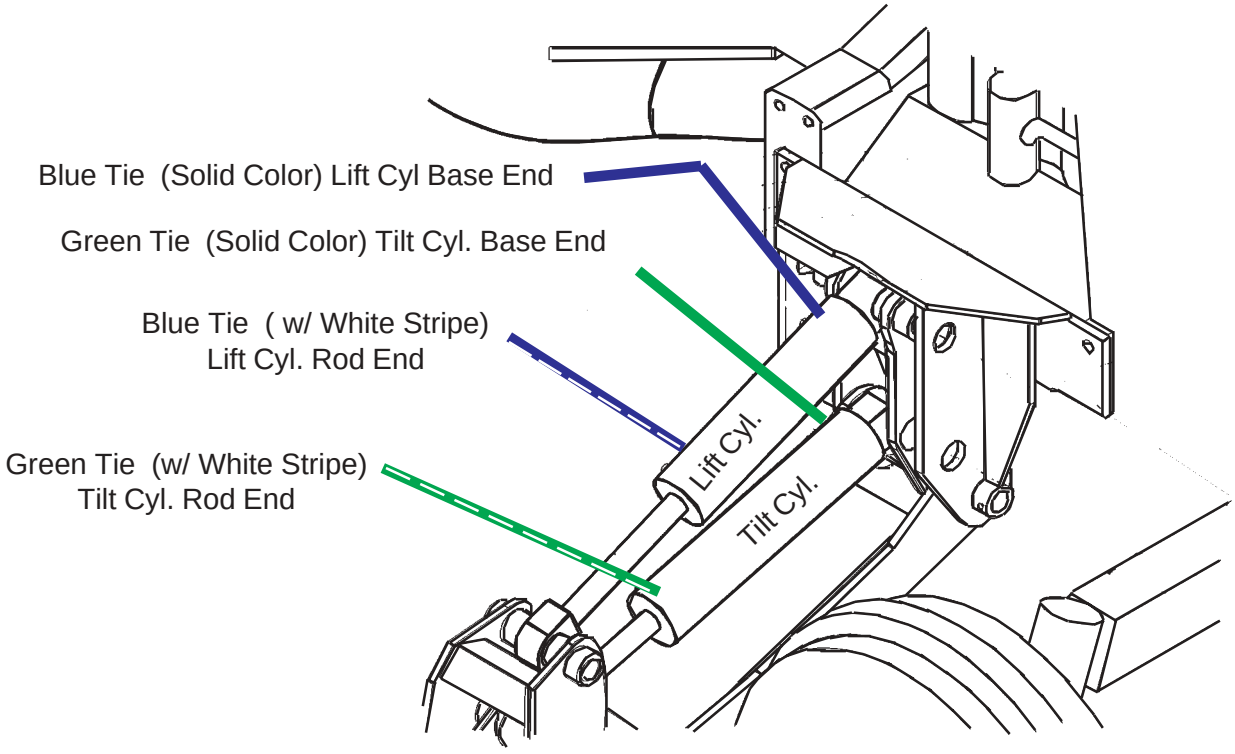


Figure 28

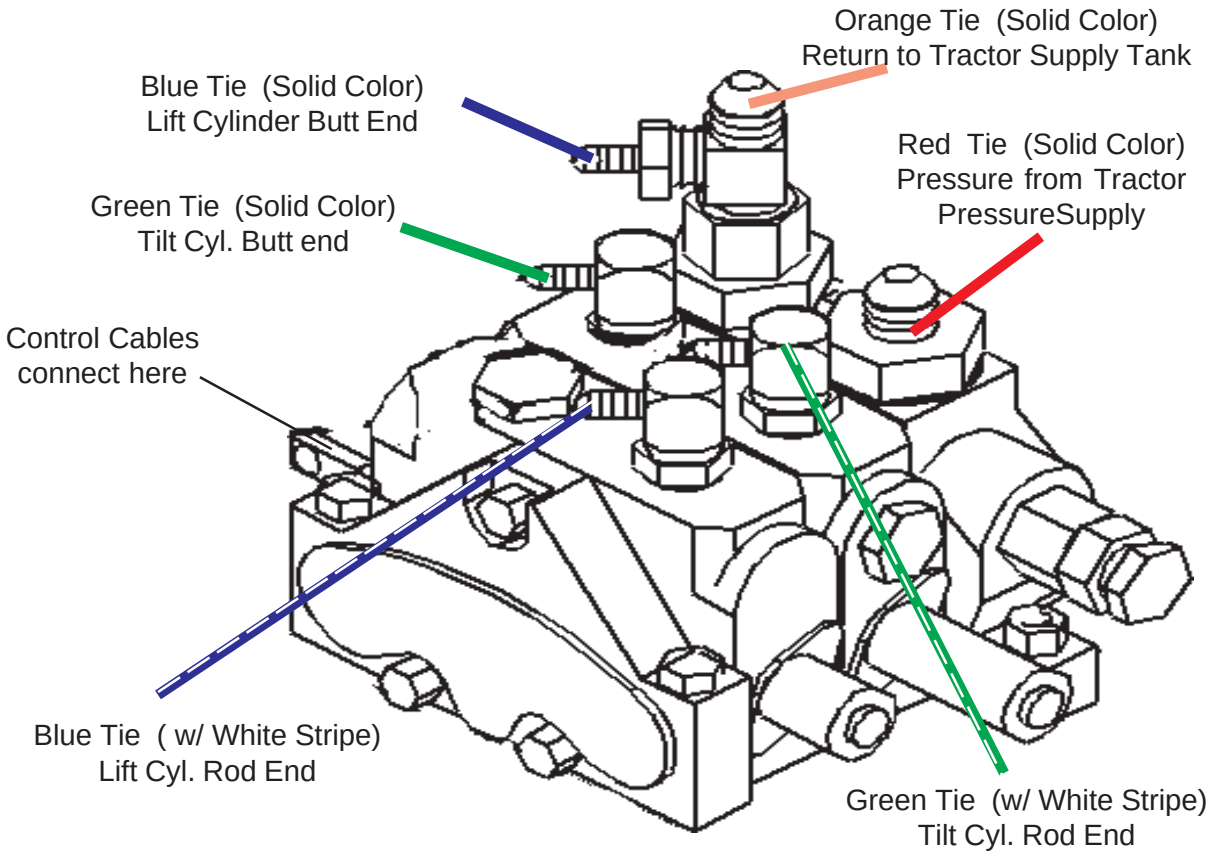


Figure 29

15. Check all connections and fittings. Check all hose connections and all mounting bolts to make certain they are tightens to specification. The Pressure Hose supply the Cylinder control valve connect to the quick Attach port of hydraulics. The Return side connects to a port just below and to the right of the three point top link connection on the tractor. NOTE: Shown (Figure 30) is a typical connection for a tractor hydraulic supply for cylinder control valve hydraulic pressure supply. This connection will vary with the tractor brand and type. See the assembly manual for the specific tractor for correct connection.

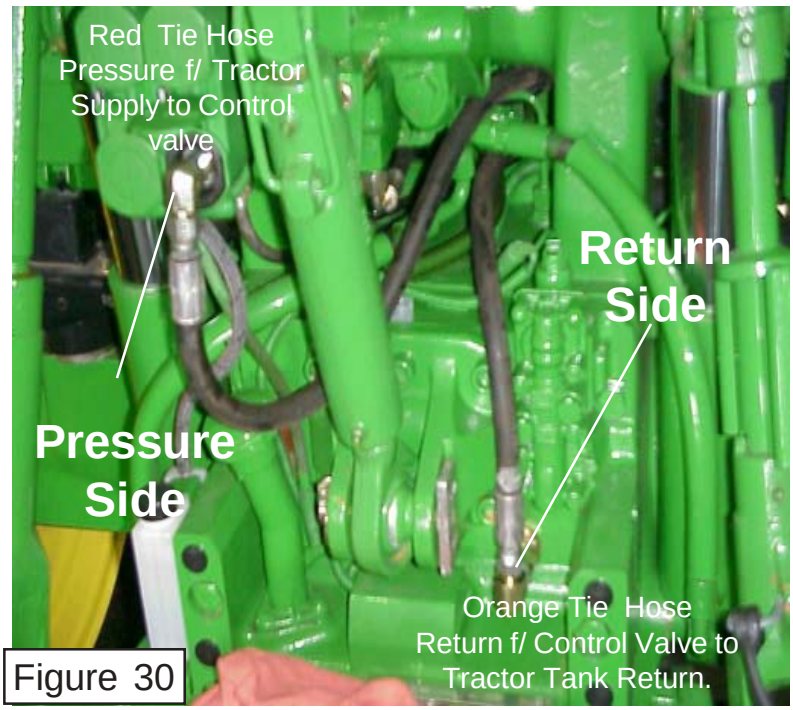


Figure 30

NOTES

Section 3

BRAHMA

Joystick & Electrical Connections

Joystick & Electrical Controls Mounting

JOYSTICK AND MOTOR CONTROLS:

1. The Joystick and Motor Control operation Decal will need to be installed in the cab of the tractor. This is a transparent decal that shown the direction of movement of joy stick in relation to the function that is activated. Install this decal where it is easily in view by the operator but where it will not interfere with his line of sight of his environment (See Figure 1)

Prepare Tractor for mounting Joystick:

2. Inside the cab of the tractor look at the right hand front door post of cab, there you will see a plastic cover. This cover snap on to the door post, remove the plastic cover and look at the back side of it. On the back side you will see some marks on the cover. If you look at the door post you will see some threaded hole. The marks on the plastic cover are marking where to drill the plastic cover to align with the threaded holes in the door post. Drill the holes in the plastic cover and snap it back on to the door post (See Figure 2)

3. Locate the mounting bracket that will bolt to the door post, bolt the bracket to the door post through the holes in the plastic cover to the door post.

4. The Joy stick will bolt to the mounting bracket using the long bolts furnished. NOTE: figure 2 below is not necessarily the type cab that you will have and the bracket may not be the same shape, but the mounting will be the same.

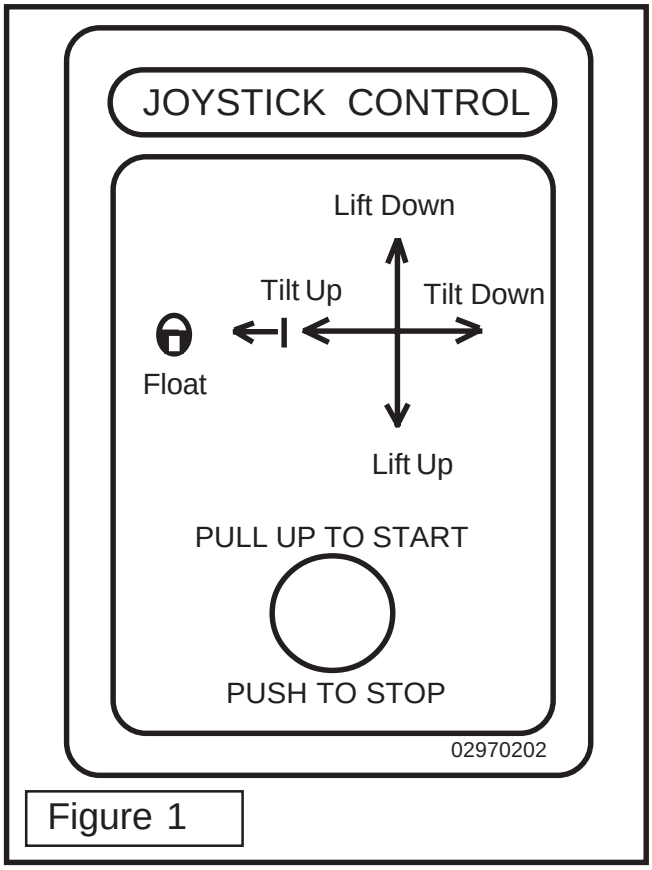


Figure 1

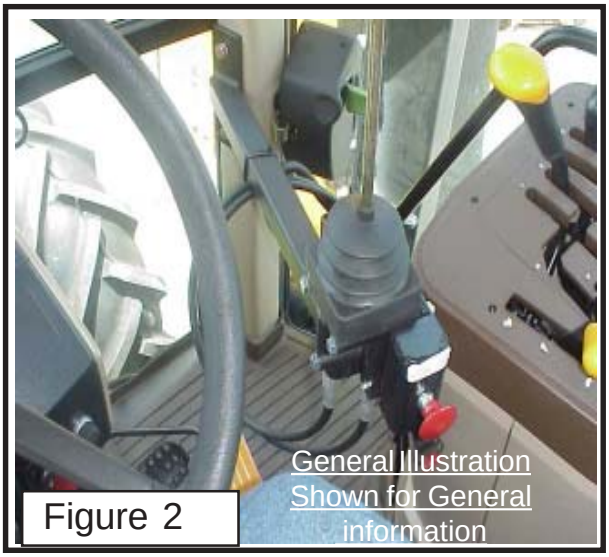


Figure 2

Joystick & Electrical Controls Mounting

JOYSTICK AND MOTOR CONTROLS:

The Joystick and Motor Control attachment varies from tractor to tractor, this is a general instruction as to the assembly and mounting of the joystick

Depending upon your Mounting Bracket it may be easier to connect the cables before attaching the Joystick to the Bracket.

In general, a Joystick Mounting Bracket is attached to the tractor, often under the Tractor Seat or the the door post. The Joystick, Momentary Start Switch, and the Push Pull Switch are mounted to the Joystick Mounting Bracket . It may be necessary to use a floor port, or cut a hole in the floor board of the Tractor. Make certain that this does not interfere with the operation of the tractor or the Brahma. The Hole for the cables and wire harness can be cut with a hole saw if required (See Figure 3).

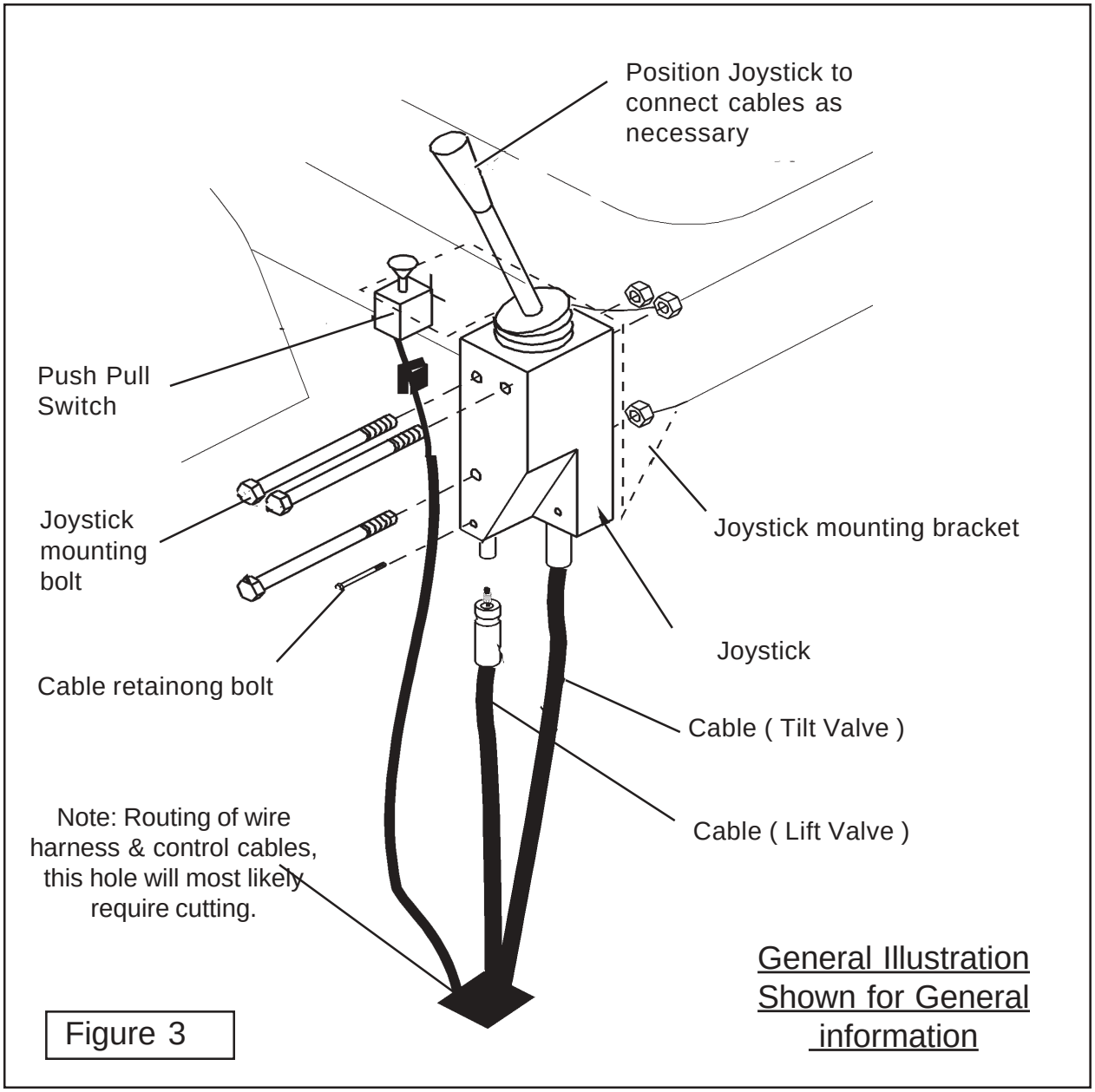


Figure 3

Joystick & Electrical Controls Mounting

CONTROL CABLE TO JOYSTICK CONNECTION:

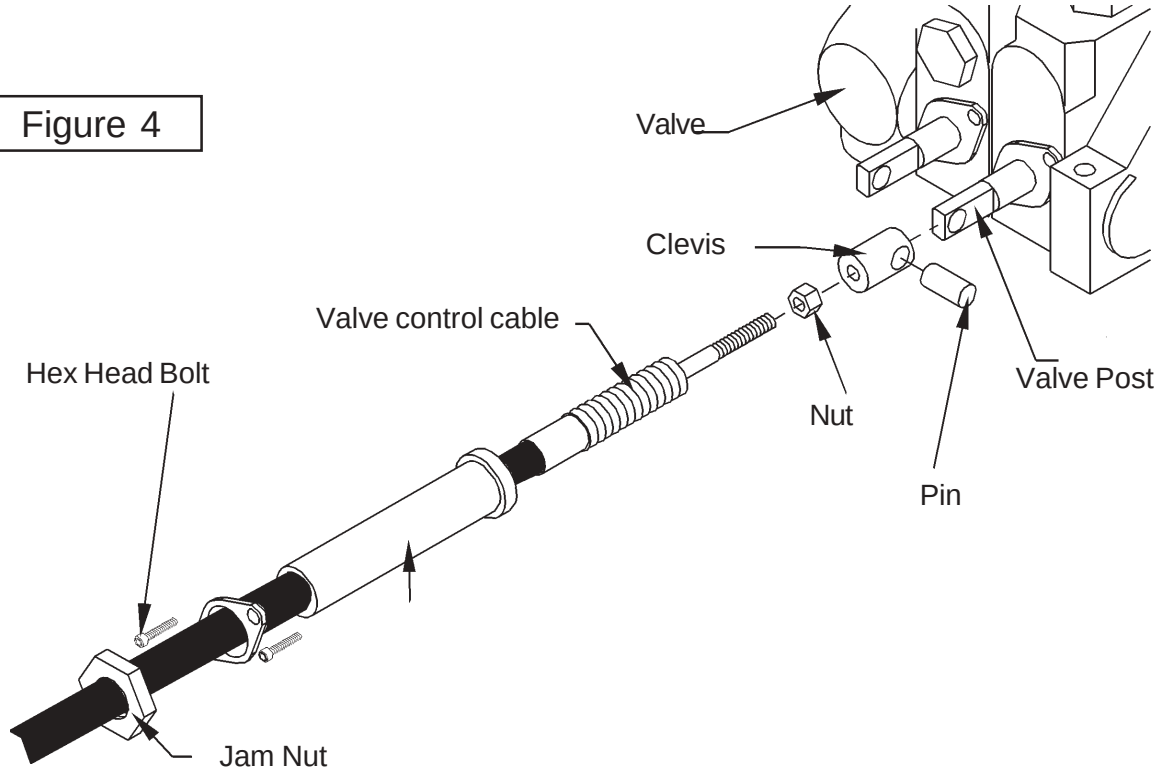
1. Remove the Cable retaining bolt for one of the directions (Lift shown).
2. Position the Joystick so that the Lift Plunger is accessible. Check the Joystick, for the proper direction for each cylinder.
3. Connect the cable leading from the left (inside) valve section to the left cable port on the joystick, this controls the Lift Cylinders motion.
4. Repeat the procedure for the Tilt Cylinder.
5. Route both cables up to the Control Valve so they do not interfere with the operation of the tractor or the mower

CONTROL CABLE TO VALVE CONNECTION:

Attach the Control Cables included in the mount kit to the valve, with the Cable Connecting Kit in the Common Box.

1. Attach the Cable Connecting Kit to the cables
2. To Center the Joystick loosen the Jam Nut and the Inset Cap Screws, and adjust by twisting the Tube on the Cable until the Joystick is Centered. Secure the Tube with the Jam Nut and the Inset Cap Screws.

Figure 4



CONTROL WIRING:

1. Disconnect the negative lead (ground) from the battery terminal to prevent any damage to the electrical system. (See Figure 4)

2. Run the Wiring Harness from the Hydraulic tank to the inside of the cab of the tractor. Make certain that the Wiring Harness is free and clear of any moving parts from the Mower or the Tractor, or any condition that may sever, bind, or entangle the cable.

3. Install the Four Prong Wiring Harness Connector to the Push Pull Switch. Do not force or bend the pins. Attach the two Spade Connectors to the Mometary Switch. **(See Figure 5)**

4. Remove ignition switch access panel or ignition switch if panels are not provided in dash. Identify the "Ignition-Start" wire and the "Ignition-Accessory" wire.

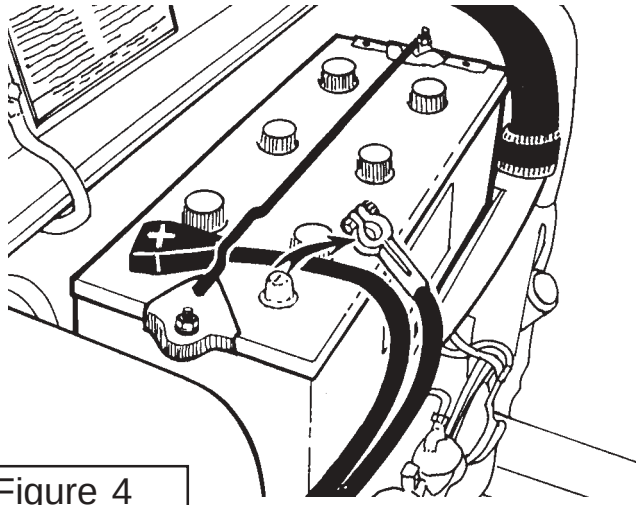


Figure 4

5. Find the "Ignition-Start" wire leading from ignition switch to starter solenoid, and cut wire approximately 3" from ignition switch. Strip off 1/4" to 3/8" of insulation from each wire.

6. Connect the 3 Pin Connector to the Pump Solenoid.

7. Installation of the wiring harness can now be completed. Install all wires according to color and instructions for that color **(See Figure 5).**

A. Brown - Connect the line connectors from the brown wire leads to the newly formed ends of the wire on the tractor that connects the tractor ignition switch and tractor starter solenoid.

B. Red - Connect directly to the ignition switch. This wire is for power supply and should be connected such that the wire is hot when the tractor ignition switch is on and off when the tractor is shut off.

C. Black - Connect "Hook Terminal" to the instrument panel ground or other remote grounding location.

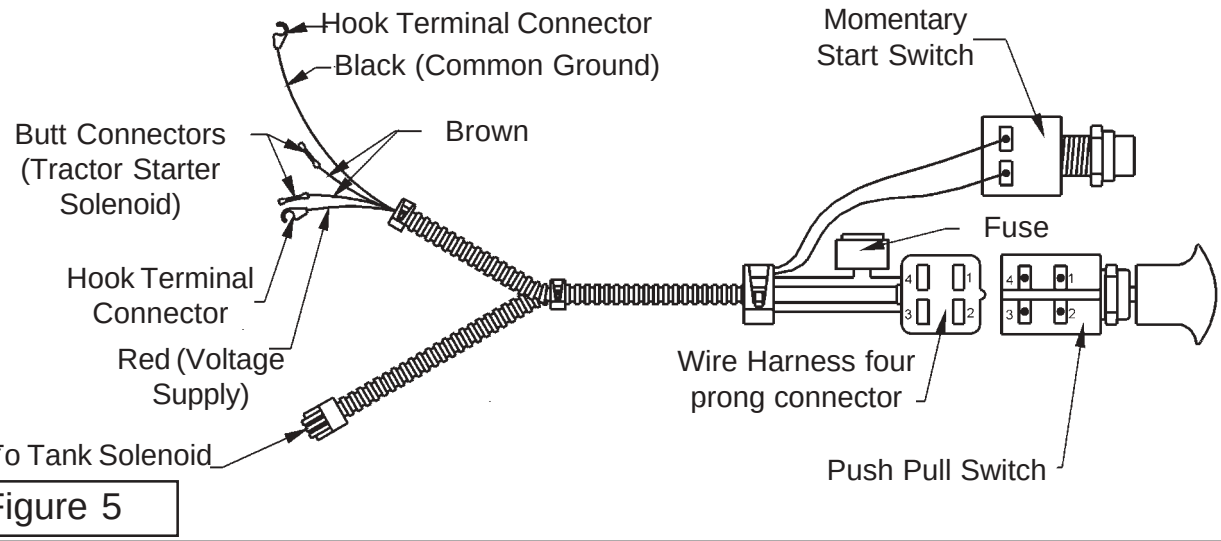


Figure 5

8. Reconnect the negative lead (ground) to the battery terminal (See Figure 4). DO NOT START TRACTOR until the assembly is complete and unit has been inspected as well as filled with oil.

NOTES

Section 4

BRAHMA

Pump Section

PUMP - GENERAL

INTRODUCTION:

The information in this Section of Book is re-printed with Permission of the Eaton Corp. This Section of Book provides service information for the Servo Controlled Piston Pump P/N 02967192. Step by Step instructions for the complete dis-assembly and re-assembly of the Pump are given. In Most diagrams there are no Component Part Numbers Listed, Only Item numbers and Descriptions, This is because most parts shown as break-down in drawings are for location & identification only and are not available as replacement parts. NO Dirt at all should be around Parts during repairs.

BEFORE STARTING REPAIRS: Service Rules (READ THIS)

1. Remove Front Cover. Clean Pump and surrounding area completely before removing any connections or Lines. NO DIRT OR DEBRIS CAN BE ALLOWED ON OR NEAR HYDRAULIC SYTEM IF IT IS BEING WORKED ON, ANY DIRT OR CONTAMINANTS IN SYSTEM NO MATTER HOW SMALL WILL DAMAGE SYSTEM!
2. After cleaning around all connections thoroughly, Dis-connect all connections, Lines, Hoses, Wiring and Remove the Pump Completely from the Tractor. Plug all hoses and Lines on Tractor and on Pump, DO NOT leave any open Lines. NO Contamination Should be allowed into system at all.
3. Clean Area, Clean all Tools, Pans etc. The cleaning of Area and Tools MUST be done before moving (Cleaned) Pump there. Drain Oil from Pump, Recheck outside of Pump to Make Sure it is Clean
4. After dis-assembly of Pump wash all metal components in clean solvent.
5. Use compressed Air to dry parts after washing (Compressed air must be filtered and moisture free). DO NOT wipe them dry with Paper Towels or Cloth as these will leave lint and/or dust contamination. DO NOT USE Compressed Air to spin any component (Such as Bearings or Plates) as this will damage them and could be dangerous.
6. Always use new Seals when re-assembling Hydraulic Pumps, Lubricate the new rubber Seals with a Petroleum Jelly, (Vaseline) before installing them.
7. DO NOT reinstall worn or damaged Parts back in Pump, DO NOT Use a worn or damaged Pump Housing.
8. Torque all Bolts over Gasketed Joints. Then repeat the Torque sequence to make sure Bolts are tight, some times Gaskets can give a Torque reading that is OK but is not, so always re-check Torque.
9. Verifying the accuracy of Pump Repairs on an authorized test stand is essential.

REQUIRED TOOLS:

1. Hex Allen Wrench (Qty 5) (9/16", 5/32", 5/16", 3/32", 5/64"
2. Retaining Ring Pliers (Qty 3), 1 each of Internal (Straight .070 tip) internal (Straight .090 tip) & 1 each External (Straight 0.90 tip)
3. Retaining E-Ring Applicator (Qty 2), 1 each 9/32" & 1 each 1/2".
4. O-Ring Pick (Qty 1)
5. End Wrench (Qty 4), 1 each of 7/16", 9/16", 3/4", 1"
6. Torque Wrench (Qty 1), 0 to 100 ft. lbs. (135.6 nm) capacity
7. Hammer, Soft Face (Qty 1)
8. Seal Driver Set (Qty 1)
9. Arbor Press (Qty 1)
10. Sockets (Qty 3) 7/16", 9/16", 3/4" (Drive Size should match Torque Wrench Drive)
11. Light Petroleum Jelly (Vaseline)
12. Locktite, # 222 and #277 or equivalent (Qty 1 tube each)

PUMP - REPAIR TOOLS

RECOMMENDED GAUGES FOR DIAGNOSTICS:

1. Inlet Vacuum: 30 PSI to 30 in Mercury (207 bar to 0 bar)
2. System Pressure Gauge: 6,000 PSI (700 bar)
3. Charge Pressure Gauge: 0 to 500 PSI (0 to 25 bar)

SYSTEM / CHARGE RELIEF PRESSURE SETTINGS:

Inlet Vacuum:	6 in Mercury (.203 bar)
Case Pressure:	25 PSI (1.7 bar)
Charge Pressure:	250 to 300 PSI (17.24 to 20.68 bar)
System Pressure:	4500 PSI Max / 3000 PSI Continuos (306 bar Max 207 bar Continuos)
Motor Relief:	4000 PSI (272 bar)

The High Pressure relief Valves are all Factory Pre-Set and Cannot be re-adjusted.

The Pressure Setting is stamped on each valve with a three digit Code number. To identify, Multiply this stamped number by 10 to get the Valves pressure settings, Example 500 stamped in valve is 10 X 500 = 5000 PSI (345 bar).

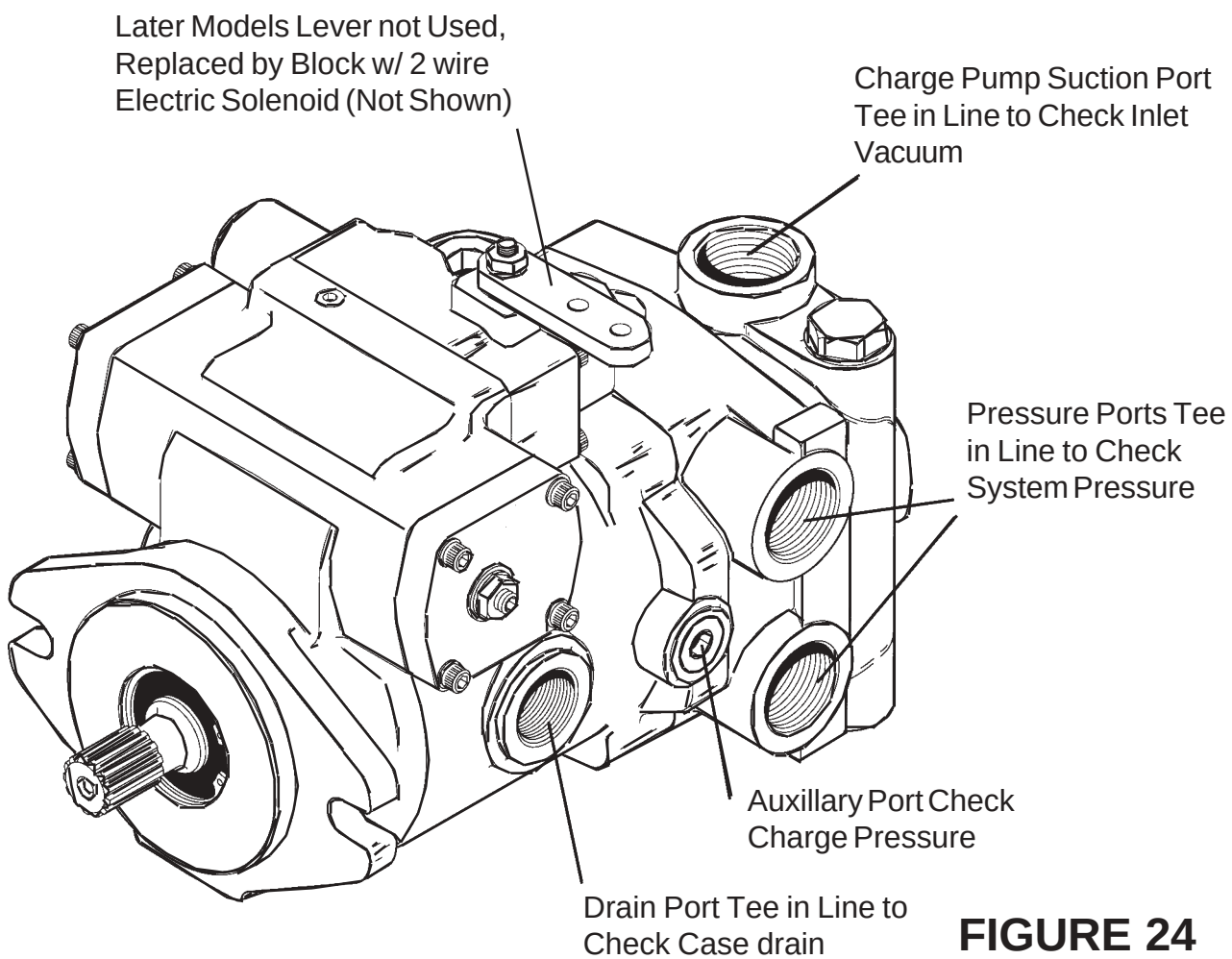


FIGURE 24

PUMP CIRCUIT - MOTOR ENGAGE

Note: The Servo Control Valve, Lever and Solenoid have been replaced by a manifold and Solenoid valve Cartridge, Please make note on all diagrams and text.

The Method used on the Machete to transmit Engine Power to the Mowing Head is called a “Closed Loop” or “ Hydrostatic” System (Figure 39). Engine Power is converted to Hydraulic Power by the Variable Displacement Hydraulic Piston Pump. Oil is sent to the Fixed Displacement Motor through the Hoses that run down the Boom. Oil passing through the Motor converts the Hydraulic Power Back into Mechanical Power to Rotate the Blades.

The Shuttle Valve in the Motor returns 8 GPM back to the Tank for Cooling. The remainder of the return oil remains in the Closed Loop. Some of the advantages of using a Closed Loop System for the Motor Circuit are, 1. A Smaller quantity of Oil is required, 2. System acts as its own “Brake” slowing down the Blades and 3. Less Fuel consumed due to “No Load” condition when Motor Circuit is disengaged.

Another feature of the Alamo System is that the Oil is filtered after it leaves the Charge Pump and before it enters the High Pressure Loop.

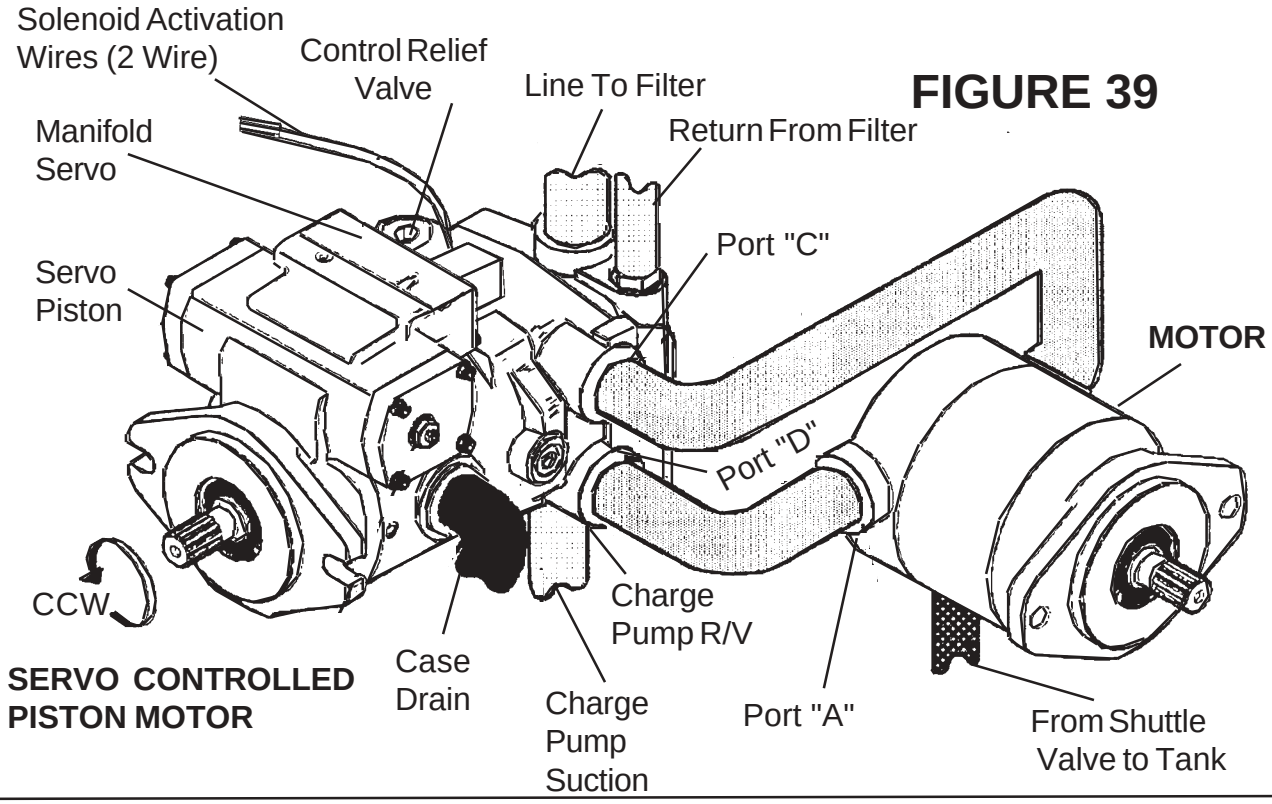


FIGURE 39

The Motor Circuit is engaged by two Manually Operated Switches (See Figures 36, 37, & 38 in Motor Repair Section for Types Used). These Switches have varied from “On - Off” to “Momentary’, But all have served the same purpose. Closing the Switches completes a Circuit through the Solenoid. The Purpose of a “Solenoid” is to actuate a Pump Control, which actuates a Valve to turn on the Pump; this has varied some over the years. This movement causes the Camplate in the Pump to move. Movement of the Camplate when the Pump is turning causes the length of Piston Stroke to Change, Causing Oil to too be moved. The Greater the Angle, the longer the stroke, The longer the stroke the more Oil is Pumped, and the more oil pumped means faster the motor turns.

PUMP CIRCUIT - MOTOR ENGAGE

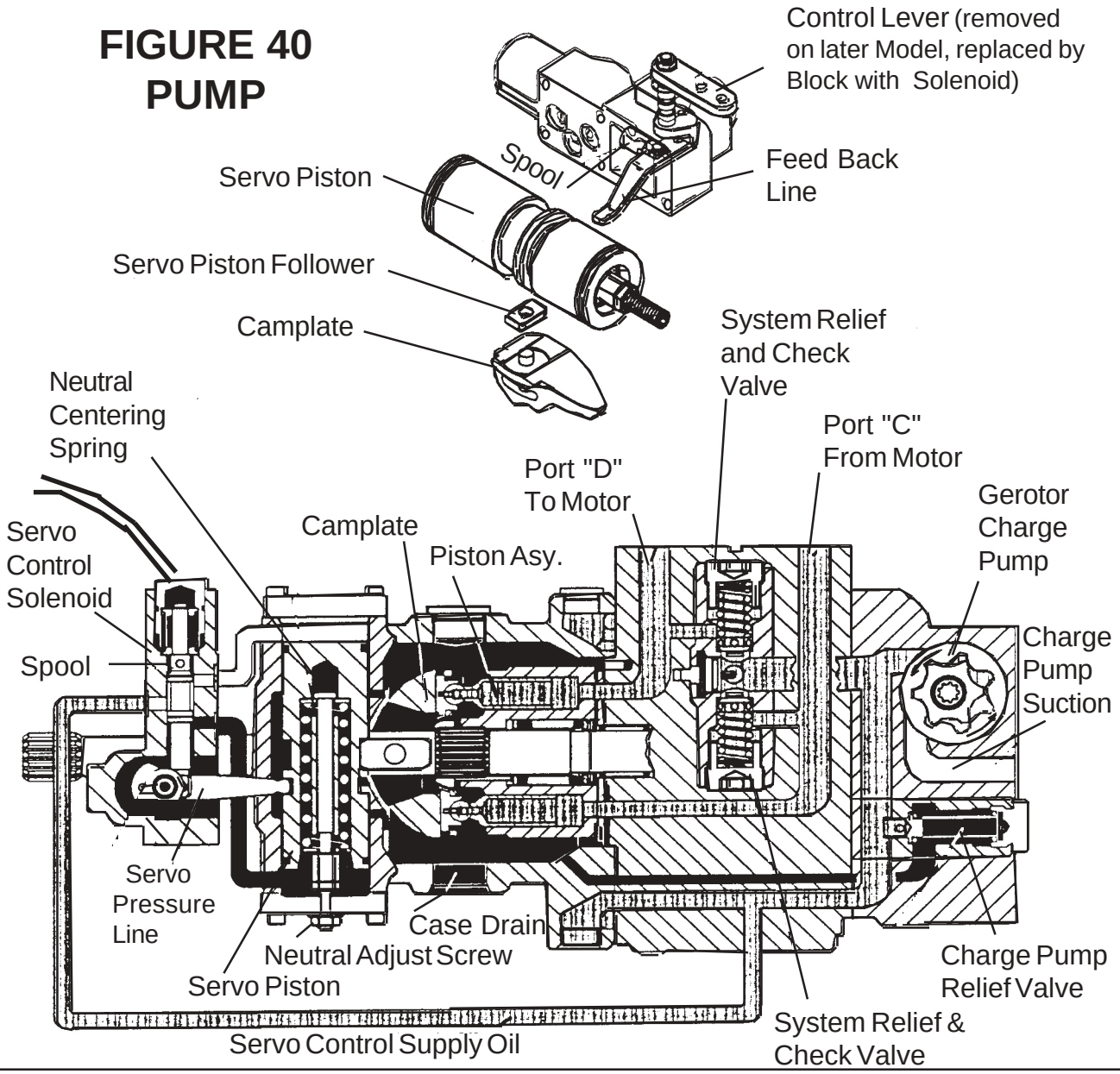
Note: The Servo Control System, (Changed see "Note" on Previous Page)

Movement of the Variable Displacement Pump Control Lever (Figure 40) starts pump Output. As Lever is rotated, it moves the Spring centered Servo Control Spool first. Movement of the Spool allows Charge Pump Oil past the Spool to one side of the Servo Piston (Figure 40). The Pressurized Servo Piston pushed against the Camplate (figure 40) causes the Camplate to rotate to a Pre-Set Angle. Oil from the opposite end of the Servo Piston is exhausted to the Pump Housing through the Control Valve Spool.

When the Control Lever (Solenoid & Block on Current Models) is returned to the Neutral position, The Spool centers itself, allowing the Pressure on both ends of the Servo Piston to equalize. The Piston and. Camplate return to a Neutral position and Oil flow from the Piston Pump ceases.

Orifices between the Control Valve and the Servo Piston control speed of the Camplate movement. Neutral Adjustment Screw is to set Servo in Neutral position to prevent flow to motor, a Buzz Bar Head will have a screw on both sides. Rotary head shown below.

FIGURE 40
PUMP



PUMP CIRCUIT - MOTOR DIS-ENGAGE

Motor Circuit Disengage (w/ Engine Running)

The Alamo Closed Loop Motor Circuit ic considered to be Neutral when there is no output being generated by the Variable Displacement Pump, as the Shaft, Internal components and Charge Pump are being driven by Tractor Engine. The Canplate is in the centered position and the length of Stroke of the Pistons is equal, therefore there is no flow being generated by the pump

At this point the Charge Pump is drawing Oil through a Suction Screen from the Tank to provide flow to perform the following functions.

1. Keep the Circuit Primed and make up internal leakage.
2. Maintain Back Pressure on Pump asnd Motor Pistons
3. Operate Control Funtions to Start Pump.
4. Maintain Temperature Control, to prevent Oil Heating in Pump.

Oil from the Charge Pump is directed to two dual pupose system Relief and Check Valves (Figure 41). Since the Charge Pressure is greater than the pressure in either side of the Closed Loop , The Check Valves open and charged Oil (at Charge Pressure) is available to both sides of the closed Loop. When the System is primed, any excess Oil is relieved through the Charge Pump relief Valve, which maintains a pressure of 250 to 300 PSI.

The Piston Pump remains in Neutral as long as the Camplate remains in the centered position, this is controlled by the Servo Control System, If Pump does not stay in neutral check the Neutral Adjusting screw. This is usually noticed by Motor wanting to run.

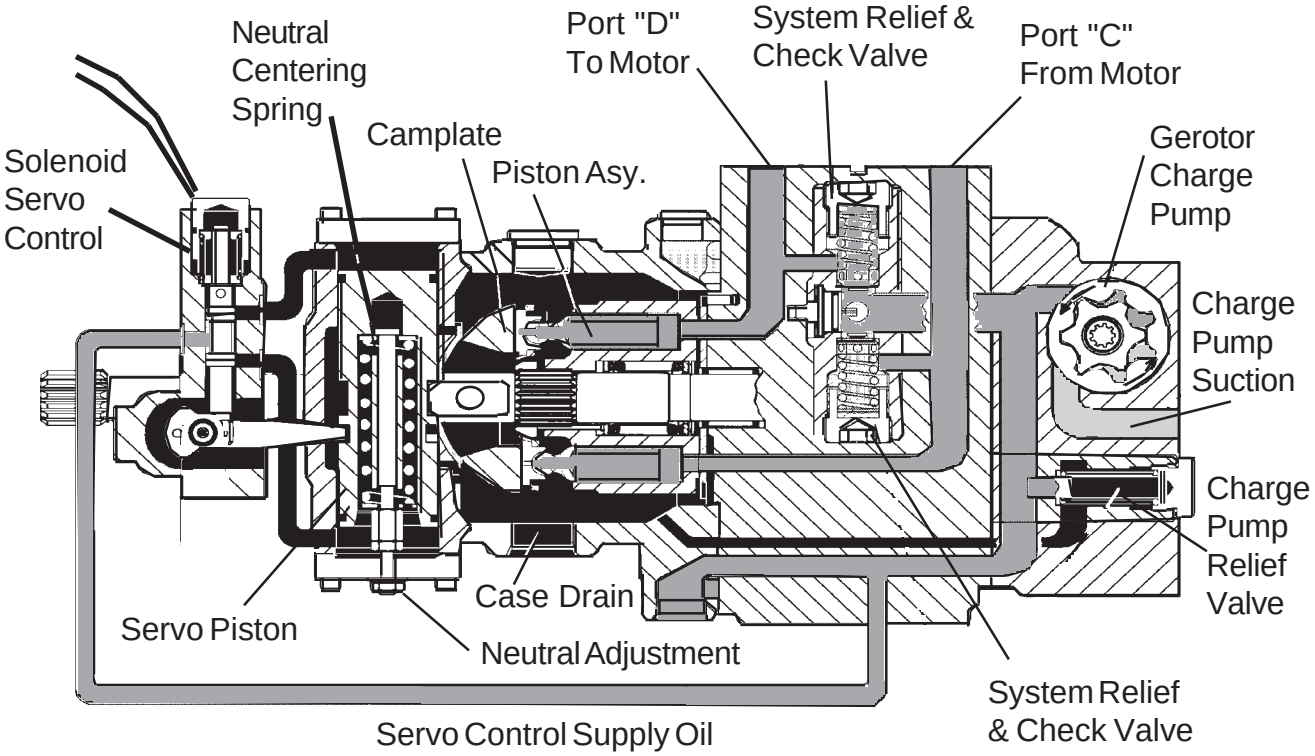


FIGURE 41 PUMP

MOTOR CIRCUIT - PUMP ENGAGE

Motor Circuit Engaged (w/ Engine Running)

When the Switch and Solenoid are activated, The Servo control System moves the Camplate to its Maximum Angle. As the Piston Block rotates, The Angle of the Camplate causes the Pistons to move in and out of thier Bores as they follow the Camplate, This results in Oil being drawn into the Piston Bore as the Piston is pulled outward, and Oil being expelled into the other side of the Loop as the Piston is forced back into its bore, This creates the flow of Oil necessary to power the Motor. Movement of the Camplate angle from the neutral to maximum is set a approximatly 6 seconds and is controlled by the size of the Orfice between the Control valve & Pump Case.

Oil under charge pressure is available at the Check Seats of the combination System Relief & Check Valves. As the Piston is drawn outwards in its bore, The combination of lower pressure in the Piston Bore and charge pressure in Port "C" causes the Check Valve for Port "C" to come off its seat, Allowing Oil At Charge pressure to fill the Piston Bore. As the Piston Block rotates the Oil is trapped in its bore by the Valve Plate. As the Piston Block rotates more, the piston is forced back into its bore expelling the Oil into Port "D" through an opening in the Valve Plate. The Higher pressure in Port "D" seats the Check Valve for Port "D", Seperating Oil in Port "C" frpm Oil in Port "D". Oil is forced to go through the Motor causing Motor Rotation.

Any Leakage from the Piston Block Valve Plate, Pistons, or excess Oil from the Charge Pump Relief Valve is vented to the case and is returned to Tank through the case Drain Port.

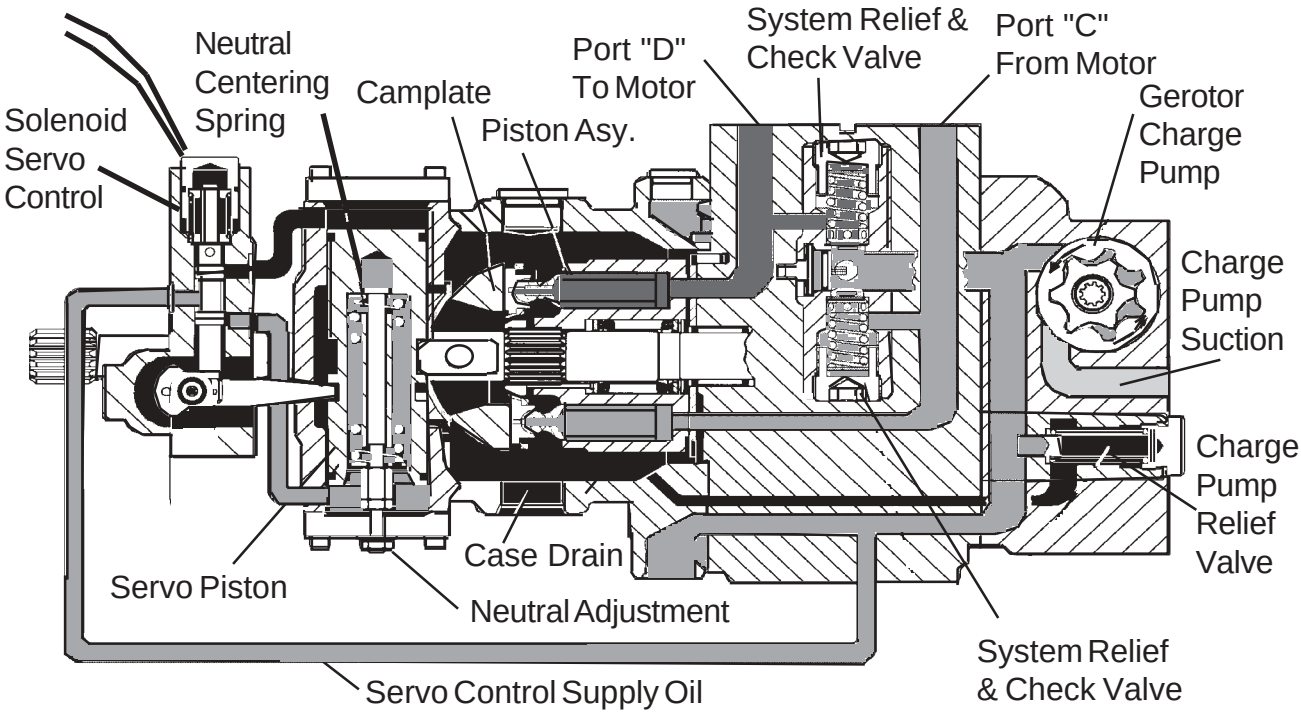


FIGURE 42 PUMP

Relief Valve Operation:

When the pressure in Port "D" exceeds the setting of the Relief Valve (4500 PSI), the large Spring in the Relief Valve is compressed, Opening an Orfice allowing excess Oil to relieve into the Charge Circuit, Since the Check Valve for Port "C" is open, The Oil is available to the intake side of Pump

There is also a relief Valve in the High Pressure side of the Loop at the Motor. This Valve is set to relieve at 4000 PSI and is in the circuit to absorb spike pressure encountered during severe operation.

PUMP - PARTS LOCATION

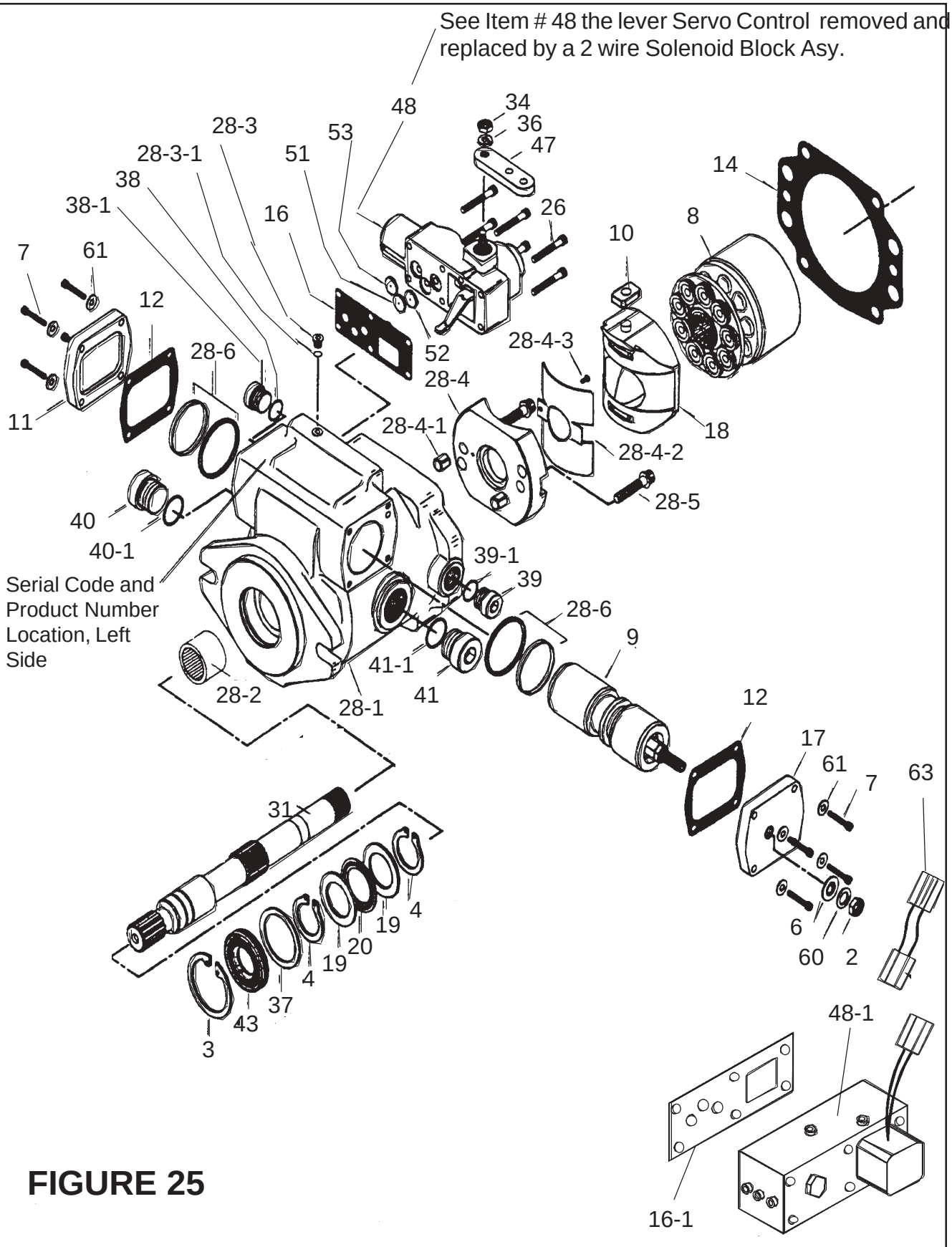


FIGURE 25

PUMP - PARTS LOCATION

Item	Qty	Description
2	1	Jam Nut
3	1	Retaining Ring
4	2	Retaining Ring
6	1	Seal Washer
7	8	Bolt, #10-24 X 1" (25.4 mm) Long
8	1	Rotating Kit Asy.
9	1	Servo Piston Asy.
10	1	Servo Piston Follower
11	1	Cover Plate
12	2	Gasket, Cover Plate
14	1	Gasket, Housing
16	1	Gasket, Control Housing (Used 1997 & Down)
16-1	1	Gasket, Solenoid Servo Asy, (Used 1998 & Up)
17	1	Cover Plate
18	1	Camplate
19	2	Thrust Race
20	1	Thrust Bearing
21	1	Relief Valve, For Port "C"
21-1	1	O-Ring, .097" Dia. X .755" ID, (2.46 mm Dia. X 19.18 mm ID)
22	1	Relief Valve, For Port "D"
22-1	1	O-Ring, .097" Dia. X .755" ID, (2.46 mm Dia. X 19.18 mm ID)
23	4	Bolt, 3/8"-16 X 2-1/4" (57.2 mm Long)
24	2	Bolt, 3/8"-16 X 3-1/5" (88.9 mm Long)
25	2	Bolt, 3/8"-16 X 4" (101.6 mm Long)
26	6	Bolt
27	1	Valve Plate
28	1	Housing Asy (Includes Following Items)
28-1	1	Housing Only
28-2	1	Bearing, Press Fit
28-3	1	Plug, Sub-Asy.
28-3-1	1	O-Ring, .064" Dia X .239" ID (1.63 mm Dia X 6.1 mm ID)
28-4	1	Cradle Sub-Asy
28-4-1	2	Dowel Bushing
28-4-2	1	Bushing
28-4-3	1	Bolt, Button Head
28-5	2	Bolt
28-6	2	Seal, Sub-Asy.
29	1	Back Plate Asy.
29-1	1	Bearing, Press fit
29-2	1	Roll Pin

Note: If replaced with a new Pump it will be the Electric Solenoid Servo Control Type, Reference to Insert Sheet # 02970224 for Electric Servo Control Manifold Asy.

PUMP - PARTS LOCATION

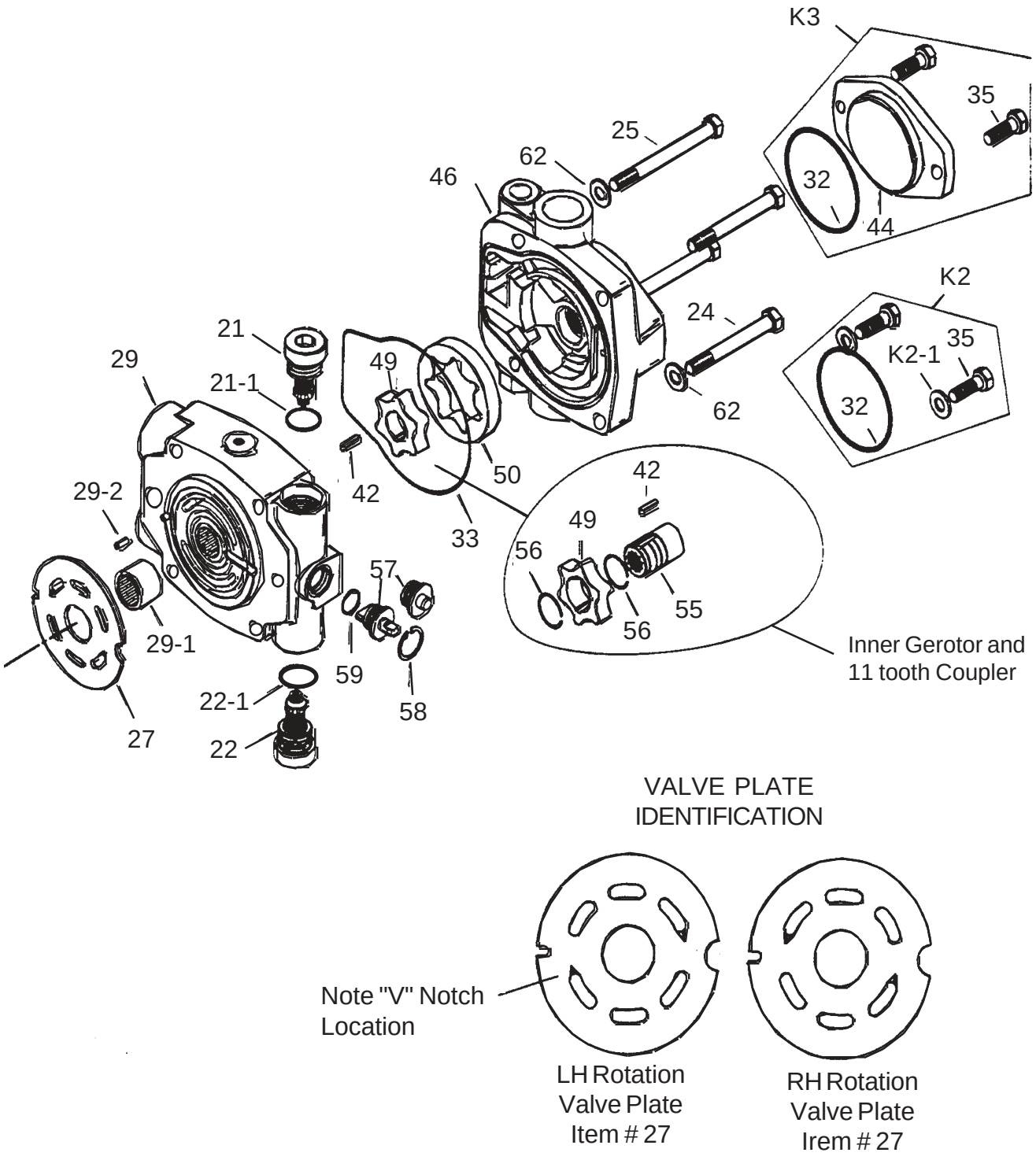


FIGURE 26

PUMP - PARTS LOCATION

Item	Qty	Description
31	1	Drive Shaft
32	1	O-Ring, .0625" Dia X 3.25" ID (1.59 mm Dia. X 82.55 mm ID)
33	1	O-Ring, Molded
34	1	Nut (Used 1997 & Down)
35	2	Bolt, 3/8"-16 X 1" (25.4 mm Long)
36	1	Lockwasher
37	1	Washer
38	1	Plug
38-1	1	O-Ring, .087" Dia. X .644" ID (2.21 mm Dia. X 16.36 mm ID)
39	1	Plug
39-1	1	O-Ring, .087" Dia. X .644" ID (2.21 mm Dia. X 16.36 mm ID)
40	1	Plug
40-1	1	O-Ring, .116" Dia. X .924" ID (2.95 mm Dia. X 23.47 mm ID)
41	1	Plug
41-1	1	O-Ring, .116" Dia. X .924" ID (2.95 mm Dia. X 23.47 mm ID)
42	1	Key
43	1	Cover Plate
44	1	Shaft Seal
46	1	Charge Pump Adapter Asy.
47	1	Control Arm (Used 1997 & Down)
48	1	Manual Servo Control Asy.(used 1997 & down)
48-1	1	Solenoid Servo Control Manifold Asy, (Used 1998 & Up) Not Shown
49	1	Inner Ring Gerotor
50	1	Outer Ring Gerotor
51	1	Supply Orfice
52	1	Control Valve Orfice
53	1	Control Arm Orfice
57	1	Dump Valve Actuator of Plug
58	1	Retaining Ring
59	1	Quad Ring .062" Dia. X .625" ID (1.59 mm Dia. X 15.9 mm ID)
60	1	Washer
61	8	Washer
62	3	Washer
63	1	Adapter Wire Harness, 3 wire to 2 wire (P/N 02970201) used only when converting pre-1997 units to later Pumps. See Insert Sheet # 02970224 for instructions.

PUMP DIS-ASSEMBLY:

The following instructions apply to a single Servo Controlled Piston Pump with or without Gerotor Charge Pump. A Tandem Pump Assembly should be separated into individual Pumps before dis-assembly

1. Position the Pump into a protected Jaw Vise (make sure Vise is Clean), Clamping onto the outer portion of the flange (DO NOT OVER TIGHTEN IN VISE), with the Bolts up, Mark the relationship of the working Ports (for re-assembly identification) to the Servo Control Assembly with a Scribe (Make a Line). Remove the four bolts retaining the Back Plate. (If no Gerotor Charge Pump Skip to Step 6).
2. Lift the Charge Pump Adapter Assembly straight up off Back Plate, Shaft and Gerotor. Gerotor may stay in adapter or on Back Plate.
3. Remove O-Ring from Charge Pump Adapter.
4. **Remove Outer Gerotor Ring** from either the Charge Pump Adapter of the Inner Gerotor Ring.
5. **Remove the Inner Gerotor Ring** and Key from the Drive Shaft or Inner Gerotor Ring and Coupler Assembly from Shaft.
6. Lift Back Plate straight up off Shaft and Housing. Remove Valve Plate from Back Plate or from rotating Kit Assembly, Still in Housing.
7. From Back Plate, remove Dump Valve Retaining Ring, Dump Valve or Plug, and Relief Valve Assemblies. NOTE: Mark the Relief Valve in relationship to the Cavity it was removed from, for Re-Assembly purposes.
8. **Back Plate inspection** (See Figure 27).
   Check the Bearing (Press Fit) in Back Plate, If Needles remain in cage, Move freely and settings is at the Dimension shown in Figure 27, removal of Bearings is not required. Check Roll Pin in Back Plate, If tight and set to dimensions shown in Figure 27 , removal is not required.

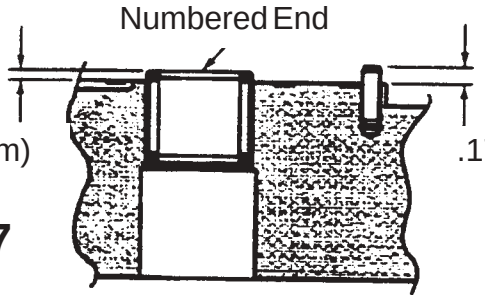


FIGURE 27

9. Remove Housing Gasket from Housing of Back Plate.
10. With Pump Still in Vise, remove the six Bolts retaining the Manual Servo Control Assembly (or Solenoid Servo Assembly 1998 & Up). Remove the Control Assembly and Control Housing Gasket from the Housing, remove the Orifice Plates noticing the Location for Re-Assembly. Remove Nut and Lock Washer from control Arm, Note position of Control Arm for Re-Assembly on Manual Servo Assembly (1997 & Down). (Refer to Appendix B for Dis-Assembly and Inspection of Control Assembly)
11. **To remove Rotating Kit Assembly** from housing first remove Pump from Vise holding the Rotating Kit assembly in position. Lower Pump so that the Shaft end (Flange End) is up. Set the rear of Housing onto table with Housing flat and Rotating Kit Assembly at rest on table. (Hole in table for protruding Shaft is required). Lift and remove the Housing and Shaft from Rotating Kit Assembly and Camplate.

12. **Remove Camplate** from rotating kit Assembly and Servo Piston follower from Camplate. (Refer to Appendix C for dis-assembly and inspection of Rotating Kit).
13. **Camplate Inspection**, The Finish on the Piston Shoe Surfaces of the Camplate should show no signs of scoring at all. Inspect Camplate Bushing surface for wear and surface for coating transfer from Bushing.
14. **To remove Servo Piston Assembly** from Housing start with the four bolts and washers retaining each cover plate.
15. In removing the Cover Plate from the Servo Piston Bolt. Remove Jam Nut, Washer and Seal Washer. Hold the Servo Piston Plate with Hex Key and unscrew Cover Plate off Bolt.
16. **Remove Servo Piston Assembly** and Seal Sub-Assemblies (Two Sets) from Housing. Note: Dis-Assembly of Servo Assembly is not required.
17. Remove retaining Ring from the Cover of the Housing. Press the Shaft, Shaft Seal or Spacer and Washer from Housing, Remove Retaining Ring Thrust Washer, Thrust Bearing, Second Thrust Washer and second Retaining Ring from Shaft.
18. **Housing Inspection** (See Figure 28), Check the Bearing (Press Fit) in Housing. If needles remain in cage, move freely and set at the dimension shown in Figure 28, Removal of Bearing will not be required.

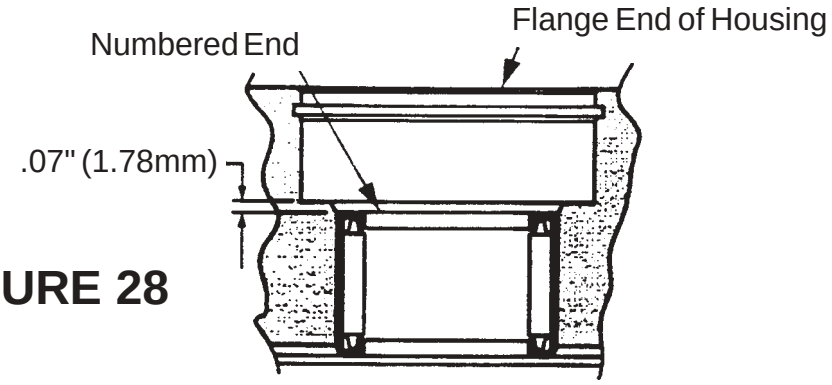


FIGURE 28

19. **To remove Cradle Sub-Assembly** remove the two Bolts retaining Cradle inside Housing. Move the Cradle Sub-Assembly back-an-forth to release Dowel Bushing and removing Cradle Sub-Assemblies from Housing.
20. Remove Button Head Bolts to remove Bushing from cradle.
21. **Bushing Inspection,** Inspect bushing for contamination embodiment within Coating of Bushing surface coming in contact with Camplate.
22. **Remove All Plugs from Housing,** This for inspection to make sure contamination is not caught under plugs or in passages.
23. **Discard Parts**, This will include, The Shaft Seal and all O-Rings from all assemblies, Replace with new ones; **NEVER** use old Seals to assemble Pump.

PUMP RE-ASSEMBLY:

The following instructions apply to a single Servo Controlled Piston Pump with or without Gerotor Charge Pump. A Tandem Pump Assembly should be separated into individual Pumps before dis-assembly and assembled back the same way.

1. All Parts should have been cleaned and critical moving parts lubricated as described in Steps below Before Starting Re-Assembly. (Also Listed in Previous Introduction Page)

- **A.** After dis-assembly of Pump wash all metal components in clean solvent.
- **B.** Use compressed Air to dry parts after washing (Compressed air must be filtered and moisture free). DO NOT wipe them dry with Paper Towels or Cloth as these will leave lint and/or dust contamination. DO NOT USE Compressed Air to Spin any component (such as Bearings or Plates) as this will damage or Blow them apart. Secure any part before using compressed Air to dry it.
- **C.** Always use new Seals when re-assembling Hydraulic Pumps, Lubricate the new rubber Seals with a Petroleum Jelly, (Vaseline) before installing them.
- **D.** DO NOT reinstall worn or damaged Parts back in Pump, DO NOT use a worn or damaged Pump Housing.

2. If Bearings are being replaced in Housing Press them in now, See Figure 28 for dimension on how far to press them in, This is a critical dimension and make sure the numbered end of Bearing is pointing outward.

3. Install the two new Seal Sub-Assemblies into the Servo Piston cavity of Housing

4. **Screw the Cover Plate onto the Servo Piston Assembly**, Install new Cover Plate Gasket in place on Housing. Install Servo Piston Assembly and Cover Plate into Servo Piston bore in right side of housing (as shown in Figure 29). Retain Cover Plate with four each Washers and Bolts, Torque these Bolts to 40 to 48 in. lbs. (4.5 to 5.4 nm).

5. **Servo Piston Neutral Adjustment,** Centering the Servo Piston Assembly is required. Measure in from the left side and set Servo Piston .5" (12.7 mm) from the surface of Housing Servo Bore as shown in Figure 29. (Final adjustment may be require after Pump is installed and operating to obtain Neutral). Special Note: if Unit is equipped with Buzz Bar Head it will have a Neutral (Centering) Adjustment on one side of Servo Piston and piston travel limiting Screw on the other side.

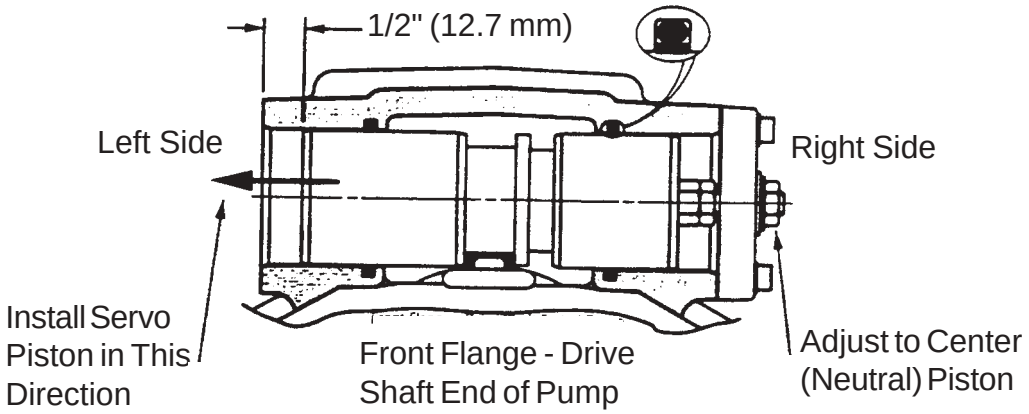


FIGURE 29

6. **Install New Seal Washer**, Washer and Jam Nut to Servo Piston Bolt (Only do this after Centering of Servo Piston has been done). Holding Servo Piston Bolt with Hex Key Wrench Torque Jam Nut to 150 to 160 in. lbs. (17 to 18 nm). Recheck Servo Piston Measurements (See Figure 29) If Measurement is OK install Cover Plate and Cover Plate Gasket on Left Side of Servo Piston, Retain cover with 4 each of # 10-24 Bolts, Torque these Bolts to 40 to 48 in. lbs. (4.5 to 5.4 nm). Note: If on Buzz Bar Head units there is Flow Limiter Bolt and Nut added in LH side cover plate, this looks like the Adjusting Centering Bolt on RH Side. This adjusting bolt on the LH side cover is only to limit the Flow to the Buss Bar Head. The Left Hand side cover is added as Servo Piston Travel Limiting Adjusting Bolt.
7. **To Assemble Cradle Sub-Assembly**, Press Dowel Bushing into Cradle and install Bushing into Cradle retaining with Button Bolt. Torque Button Bolt to 14 to 16 in. lbs. (1.6 to 1.8 nm).
8. **Place Cradle Sub-Assembly into Housing making** sure Dowel Bushings and Cradle is completely seated into Housing. Retain Cradle Sub-Assembly with two Bolts that have Locktite # 277 (or equivalent) applied to the end of the threads. Torque these Bolts to 25 to 28 in. lbs. (34 to 38 nm)
9. **To Install Shaft Components,** Place Exterior Retaining Ring, Thrust Race, Thrust Bearing, Second Thrust Race and second Retaining Ring onto Shaft. Position Washer and Shaft Seal or Spacer onto Shaft.
10. **Install Servo Piston Follower onto Camplate Dowel Pin**, Install Camplate carefully onto Bushing (Coat Bushing Surface with Hydraulic Oil), Aligning Servo Piston Follower with Slot in Servo Piston Assembly. (Refer to Appendix C for Re-Assembly of Rotating Kit Assembly).
11. **To Install Rotation Kit Assembly**, Leave Housing and Shaft in the Horizontal position. Holding Camplate into position with Screw Driver through Controller Linkage passage-way at the top of the Housing, Place Rotating Kit Assembly over shaft and into Housing until Pistons are in against Camplate. Make sure all parts are in Housing completely and properly positioned. Return the Pump to the Vise with open end of Housing up. Clamping Housing on the outer portion of the flange.
12. **Install Gasket on Housing**, Install New Gasket on Housing now.
13. **If necessary, Press New Bearing and Roll Pin in to Back Plate** to dimension shown in Figure 34. Bearing MUST be installed with the numbered end of Bearing Outward. Roll Pin must be installed with split in Roll Pin away from Bearing.
14. **Install Relief Valve**, Always Install New O-Rings on Relief Valves, Install Relief Valves in its original cavity in Back Plate that it was taken out of is recommended, but if they are switched it should not affect anything as they are both the same setting. Torque Relief Valves (Tighten) to 100 to 110 ft. lbs. (136 to 149 nm).
15. **Install New Quad Ring on Dump Valve or Plug**, Install Dump Valve or Plug and retain with Retaining Ring into Back Plate. Note: Make sure paddle of Dump Valve is perpendicular to relief valve axis prior to installing or damage could occur.
16. **Apply a small amount of Petroleum Jelly to the Steel Side of Valve Plate** to hold it in place for installation. Aligning the Index Pin, Place the Valve Plate in position onto the Back Plate with the Steel side against Back Plate.
17. **Install Back Plate Assembly into Housing Assembly**; Make sure Ports are positioned correctly, Valve Plate and Gasket stay in place. If No Gerotor Charge Pump Skip to step 22

18. **Install Key and Inner Ring Gerotor** onto Shaft or Coupler Assembly, Lubricate Inner Ring Gerotor before Assembly. (Refer to appendix A for Re-Assembly of Charge Relief Valve in Adapter Plate).
19. **Install O-Ring and Outer Ring Gerotor** onto Adapter Plate, Lubricate both O-Ring and outer ring to hold in position during assembly of adapter plate, Install adapter plate onto Back Plate. Make sure O-Ring and Gerotor Ring stay in place.
20. **Retain Back Plate and Adapter Plate** (when used) with four Bolts, Torque these Bolts to 27 to 31 ft. lbs. (37 to 42 nm). (refer to Appendix B for Re-Assembly of Manual Servo Control Assembly).
21. **Install Control Housing Gasket onto Housing**, Install Orifices into Control Assembly and retain in position with Petroleum Jelly (Vaseline). Install Manual Servo Control Assembly onto housing making sure feed back link entered small groove in Servo Piston Assembly (Manual Servo Control on units 1997 & Down). Units 1998 & Up have Solenoid Servo Manifold Assembly to install here.
22. **Retain Servo Control Assembly with six Bolts**. Torque these Bolts to 40 to 48 in. lbs. (4.5 to 5.4 nm)
23. **Install Control Arm.** Only applies to units 1997 & Down with Manual Servo Control. Install Control Arm onto Control Assembly input Arm, Retain with Lock Washer and Nut, Torque from 4 to 6 ft. lbs. (5 to 8 nm).
24. **Install Plugs:** Install new O-Ring on all Plugs into Housing, Torque 3/4" Plugs from 21 to 24 ft. lbs. (28 to 32 nm) and torque 1-1/4" Plugs from 40 to 45 ft. lbs. (54 to 61 nm).
25. **Check all Assembly Steps** before Testing and Re-Installing Pump back on Tractor, Follow Start-Up procedures as outlined in Operators Manual. Pump MUST be Pre-Lubed prior to starting up or Pump will be damaged. This is done by putting recommended Hydraulic Oil into pump, See Specification chart for type Oil recommended. On Models (Machete) where the tank is higher than the pump the suction line will have positive Oil flow and usually Pre-Lube itself.

NOTES

PUMP - CHARGE PUMP ADAPTER ASY

CHARGE PUMP ADAPTER DIS-ASSEMBLY:

1. **The following instructions apply to Charge Pump Adapter Dis-Assembly** (See Figure 30 & 31)
2. **Clean,** Make Sure that every thing, Pump, Connections, Tools, Work Bench, Vise and all general conditions are very clean before beginning any work.
3. **Remove** Plug, Shims, Springs, and Poppet from Adapter Assembly
4. **Inspect Charge Pump Relief Valve Seat** inside the Charge Pump Adapter. Check to insure that seat is smooth and free of Burrs or other defects or damage.
5. **Inspect the Charge Pump Relief Valve Spring**, Make sure it is not bent or broken.
6. **Inspect the Bearing or Bushing inside the Charge Pump Adapter**. The Bearing Needles must remain in the bearing Cage at dimensions shown in Figure 36. The Bushing (if used) must have no excessive scoring.

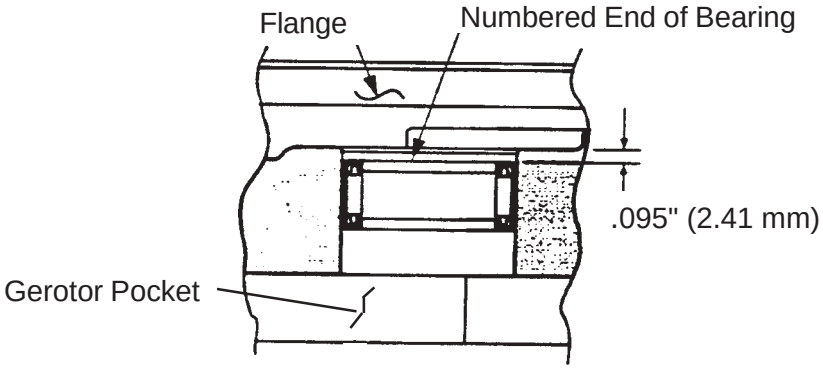


FIGURE 30

CHARGE PUMP ADAPTER RE-ASSEMBLY:

1. **New Bearing or Bushing in Adapter Assembly,** If necessary Press New Bearing or Bushing into Adapter Assembly. The Bearing must be installed to dimensions as listed in Figure 30. The Numbered end MUST be install Outward toward Flange as Shown in Figure 30
2. **The Bushing,** if used must be pressed flush to .010" (.254 mm) recessed
3. **Install Poppet,** Spring, Shims, and New O-Ring on Plug. Screw Plug into Adapter Assembly (See Figure 37). Torque Plug to 27 to 30 ft. lbs. (36.6 to 40.7 nm)

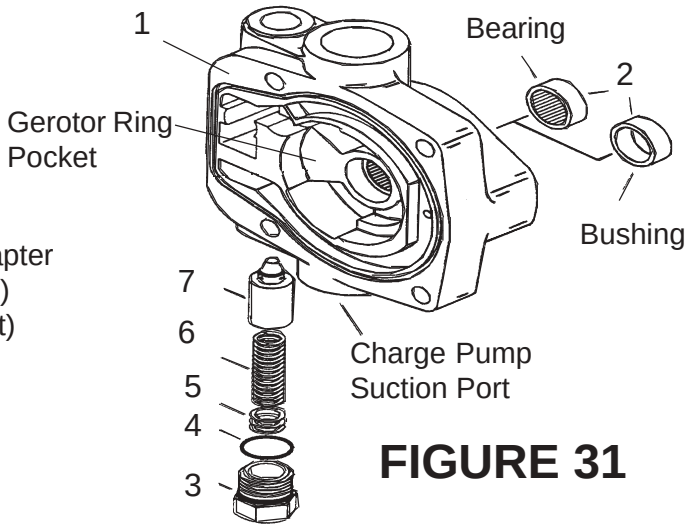


FIGURE 31

Item	Qty	Description
1	1	Chrage Pump Adapter
2	1	Bearing (Press Fit)
	1	Bushing (Press Fit)
3	1	Plug
4	1	O-Ring
5	a/r	Shims
6	1	Spring
7	1	Poppet

PUMP - MANUAL SERVO CONTROL ASY

MANUAL SERVO CONTROL DIS-ASSEMBLY: (Used 1997 & Down)

1. **The following instructions apply to Manual Servo Control Dis-Assembly** (See Figure 32)
2. **Clean,** Make Sure that every thing, Pump, Connections, Tools, Work Bench, Vise and all general conditions are very clean before beginning any work.
3. **Input Shaft Removal,** Remove Wiper Seal (item 16) with Screwdriver. Remove Set Screw (item 13) retaining Input Shaft (item 14) and remove it from Control Housing.
4. **Valve Spool Plug,** Remove Set Screw (item 8) from Plug (item 2) retaining Valve Spool (item 7) and remove Plug. Remove O-Ring (item 3) if it did not come out with plug or remove after Valve Spool is removed.
5. **Feedback Link and Bell Crank,** Remove E-Ring (item 11) from Pin (item 10) retaining Feedback Link (item 9). Remove Feedback Link and Bell Crank from Control Housing, Head Pin (item 17) is a press fit into Bell Crank, Removal of Head Pin is not required as part of repair unless it is damaged.
6. **Valve Spool,** Remove Valve Spool (item 7) from Housing after Step 5 is done, Compress Spring (item 6) on Spool and remove E-Ring (item 4), This allows Spring Retainer (item 5), Spring (item 6) and other Spring Retainer (item 5) to slide off of Valve Spool.
7. **O-Rings and Cleaning Parts,** Make sure all O-Rings are removed from Housing, (Throw away all old O-Rings). Inspect and clean all parts, clean all Parts with Clean Solvent and Dry with Compressed Air Only (See introduction section for more cleaning information). Lubricate all parts in preparations for re-assembly.

MANUAL SERVO CONTROL RE-ASSEMBLY: (Used 1997 & Down)

1. **The following instructions apply to Manual Servo Control Re-Assembly** (See Figure 32)
2. **Clean,** Make Sure that every thing, Parts, Tools, Work Bench, Vise and all general conditions are very clean before beginning any work. Make sure all parts are lubricated.
3. **Valve Spool Spring,** Install Spring Retainer (item 5), Spring (item 6) and second Spring Retainer (item 5) onto Valve Spool (item 7). Compress Spring by pushing on outer Spring Retainer and install E-Ring (item 4) onto Valve Spool.
4. **Valve Spool,** Install Valve Spool assembled into Control Housing (item 1) making sure that the metering notches (See Figure 32) are facing outward and can be seen through the Metering Ports, Check the notches at this time, if the notches cannot be seen it will not work.
5. **Feedback Link and Bell Crank,** Bell Crank (item 12) should have Head Pin (item 17) already installed. Position Bell Crank in Housing, Slide Feedback Link (item 9) into position between Clevis on Valve Spool aligning holes, install Retaining Dowel Pin (item 10) and E-Ring (item 11).
6. **Input Shaft,** Install New O-Ring (item 15) onto Input Shaft (item 14), Hold Bell Crank in position with Feedback Link Slot and align Splined Hole of Bell Crank with Input Shaft Cavity. Install Input Shaft into Control Housing and Bell Crank. Apply Locktite # 242 or equivalent to Set Screw (item 13) and install it to retain Input Shaft. Tighten Set Screw till it bottoms out against Input Shaft and then back it out 1/4 turn.
7. **Wiper Seal,** Install Wiper Seal (item 16) on Input Shaft and seat into Control Housing.
8. **Valve Spool Plug,** Install New O-Ring (item 3) onto Valve Spool Plug (item 2) and install Plug, Tighten Plug till there is no play in Valve Spool with Input Shaft held stationary. Lock in place with Set Screw (item 8), Torque Set Screw to 17 to 25 in. lbs. (2 to 3 nm)

PUMP - MANUAL SERVO CONTROL ASY

USED 1997 & Down

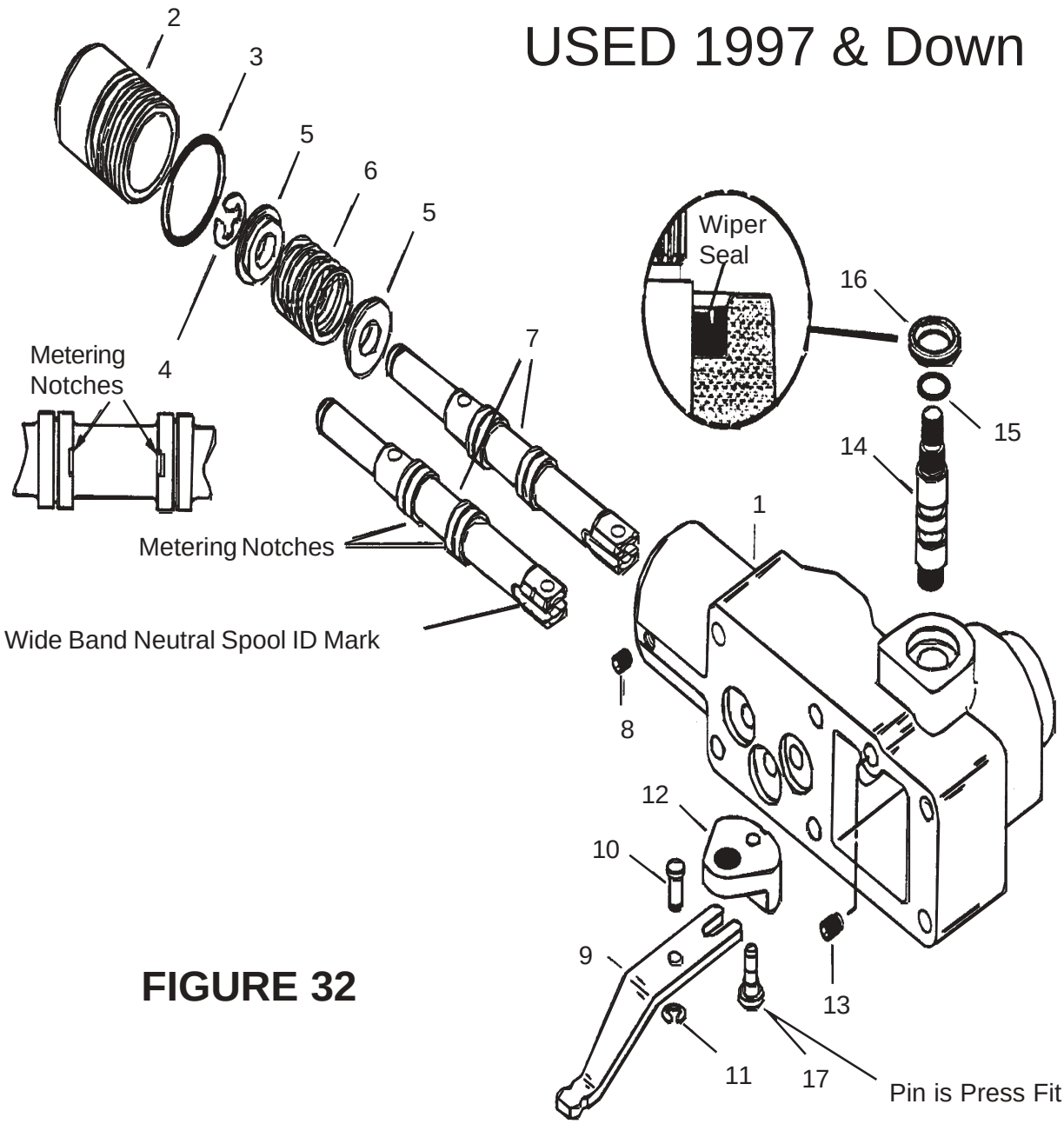


FIGURE 32

NOTE: SOLENOID SERVO CONTROL MANIFOLD ASSEMBLY, (Used 1998 & Up See Figure 39), The Manual Servo Control Assembly Shown in Figure 32 was used through 1997, at which time it was replaced by a Solenoid Servo Manifold, There are not really any repairs to be done to this later version, other than replacing the complete manifold assembly or the Solenoid. Also many of the earlier units were upgraded to this later Manifold by using up-grade Kit # 02970206 See Pump Conversion Kit Insert Sheet # 02970224 (See Figure 33 on next pages).

PUMP - SERVO CONTROL MANIFOLD ASY

USED 1998 & Up

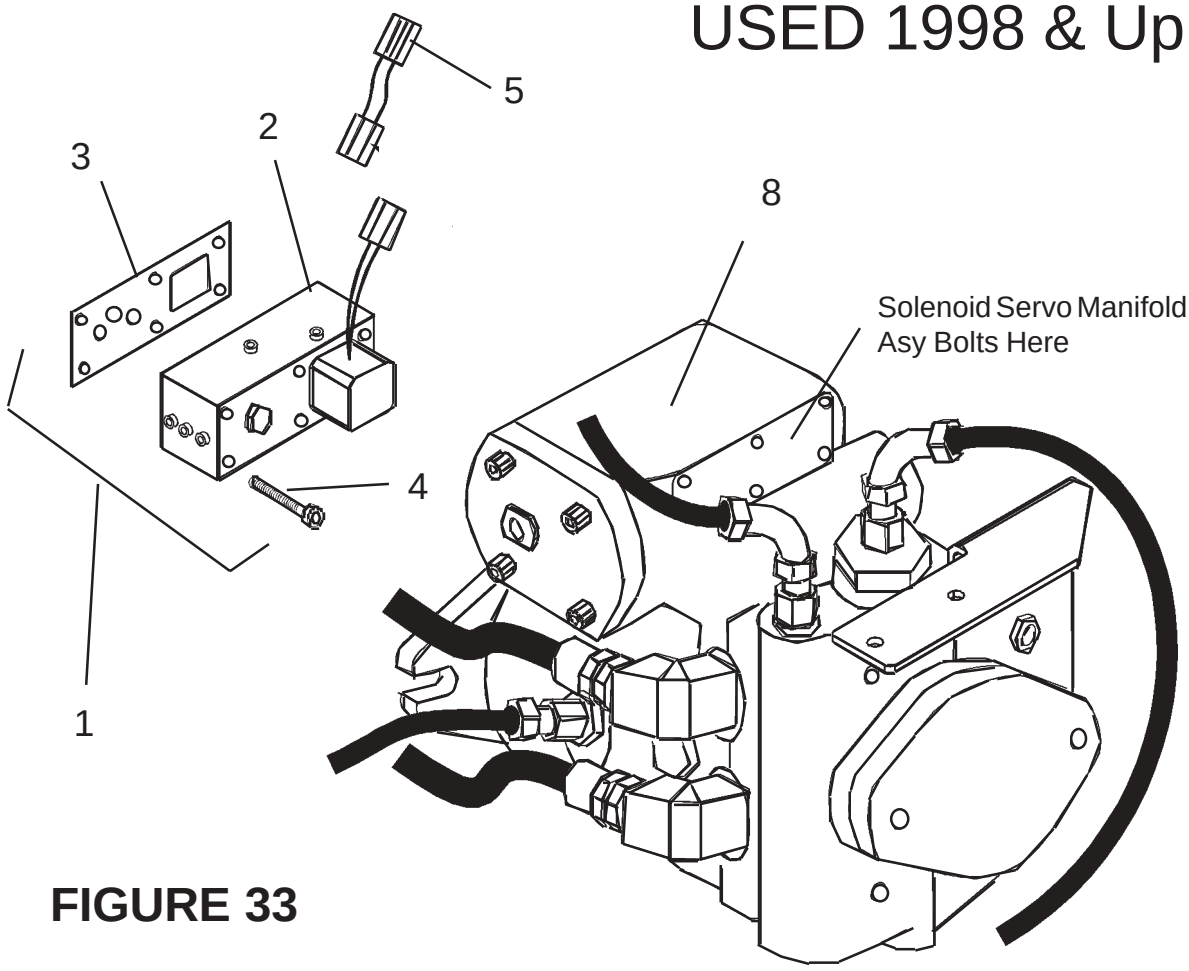


FIGURE 33

Solenoid Servo Control Manifold Assembly

Item	Part No.	Qty	Description
1	02970206	1	Solenoid Servo Control Manifold Kit (w/ items 2 through 7)
2	02970207	1	Solenoid Manifold Assembly w/ Solenoid
3	02970209	1	Gasket
4	02970208	6	Bolt
5	02970205	1	Wire Harness Adapter 3 wire to 2 (only used if converting old style Manual Servo to Solenoid Type.
6	02970201	1	Decal Instructions (Not Shown)
7	02970224	1	Insert Sheet for Conversion (Not Shown)
8	02969527	1	Pump Assembly w/ Item # 1 (New Pump)
	02969527RB	ref	Pump Assembly w/ Item # 1 (Re-Built Pump)

NOTE: Listed above (Item 1) is a Conversion Kit to convert old style Manual Servo Control to New Style Solenoid Control Servo, Also listed is Pump Assembly Complete, To Convert over and use the Wire adapter will have to be used.

PUMP - ROTATING KIT ASY

ROTATING KIT DIS-ASSEMBLY: (See Figure 34)

1. **The following instructions apply to Rotating Kit Assembly Dis-Assembly**
   Dis-Assembly of Rotating Assembly is required for inspection Only, There are no repairable Parts that can be replaced. (See Figure 34)
2. **Clean,** Make Sure that every thing, Tools, Work Bench, Vise and all general conditions are very clean before beginning any work.
3. **Inspection,** Examine the outside diameter of the Pistons for finish condition. They should not show wear or deep scratches, Inspect the shoes for a snug fit on the ball end of the Pistons and a flat smooth surface that comes in contact with the Camplate. DO NOT LAP the Piston Shoes. (Do Not Lap means do not sand, file or try to smooth machined surface).
4. **Piston Shoes,** If Piston Shoes are rough DO NOT LAP them.
5. **Spider,** Examine Spider for wear in the Pivot area, Examine Pivot to insure smoothness and no signs of wear.
6. **Piston Block,** Inspect the Piston Block surface that makes contact with Valve Plate. This surface should be smooth and free of deep scratches, DO NOT LAP Piston Block
7. **Pistons,** The Pistons should move freely in Piston Block Bore. If they are sticky in the Bore, Examine the Bore for scoring or contamination.
8. **Pins and Spring,** To inspect Pins and Spring CAUTION should be taken in removing Spring, The Spring is highly compressed and the retaining Ring should not be removed without compressing the Spring safely.
9. **Piston Block Dis-Assembly,** The following Tools will be needed to dis-assemble Piston Block.
   A. Flat Washers, 2 ea. 3/8" ID X 1-1/8 OD
   B. Bolt, 1 ea. 3/8" X 3-1/4" NC
   C. Nut, 3/8" NC
10. **To remove Spring**, Place one of the Flat Washers over the 3/8" X 3-1/4" NC Bolt, Put Bolt through the center of the Piston Block and apply the second Flat Washer. Let the Washer rest on the three Pins and retain with Nut. Turning Nut and compressing Spring inside Block. Use a pair of Retaining Ring Pliers and remove the Internal Retaining Ring. Remove the Nut, Bolt and two Flat Washers from Block, removing the Washer, Spring, Second Washer, Three Pins and Pin Keeper at the same time.

ROTATING KIT RE-ASSEMBLY: (See Figure 34)

1. **The following instructions apply to Rotating Kit Assembly Re-Assembly**
   Re-Assembly of Rotating Assembly. (See Figure 34)
2. **Clean,** Make Sure that every thing, Tools, Work Bench, Vise and all general conditions are very clean before beginning any work. Make sure all parts are lubricated with Hydraulic Oil prior to re-assembly.
3. **To reassemble the rotating Kit Assembly** complete the following, Compress the Pin Keeper and install in Spline of the Piston Block. Install the three Pins with the Head end to the inside of the Block and position in Special grooves of the Piston Block Spline.
4. Install the Washer, Spring and second Washer into the Piston Block, Use the two 3/8" ID Flat Washers, the 38" Nut and the 3/8" x 3-1/4" Bolt to compress Spring and retain with Retaining Ring. Remove the Nut, Bolt and two washers.
5. Install Pivot onto the three Pins, Spider on the Pivot and Piston Assemblies through the Spider and into Piston Block, resting on Spider.

PUMP - ROTATING KIT ASY

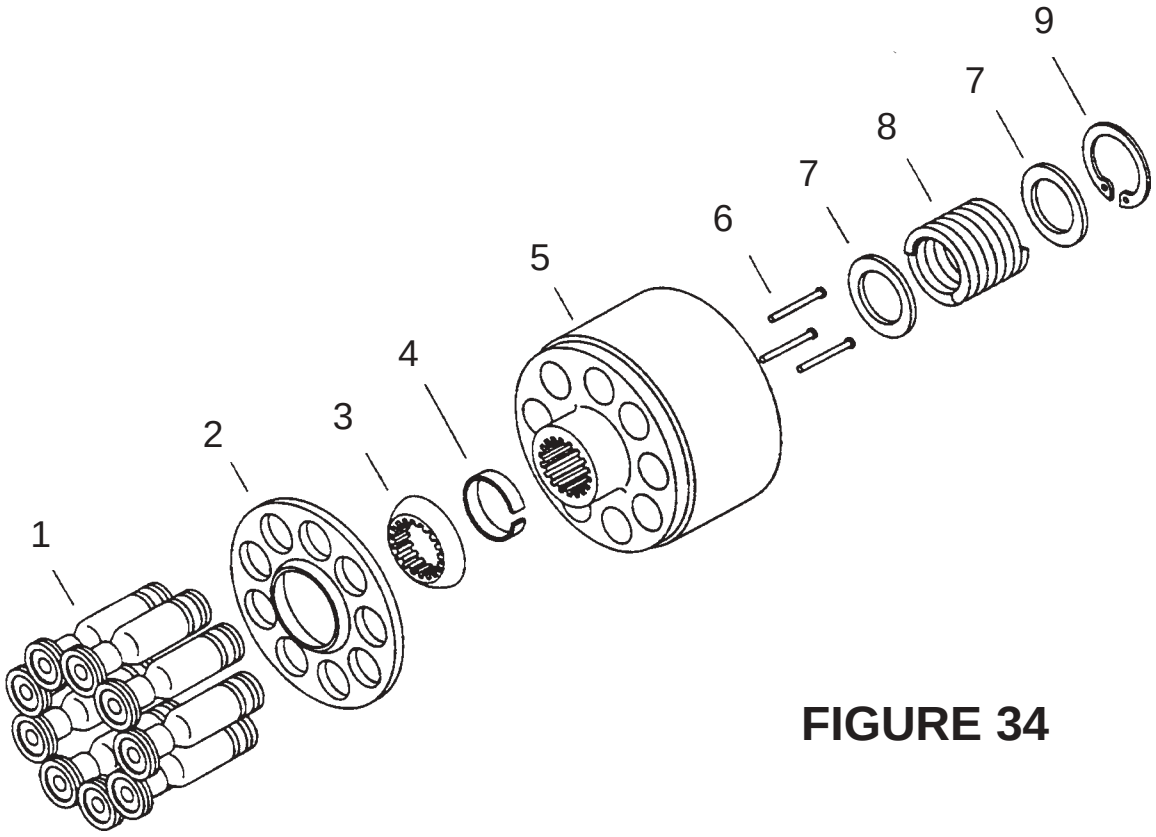


FIGURE 34

Rotating Kit Assembly

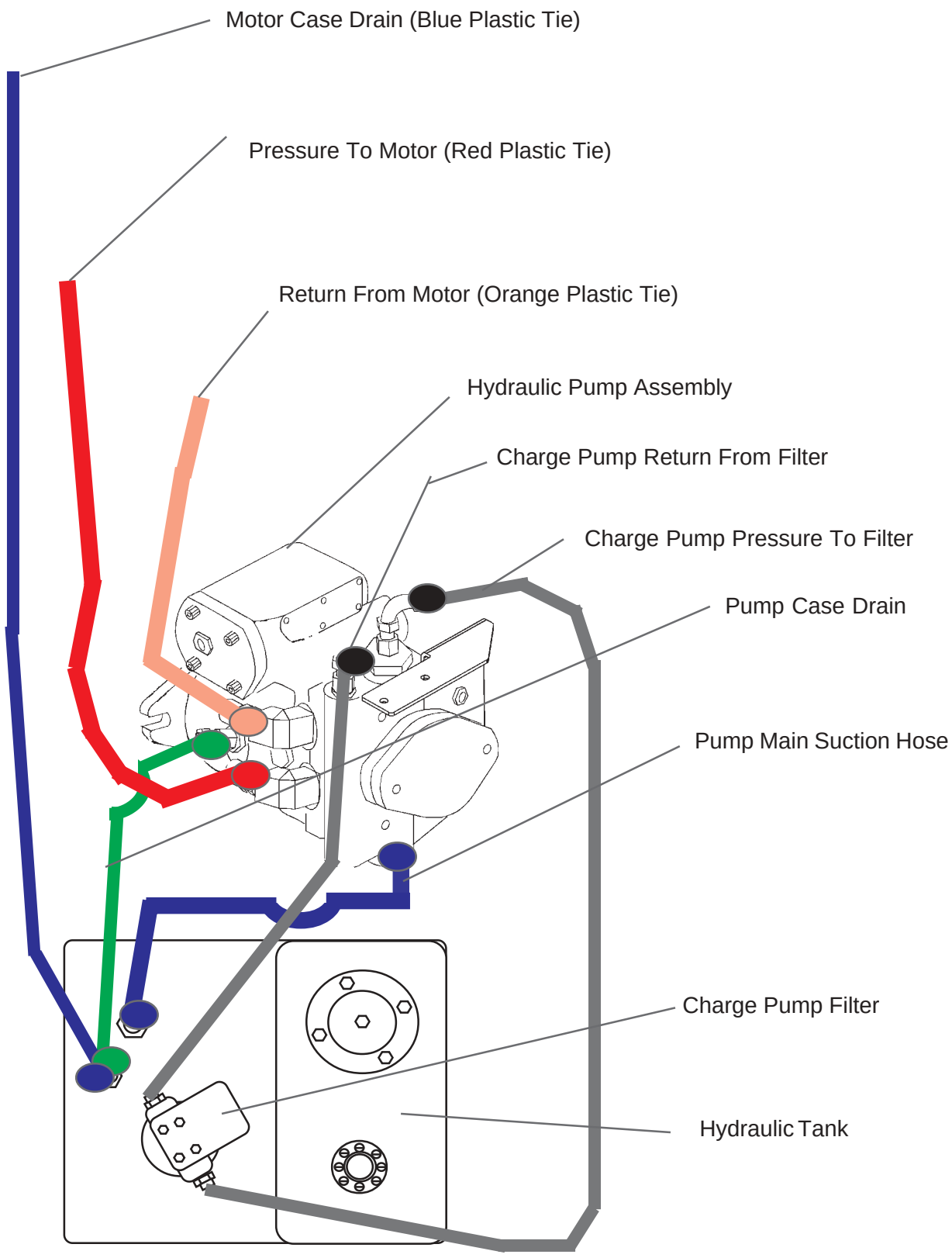
Item	Qty	Description
1	9	Piston Assembly
2	1	Spider
3	1	Spider Pivot
4	1	Retainer
5	1	Piston Block
6	3	Pins
7	2	Wsher
8	1	Spring
9	1	Retaining Ring

Section 5

BRAHMA

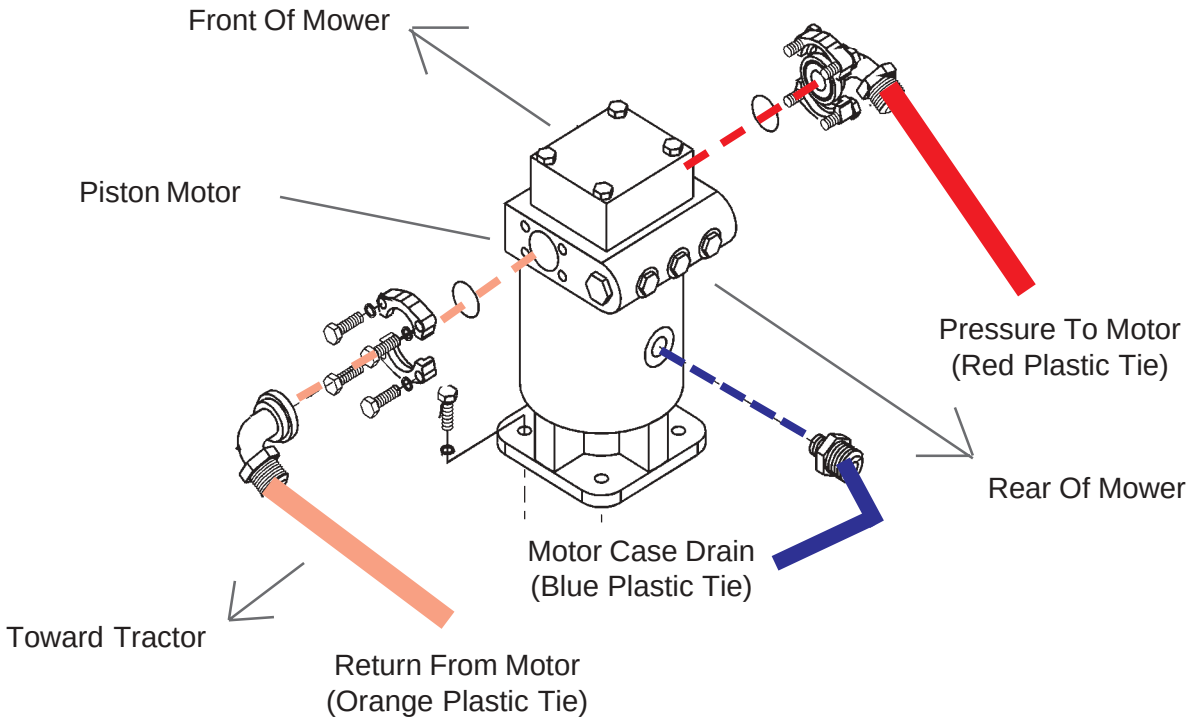
Pump Hose Connections

Pump & Tank Hydraulic Schematic

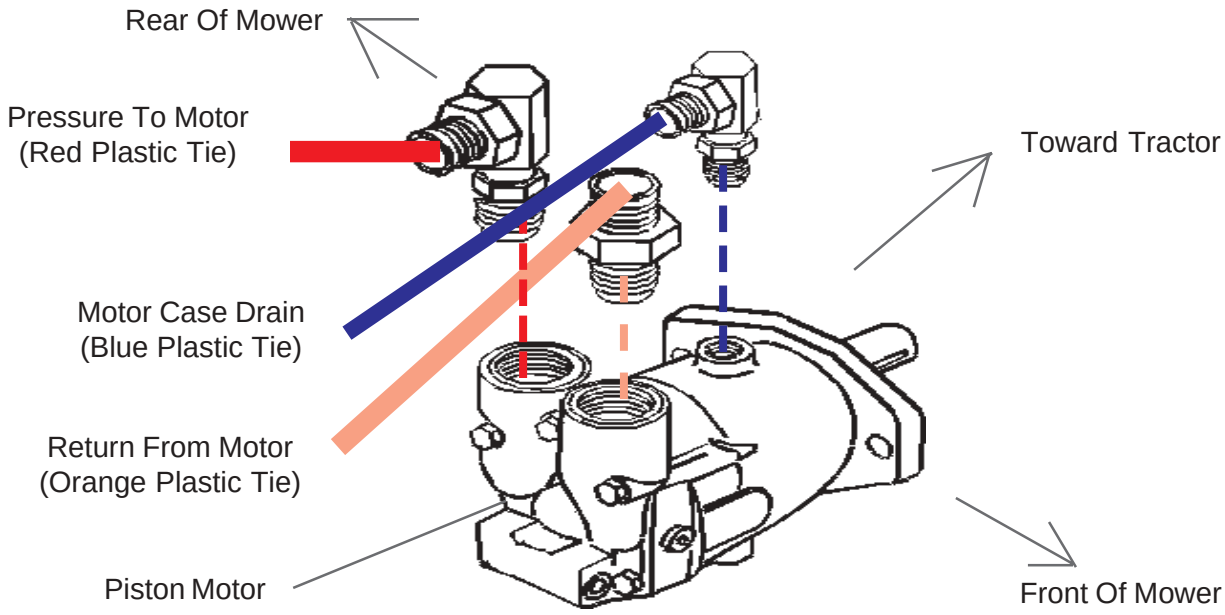


Motor Hydraulic Schematic

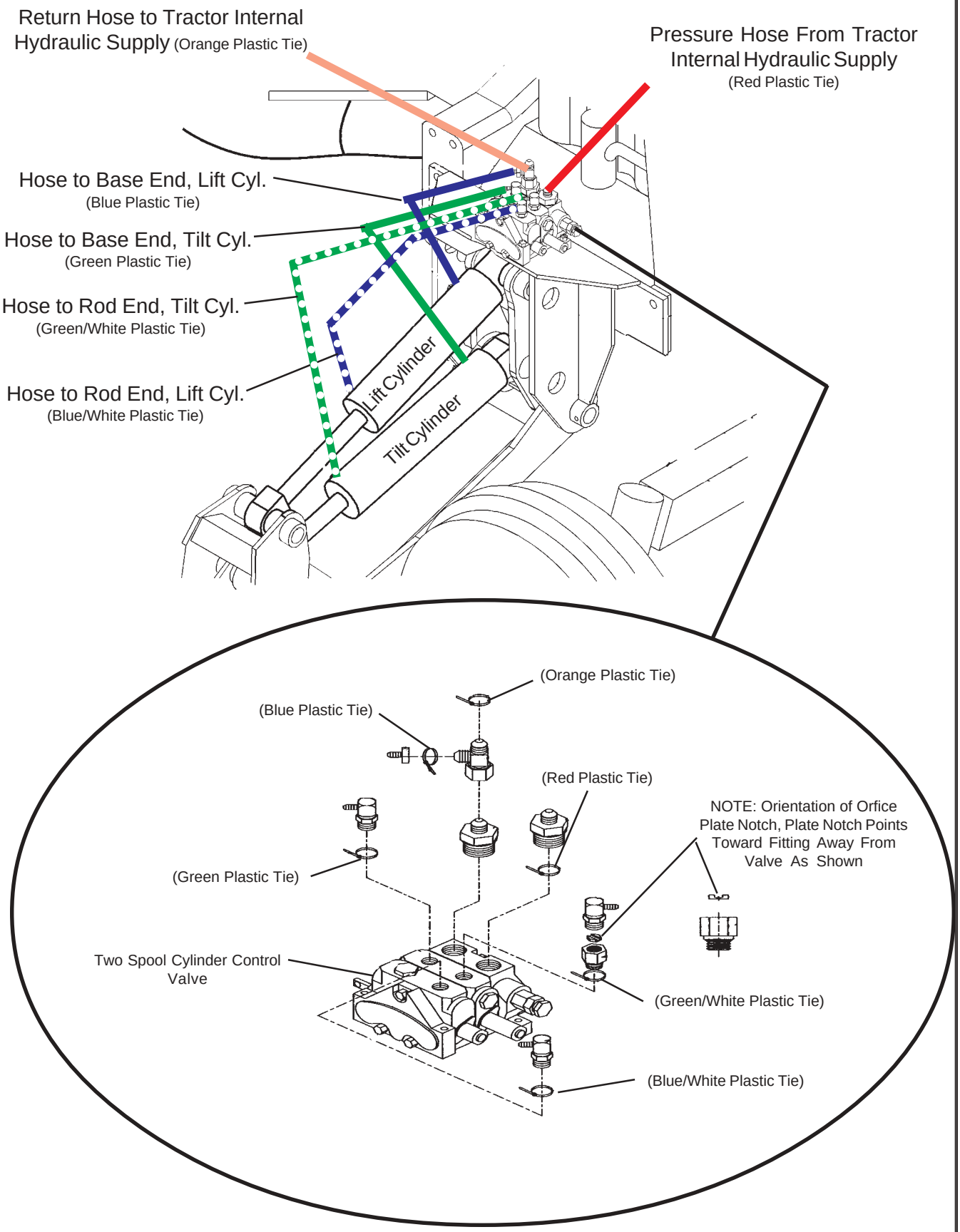
Rotary Head Motor



Flail Head / HD 1500 & HD2000



Control Valve Hydraulic Schematic



Connecting Hoses To Pump & Frame

GENERAL INFORMATION AND WARNINGS - HYDRAULICS:

(See Figure 1)

Inspect and clean all hydraulic hoses and fittings prior to installing them onto the tractor or Mower. If dirt or material is seen in any of the parts, they should be washed and cleaned thoroughly with an oil-compatible solution. Do not blow the material further into a hose since this sometimes does not remove the foreign material and can cause damage to hydraulic components down stream.

It is important that pipe thread sealant be used only on solid connections of pipe thread; never on connections between swivel fittings and external pipe threads or on straight thread "O" ring fittings. Use pipe thread sealant suitable for hydraulic service. Do not substitute some other type of sealant, i.e., teflon tape, paint, shellac, etc.

Hoses supplied have two types of Fittings; solid or rigid. Some Hoses have rigid Fittings on both ends; others have a rigid fitting and a swivel fitting. Hoses with two rigid fittings will fit into either an internal rigid thread, or a swivel adapter union. When installing either type hose, rigid fittings must be installed first. Then install the swivel end of the hose.

The Brahma hydraulic system incorporates three basic types of hydraulic fittings:

A. **Standard pipe** (NPT or NPTF) thread fittings. This type requires a small amount of evenly-applied sealant.

B**.** **JIC Swivel fittings**. This type does not require any sealant on the swivel end because it seals against an internal flare.

C. **"O" Ring fittings.** This type does not require any sealant on the "O" Ring end of the fitting.

It is extremely important to avoid getting pipe thread sealant inside the fittings or hoses. KEEP THE INTERIOR OF ALL HYDRAULIC COMPONENTS ABSOLUTELY CLEAN. Inspect the inside diameter of each hose before assembly. Ensure that no obstruction is present. Dirt, sand, dust, etc., are abrasive and, once in the system, can cause immediate or early failure.

CAUTION

When assembling the fittings and hoses, be careful not to introduce any dust or contaminants into the system. Keep all fittings, hoses, and hydraulic components sealed until installed. Do not allow any components to lie open and exposed to dust or contamination. Do not lay parts down on the dirt or sand and then assemble them as this will introduce contamination into the system. **(See Figure 1,2 & 3).**

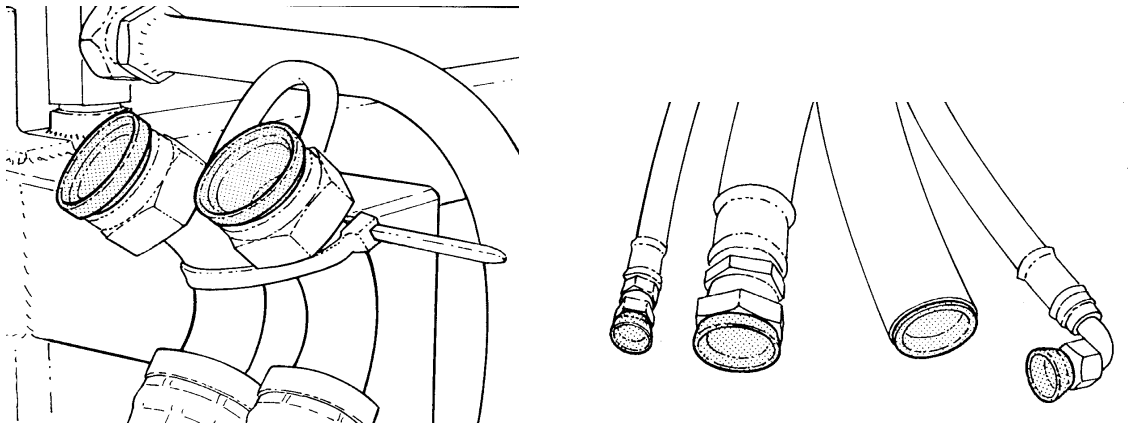


Figure 1

Connecting Hoses To Pump & Frame

Refer to your Operator's Manual and Parts Listing for part numbers and Hydraulic Schematic. Tighten any leaking Hydraulic Fittings. If pipe fittings leak, loosen the fitting, apply a pipe thread compound to pipe threads and tighten. Care must be taken when tightening Hydraulic Fittings. Too much tightening can cause the fittings to crack and require replacement. Please use recommended hose end torque values.

WARNING

Once Pumps are installed, DO NOT start the tractor (which will turn the pump) unless the hydraulic circuit is filled with AW ISO VG100 hydraulic fluid. Running pump without oil will cause nonwarrantable, and immediate damage

HYDRAULIC HOSE CONNECTIONS: (FRONT MOUNTED TANK HYDRAULICS)

On all Hoses, and Major Connections, colored ties are used to identify the proper flow of hydraulic fluid. There are two hydraulic systems; The Motor Hydraulics and the Cylinder Hydraulics.

1. The Motor Hydraulics consists of the Front Mounted Pump and Tank, and the larger hoses, and the Motor on the Mowing Head (which can vary). There are three types of hoses in this system, marked with the colored ties.

Color(s)	Abbreviation	Hydraulic Direction
Red Tie	R	Pressure Flow
Orange Tie	Or	Return Flow
Blue Tie	B	Case Drain

Note: The colored ties do repeat, but the motor hoses can be identified by their large size, compared to all the other hoses.

2. The Hoses for the Brahma are included in the Mount Kit and with the Head, each may vary in length.

3. Connect the Mount Kit hoses to the marked Tank Ports, and route the hoses to the tractor so that they do not interfere with the tractor, mowers operation, Be especially aware of any pinch points on the tractor or any position where the hoses may become entangled in brush.

4. Connect the Mount Kit hoses to the Right Side of the Fittings located on the Middle Rear of the Arm, first- Red, second - Orange, then Blue.

5. Connect the Hoses from the Head to the Left Side of the Arm Fittings in the same order, Note the Motor is marked with the same color codes.

6. Check each connection by following one hose and checking the color connections.

Connecting Hoses To Pump & Frame

Pump To Frame Hose Connections:

1. Connect Hoses to the Mounting Arm Bulkhead. The Mounting Arm has a bulkhead fitting lug welded on to on the rear side. These lugs are color coded with a plastic tie on the bulkhead fitting (See Figure 2).

Orange Tie = the top fitting
Red Tie = the middle fitting
Blue Tie = the bottom fitting

Orange Tied Hose Returns Flow back to Front Pump Hydraulic Reservoir.
Red Tied Hose Supplies Pressure Flow From Front Pump.
Blue Tied Hose is Case drain from Motor back to Hydraulic Tank in front of tractor.

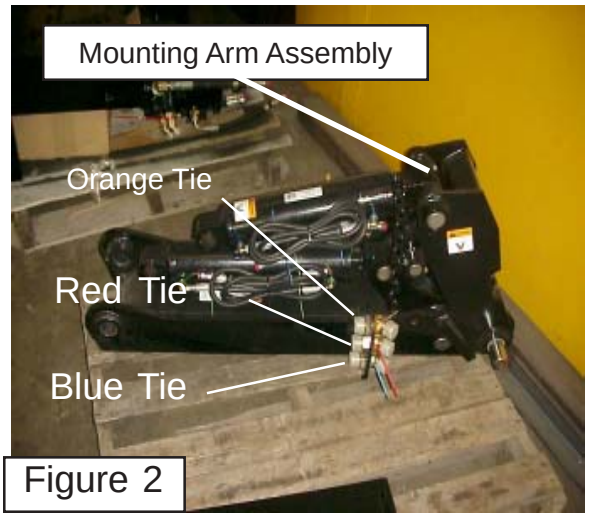


Figure 2

2. Run Hoses Along Side RH Frame Rail. The hoses rub up and over under beam and back along the RH side of Tractor Frame. Install hoses through the sleeving material furnished (See Figure 3). Hoses will be run through a bolt hose ring (See Figure 4). Hoses will then be connected to the tank and pump as shown (See Figure 5)

Caution: DO NOT try to start tractor as there is no hydraulic in tank and all hoses are NOT connected.

Figure 3

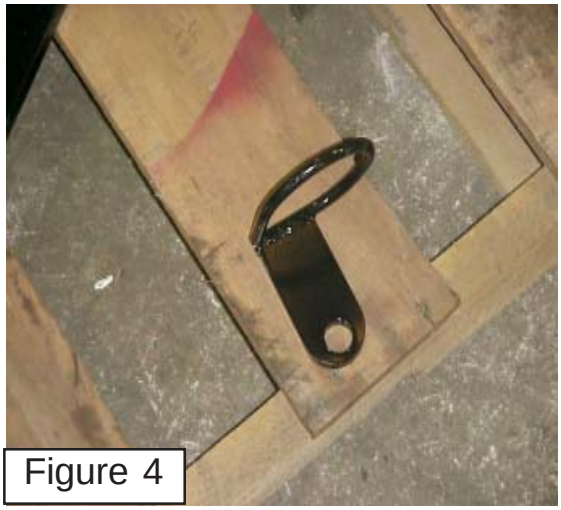


Figure 4

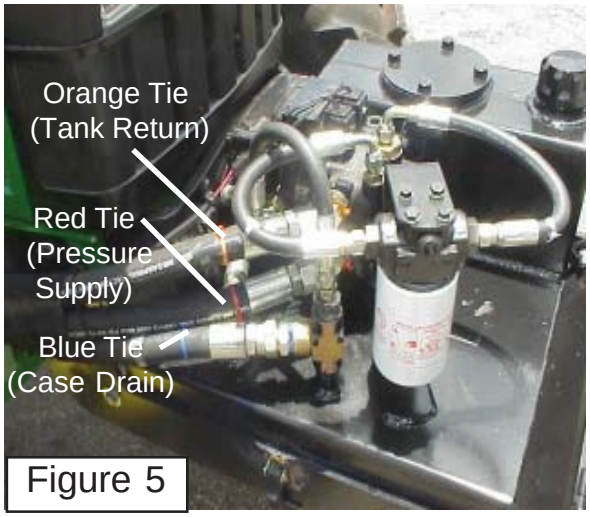


Figure 5

Connecting Head To Frame

Install Cutting Head:

1. Prepare to Install Cutting Head. There is a Flail Head and a Rotary Head option. Shown here is the Flail Option. The Mounting frame will be shipped already bolted to the Flail Head. The Rotary Head the Mounting Frame is part of the head (See Figure 6). There are lift lugs bolted to each end of the flail deck for lifting (See Figure 6 & 7)

There are two pins that will need to be removed from the mounting frame before attempting to install the Cutting head. The Tilt cyl. Arm Pin and/or the Head Pivot Pin. The head pivot pin can be in Head Frame or it can be in Mounting Arm depending which one you used to install mounting arm. (See Figure 7)

Figure 6

2. Align Cutting head with Mounting arm. The Cutting Head will have to aligned with the mounting arm and the tilt lug weldment at the same time. This is recommended that two person work on this together. When the Head Mounting frame is aligned with the mounting arm install a temporary under size pin into the front side to help hold the head in position (See Figure 8). From the back side start the pivot pin into the hole, make certain to try to keep the retaining bolt hole of pin a closely aligned with the frame as possible. DO NOT use excess force to install this pin. With the Head suspended by a hoist have your helper move the head to keep it from binding on pin while you install the pin with a minimum amount of force. If the Teflon Bushing are damage during this installation you will know it because as pin is installed it will push out pieces of the bushing. If this happens the bushing must be replaced.

Use a Rubber Hammer or a soft piece of metal such as brass or aluminum to protect the pivot pin if it is hammered on. Installing the pivot pin will push the under sized pin out that you have installed into the front. Go slowly as you will need to align the lift lug as the pin starts through and then the outer part of the mount arm. Sometimes it is best to put a floor jack under the mounting arm to help align the mounting arm and head.

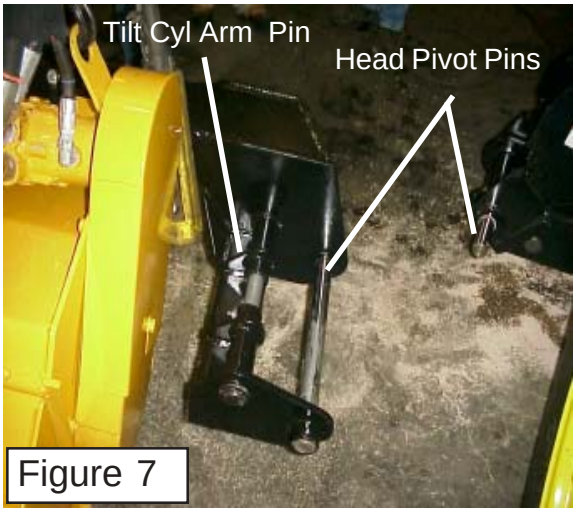


Figure 7

Figure 8

Connecting Head To Frame

Install Cutting Head:

3. Secure The Head Pivot Pin. The head pivot pin uses a bolt and nut to retain the pin. You may have to realign the hole in the pin with the hole in mounting frame. If you can not see the hole at all you can push the pin back out a short distance till the pin hole is visible, not to much or you will lose the alignment of pin and components. Using a small punch or bolt insert it into the pin retaining hole, using a hammer tap on punch or bolt to rotate pin. NEVER USE a tool that will scratch or cut pin. It will help if you have you helper rock the head a bit as you align the pin.


Figure 9

4. Install the Lift Lug Pin for the Tilt Cyl. Start the Lift Pin into the front side of the frame. Push pin through while holding the lifting lug into alignment, the other end of this lug is connected to the same pivot bracket as the cylinder is connected to. Sometimes it will be required to extent or retract the cylinder to align this lug. If you need to extend or retract the cylinder you can usually do it with a pry bar, but you may have to loosen the hoses to let pressure escape. The lift lug uses a retaining bolt and nut, if you need to align the retaining bolt hole in pin with hole in the mounting frame. The pin has a head welded on to it in the front side that can turned by using a large pair of pliers or a pipe wrench. Align pin and install retaining nut and bolt. (See Figure 10, 11 & 12) NOTE: The two holes where cylinder can be connected, which hole determines what degrees the head will fold into transport.

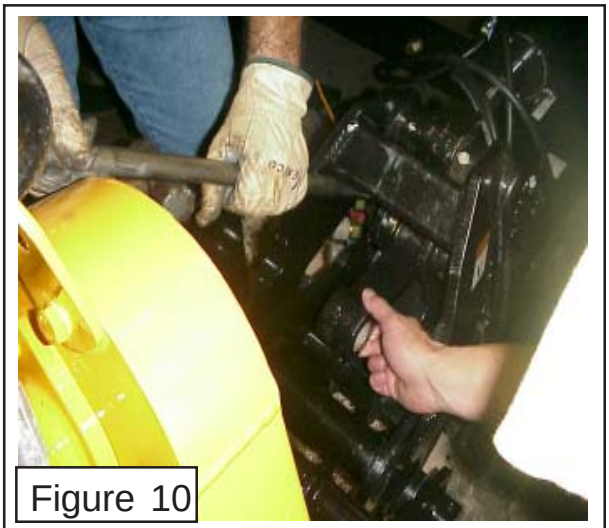


Figure 10

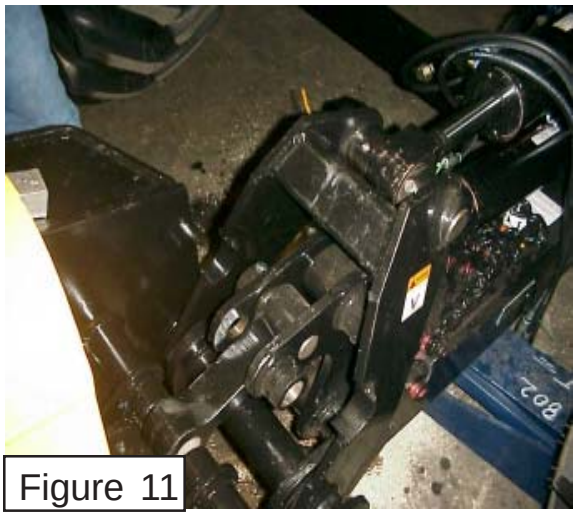


Figure 11


Figure 12

Connecting Head To Frame

Install Cutting Head:

5. Check Head mount Frame To Head Connections. The head mounting frame for the flail head is a bolt on clamp type. Always check these bolts to make certain they have been tightened (See Figure 13).

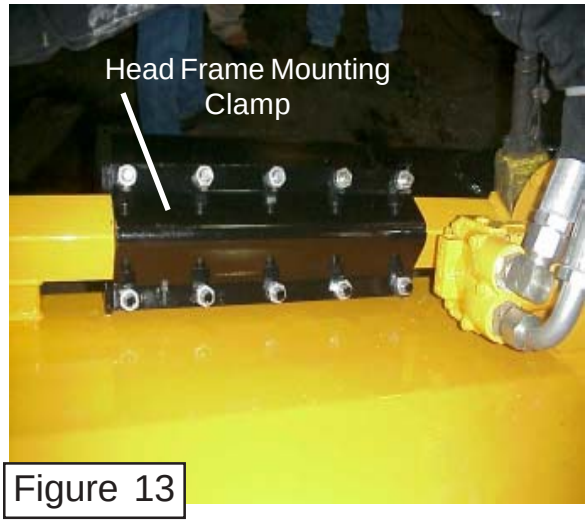


Figure 13

6. Connect Hoses from Head to Mounting Arm. The hoses are already assembled on to the head and will have the sleeving installed. It may be required to loosen some of the fittings at the Motor to allow hose / Fitting clearance or for the hoses to run in the direction you need them to. These hose will have color coded plastic ties on them.

Orange Tie = the top fitting
Red Tie = the middle fitting
Blue Tie = the bottom fitting

Orange Tied Hose Returns Flow back to Front Pump Hydraulic Reservoir.
Red Tied Hose Supplies Pressure Flow From Front Pump.
Blue Tied Hose is Case drain from Motor back to Hydraulic Tank in front of tractor.

Make certain that the hoses are connected where they will not rub or get pinched when Head is folded up (See Figure 14).

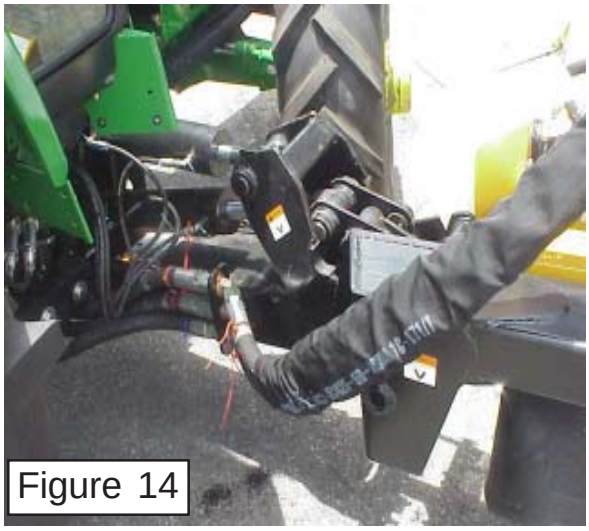


Figure 14

7. Connecting Rotary Head. The rotary head will connect the same as the Flail Head with the exception of the bolt on mounting frame like the Flail has. The rotary Head mount is built on the the rotary head. The hoses will have the same color coded plastic ties on them as the flail has and will connect in the same order (See Figure 15).


Figure 15

Section 6

BRAHMA

Motor Circuit Section
Rotary Mower Head
(Old Style)

MOTOR - ELECTRICAL CONTROL

Note: The Servo Control Valve, Lever and Solenoid have been replaced a manifold and Solenoid valve Cartridge, Please make note on all diagrams and text.

The Method used on the Machete to transmit Engine Power to the Mowing Head is called a “Closed Loop” or “ Hydrostatic” System (Figure 39). Engine Power is converted to Hydraulic Power by the Variable Displacement Hydraulic Piston Pump. Oil is sent to the Fixed Displacement Motor through the Hoses that run down the Boom. Oil passing through the Motor converts the Hydraulic Power Back into Mechanical Power to Rotate the Blades.

The Shuttle Valve in the Motor returns 8 GPM back to the Tank for Cooling. The remainder of the return oil remains in the Closed Loop. Some of the advantages of using a Closed Loop System for the Motor Circuit are 1. A Smaller quantity of Oil is required, 2. System acts as its own “Brake” slowing down the Blades and 3. Less Fuel consumed due to “No Load” condition when Motor Circuit is disengaged.

Another feature of the Alamo System is that the Oil is filtered after it leaves the Charge Pump and before it enters the High Pressure Loop.

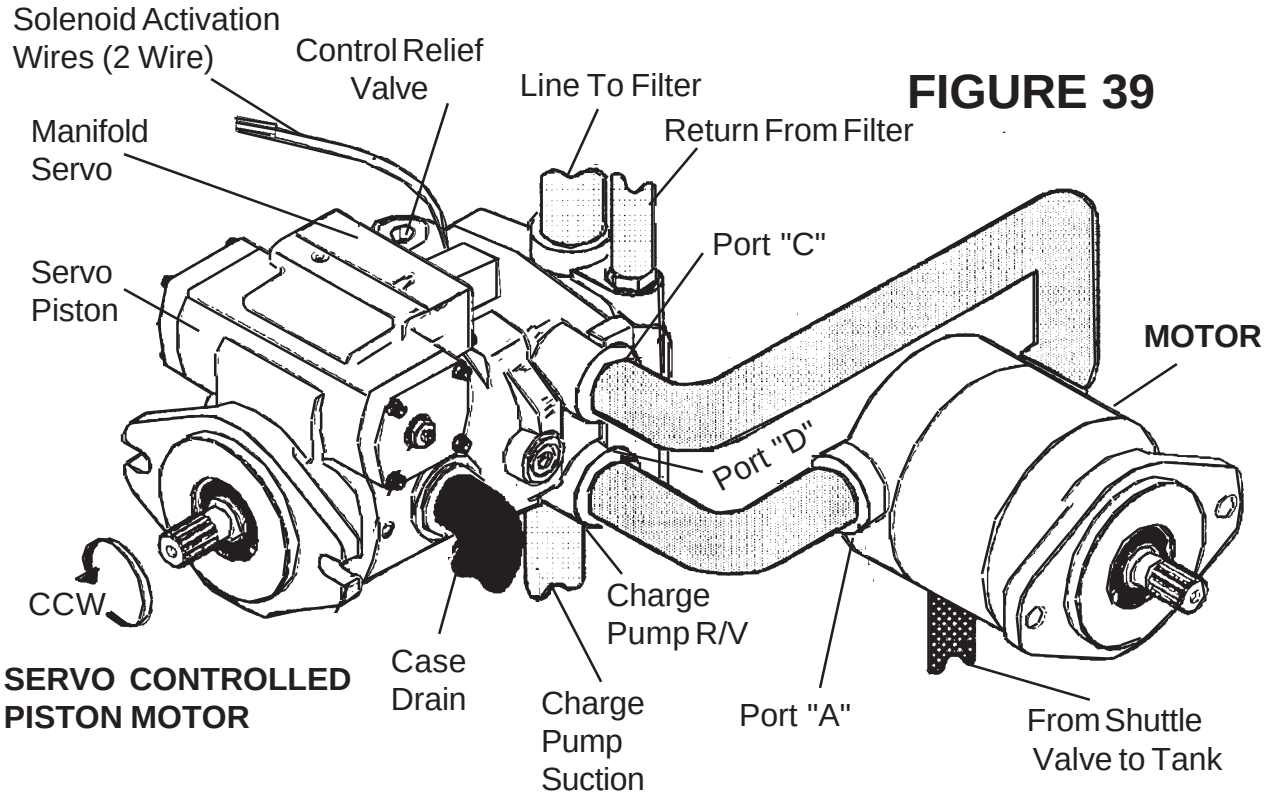


FIGURE 39

SERVO CONTROLLED PISTON MOTOR

The Motor Circuit is engaged by two Manually Operated Switches (See Figures 36, 37, & 38 for Types Used). These Switches have varied from “On - Off” to “Momentary’, But all have served the same purpose. Closing the Switches completes a Circuit through the Solenoid. The Purpose is for a “Solenoid” to actuate a Pump Control, which actuates a Valve to turn on Pump; this has varied some over the years. This movement causes the Camplate in the Pump to move. Movement of the Camplate when the Pump is turning causes the length of Piston Stroke to Change, Causing Oil to too be moved. The Greater the Angle, the longer the stroke, The longer the stroke the more Oil is Pumped, and the more oil pumped means faster the motor turns.

MOTOR - PUMP ACTIONS

Note: The Servo Control System, (Changed see "Note" on Previous Page)

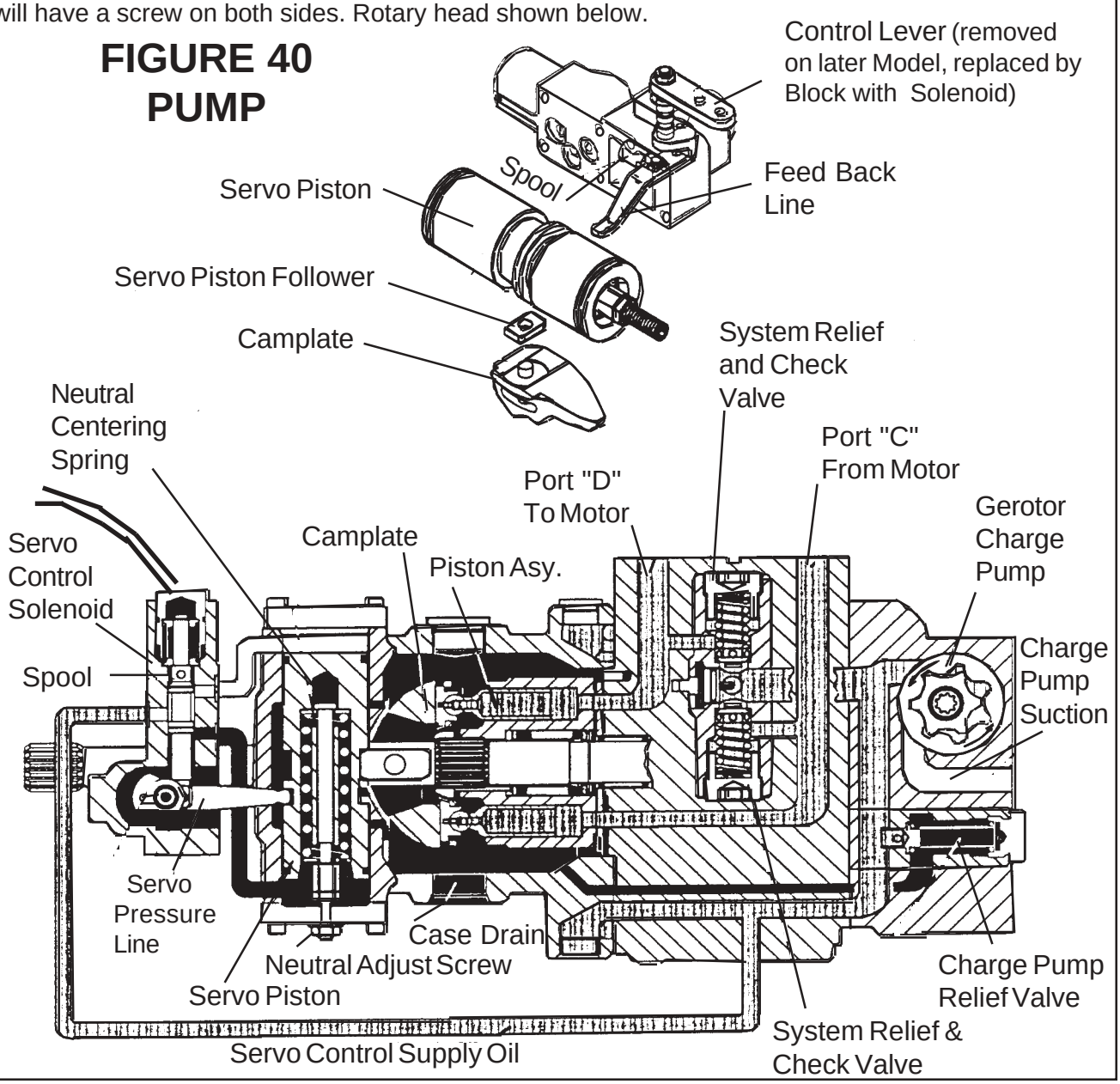
Pump Output is started by movement of the Variable Displacement Pump Control Lever (Figure 40). As the Lever is rotated, it moves the Spring centered Servo Control Spool first. Movement of the Spool allows Charge Pump Oil past the Spool to one side of the Servo Piston (Figure 40). The Pressurized Servo Piston pushed against the
Camplate (figure 40) causing the Camplate to rotate to a Pre-Set Angle. Oil from the opposite end of the Servo Piston is exhausted to the Pump Housing through the Control Valve Spool.

When the Control Lever (Solenoid & Block on Current Models) is returned to the Neutral position, The Spool centers itself, allowing the Pressure on both ends of the Servo Piston to equalize. The Piston and. Camplate return to a Neutral position and Oil flow from the Piston Pump ceases.

Speed of the Camplate movement is controlled by orifices between the Control Valve and the Servo Piston.

Neutral Adjustment Screw is to set Servo in Neutral position to prevent flow to motor, a Buzz Bar Head will have a screw on both sides. Rotary head shown below.

FIGURE 40
PUMP



MOTOR - PUMP DIS-ENGAGE

Motor Circuit Disengage (w/ Engine Running)

The Alamo Closed Loop Motor Circuit is considered to be Neutral when there is no output being generated by the Variable Displacement Pump, as the Shaft, Internal components and Charge Pump are being driven by Tractor Engine. The Camplate is in the centered position and the length of Stroke of the Pistons is equal, therefore there is no flow being generated by the pump

At this point the Charge Pump is drawing Oil through a Suction Screen from the Tank to provide flow to perform the following functions.

1. Keep the Circuit Primed and make up internal leakage.
2. Maintain Back Pressure on Pump and Motor Pistons
3. Operate Control Functions to Start Pump.
4. Maintain Temperature Control, to prevent Oil Heating in Pump.

Oil from the Charge Pump is directed to two dual purpose system Relief and Check Valves (Figure 41). Since the Charge Pressure is greater than the pressure in either side of the Closed Loop, The Check Valves open and charged Oil (at Charge Pressure) is available to both sides of the closed Loop. When the System is primed, any excess Oil is relieved through the Charge Pump relief Valve, which maintains a pressure of 250 to 300 PSI.

The Piston Pump remains in Neutral as long as the Campmate remains in the centered position, this is controlled by the Servo Control System, If Pump does not stay in neutral check the Neutral Adjusting screw. This is usually noticed by Motor wanting to run.

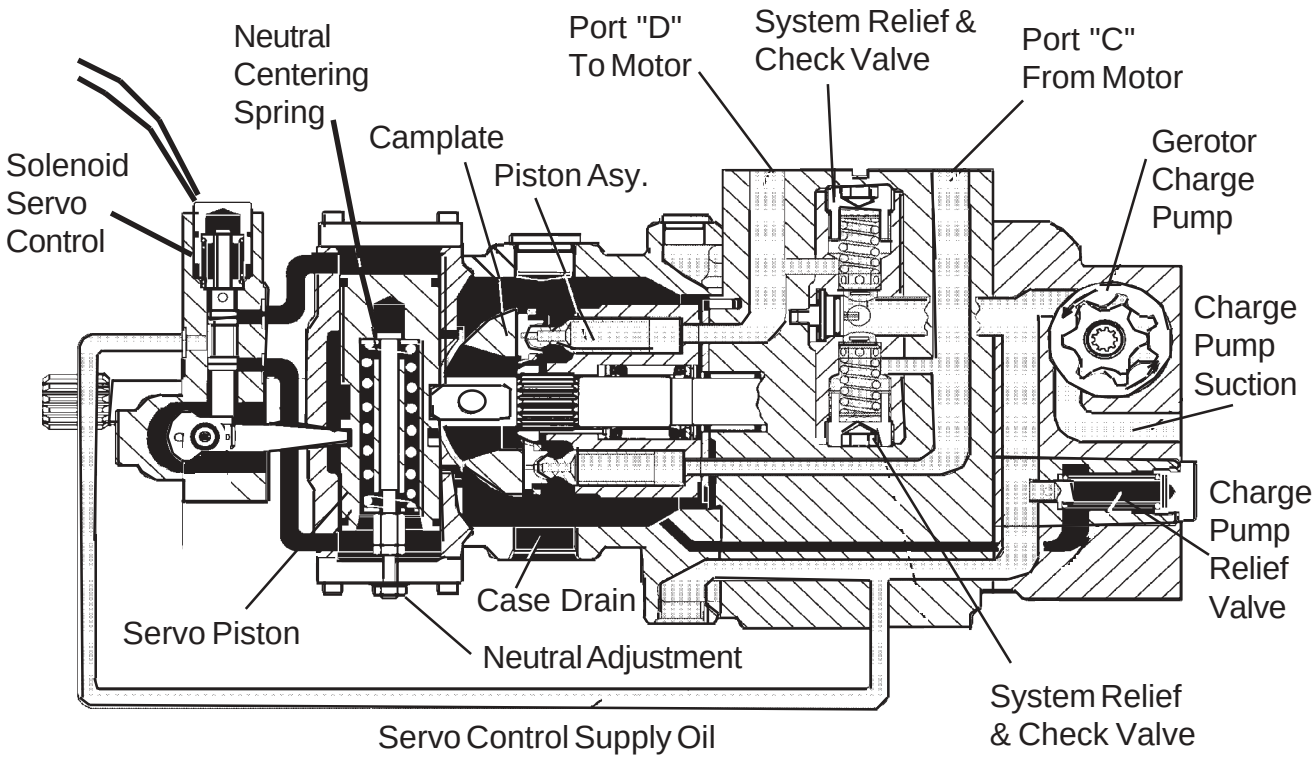


FIGURE 41 PUMP

MOTOR - PUMP ENGAGE

Motor Circuit Engaged (w/ Engine Running)

When the Switch and Solenoid are activated, The Servo control System moves the Camplate to its Maximum Angle. As the Piston Block rotates, The Angle of the Camplate causes the Pistons to move in and out of their Bores as they follow the Camplate, This results in Oil being drawn into the Piston Bore as the Piston is pulled outward. The Oil being expelled into the other side of the Loop as the Piston is forced back into its bore, This creates the flow of Oil necessary to power the Motor. Movement of the Camplate angle from the neutral to maximum is set at approximately 6 seconds and is controlled by the size of the Orifice between the Control valve & Pump Case.

Oil under charge pressure is available at the Check Seats of the combination System Relief & Check Valves. As the Piston is drawn outwards in its bore, The combination of lower pressure in the Piston Bore and charge pressure in Port “C” causes the Check Valve for Port “C” to come off its seat, Allowing Oil At Charge pressure to fill the Piston Bore. As the Piston Block rotates the Oil is trapped in its bore by the Valve Plate. As the Piston Block rotates more, the piston is forced back into its bore expelling the Oil into Port “D” through an opening in the Valve Plate. The Higher pressure in Port “D” seats the Check Valve for Port “D”, Separating Oil in Port “C” from Oil in Port “D”. Oil is forced to go through the Motor causing Motor Rotation.

Any Leakage from the Piston Block Valve Plate, Pistons, or excess Oil from the Charge Pump Relief Valve is vented to the case and is returned to Tank through the case Drain Port.

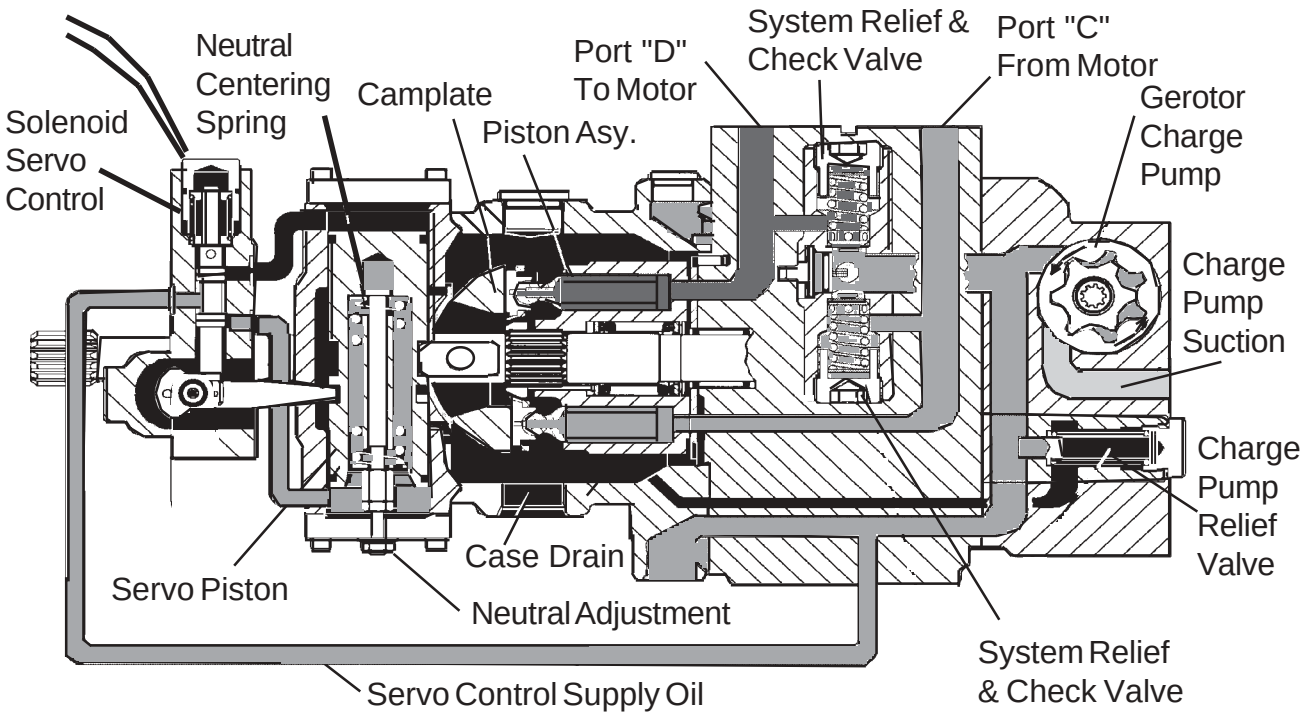


FIGURE 42 PUMP

Relief Valve Operation:

When the pressure in Port “D” exceeds the setting of the Relief Valve (4500 PSI), the large Spring in the Relief Valve is compressed, Opening an Orifice allowing excess Oil to relieve into the Charge Circuit, Since the Check Valve for Port “C” is open, The Oil is available to the intake side of Pump

There is also a relief Valve in the High Pressure side of the Loop at the Motor. This Valve is set to relieve at 4000 PSI and is in the circuit to absorb spike pressure encountered during severe operation.

MOTOR - SYSTEM SCHEMATIC

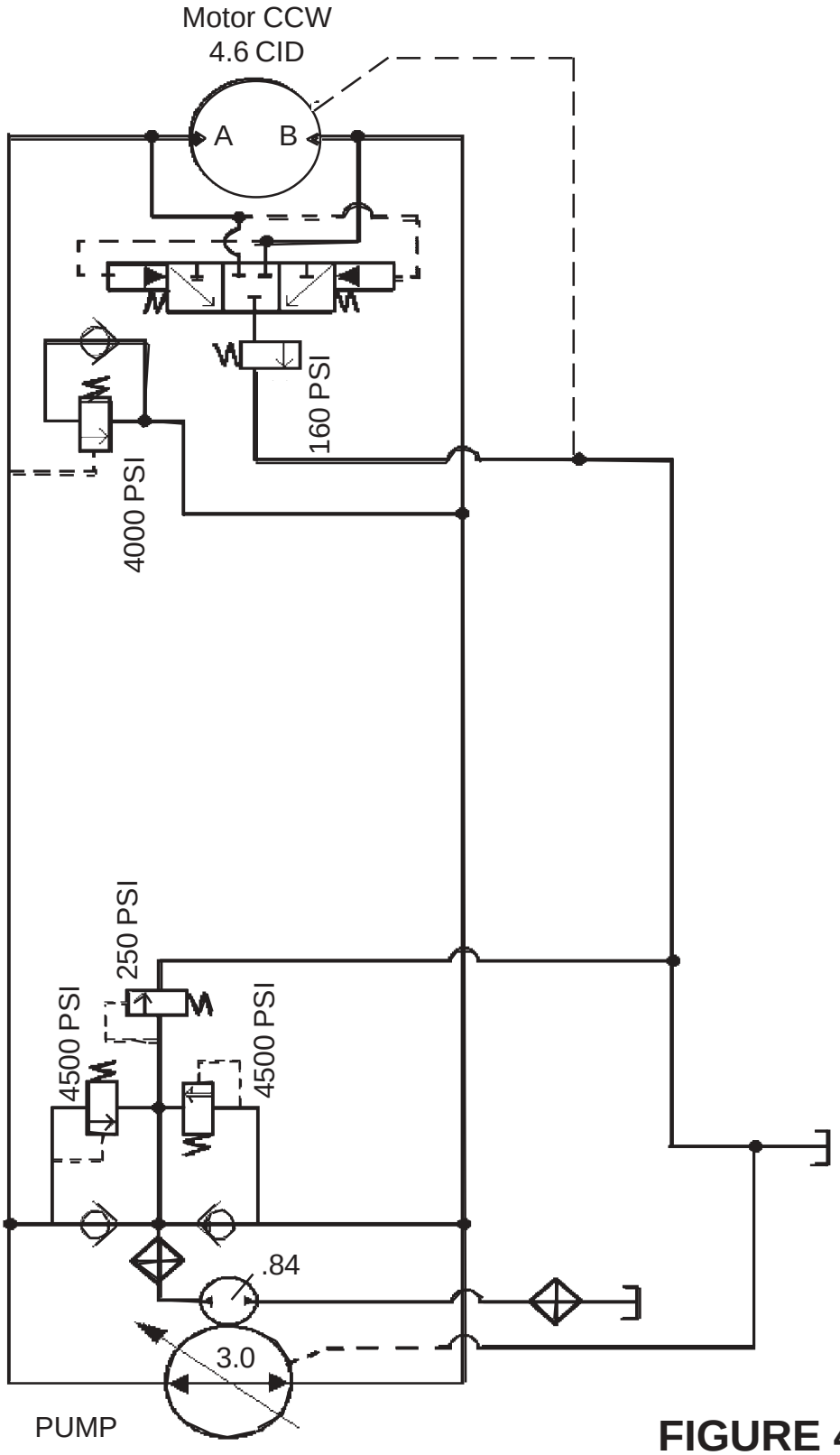


FIGURE 43

MOTOR - SHUTTLE VALVE

Motor Shuttle Valve: (Figure 44 & 45)

The Shuttle Valve is located in the Motor Housing, The purpose of the Shuttle valve is to direct a controlled amount of Oil out of the Hydrostatic Loop and back to the Tank for Cooling

The Spool (item 3) is centered in its bore by springs on each end. While the Pump Shaft is turning and the Camplate is in the neutral Position (Figure 44), Both ends of the Shuttle Spool are exposed to a charge pressure. When the Camplate Angle is changed, The Pressured side if the Spool sees an increased pressure while the opposite end is still seeing the charge pressure (return side of circuit) (Figure 45). This causes the Spool to shift in its bore, opening a passage for Oil in the return side of the Loop to go to the Tank through the Case Drain Line.

The Volume of Oil flowing through the Case drain Line should not exceed the Charge Pump Volume unless excessive internal leakage exists in the Motor. The low Pressure relief is designed to prevent the Motor seal from blowing out if excessive pressure should enter case.

The Case Drain serves to lubricate the Motor, approx. 3 GPM goes through to Lube motor. The volume through case drain should not exceed 8 GPM, if it does check the motor for wear or a malfunction.

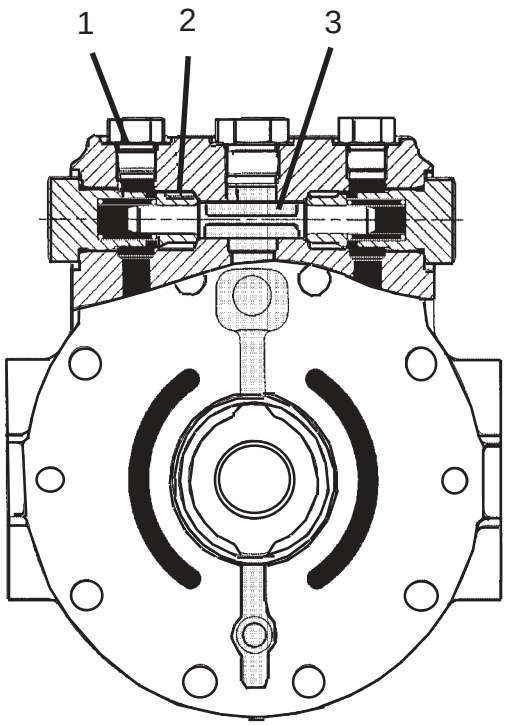


FIGURE 44

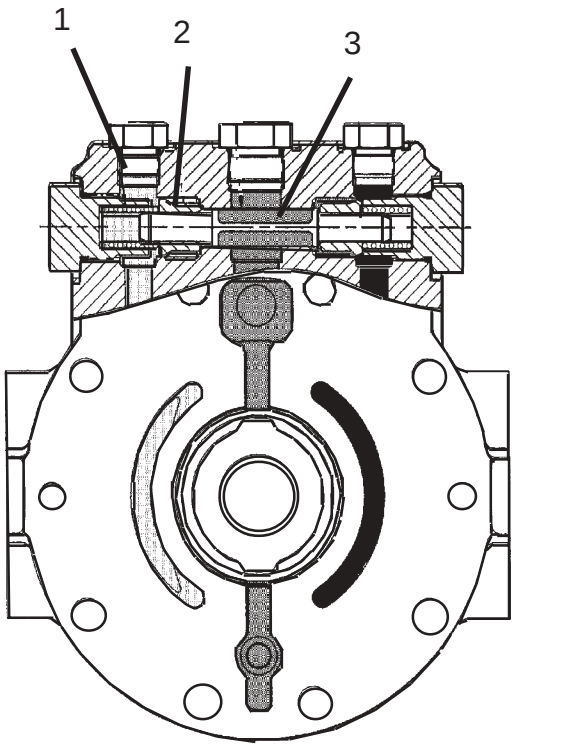


FIGURE 45

Motor Dis-Assembly or Assembly Comments:

The purpose of this Section is to provide Service information and procedures for Dis-Assembly and Re-Assembly of the Hydrostatic Fixed Displacement Motors. Motors with Valve Blocks, Motors with integral Shuttle and Low Pressure Relief Valves are covered. The Procedures in this Manual will allow better Service of Motors. This Manual will show some Components Dis-Assembled that are not available as replacement parts, Some Sub-Assemblies that are to be Dis-Assembled for cleaning or inspection only. There are Special Tools that may be required. SEE BACK PAGES for Tool Drawings.

Tools Required: Recommended Tools for Service / Repair Work on Motor

1. Stationary Seal Puller (1/4" X 20 UNC Cap Screw, 3" to 4" Long)
2. Rotating Seal Puller, (Special Tool)
3. Retaining Ring Pliers, (No. 5 and No.7)
4. Ratchet Wrench or Breaker Bar (Drive Size Optional)
5. Wrench, Box End / Open End Combination, (1-3/8")
6. Wrench, Box End / Open End Combination, (1")
7. Socket, (Drive Size Optional)
8. Torque Wrench, (200 ft. lb. Capacity Drive Size Optional)
9. Hex Bit Socket, (1/4")
10. Hex Key, (1/4")
11. Tube Locktite (No. 271)
12. Pliers
13. Punch
14. Magnetic Base Indicator Dial
15. Hammer
16. Bearing Press or Driver
17. Light Petroleum Jelly (Like Vaseline)
18. Cleaning Solvent (CLEAN UN-USED NON-CONTAMINATED), Non-Petroleum Base
19. Two Headless Cap Screws, (5/16" X 5" to 6" Long) Special
20. Micrometer or Vernier Calipers
21. Small Screwdriver, (1/8" Blade)
22. Low Clearance Bearing Puller, (Special)
23. Filtered Moisture Free Compressed Air / Clean Lint Free Rags (IF NOT LINT FREE, DO NOT USE THEM)

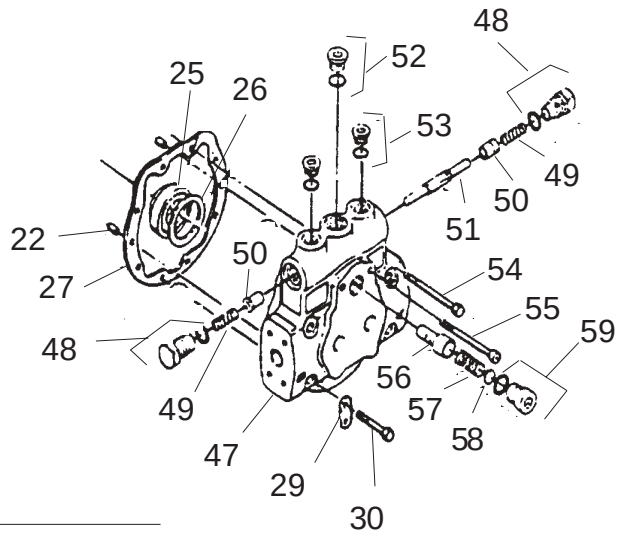
GENERAL NOTES:

1. DO NOT Dis-Assemble anything till everything has been thoroughly cleaned on or around Motor, Connections and Head.
2. Seal All Opening to Hydraulic System when opened to keep Contamination Out, This will include opening in all Fittings, Hoses and Motor.
3. Whenever a Unit is dis-assembled and cleaned lubricate Parts with Clean Lubricant as soon as possible to keep moisture off of them.
4. Always use New Seal to Re-Assemble and lubricate them with Petroleum Jelly (Vaseline).
5. Cleanliness is extremely important when repairing ANY HYDRAULIC Components. The Work Area, Tools and anything that comes in contact with components. Always clean parts in clean Solvent and Blow Dry with filtered moisture free Air is best.

NOTES

MOTOR - PARTS LOCATION

End Cover with Integral Shuttle and Low Pressure Relief Valve (Used on Machete Motor)



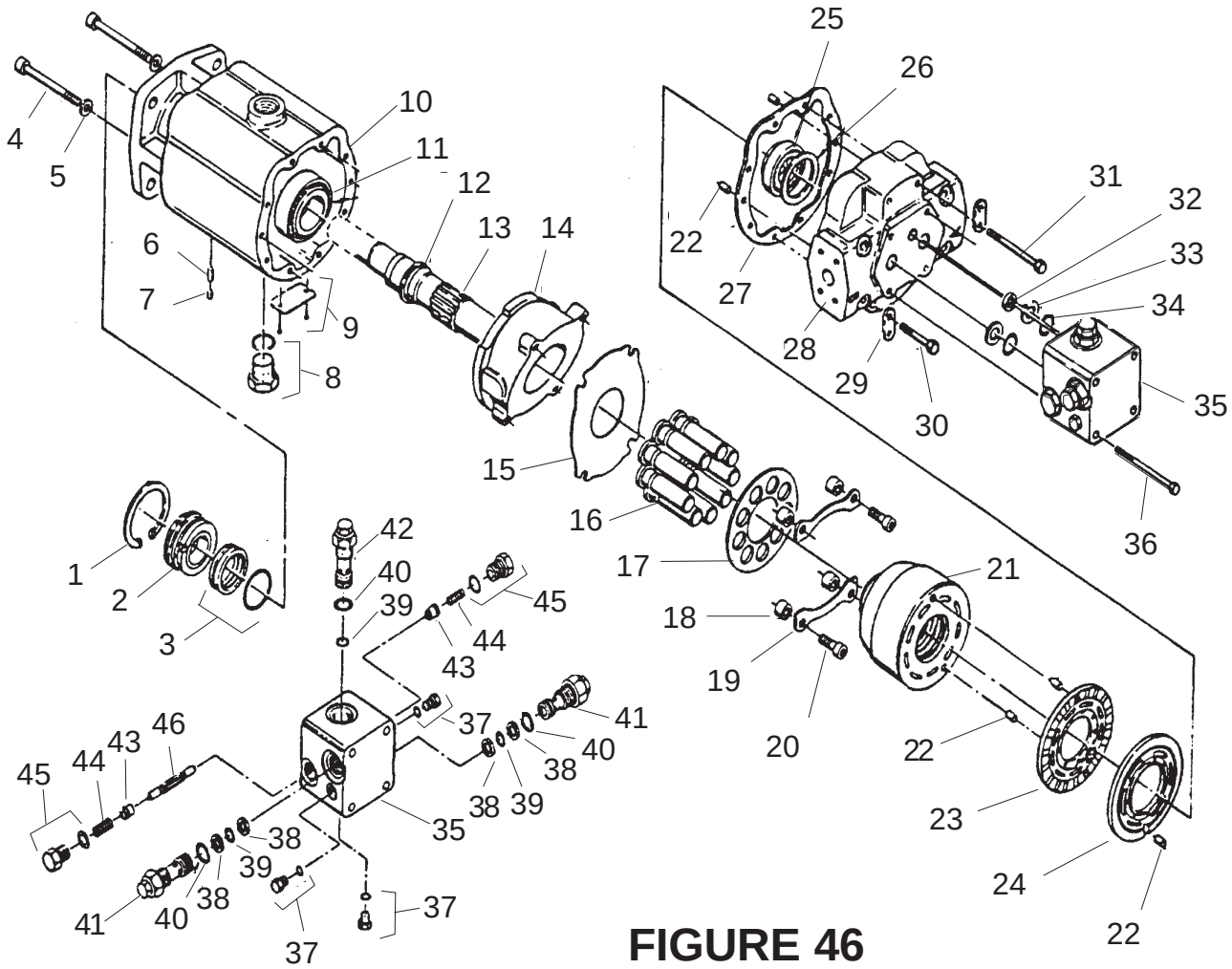


FIGURE 46

MOTOR - PARTS LOCATION

Motor Assembly P/N 02967193

Item	Qty	Description
1.	1	Retaining Ring
2.	1	Stationary Seal
3.	2	Rotating Seal & O-Ring
4.	2	Cap Screw
5.	1	Washer
6.	1	Dowel Pin
7.	1	Plug, Pipe (Socket Head)
8.	1	Case Drain Plug & O-ring
9.	1	ID Tag & Screws
10.	1	Motor Housing
11.	1	Output Shaft Brg. (Cup & Cone)
12.	1	Retaining Pin
13.	1	Motor Drive Shaft
14.	1	Swash Plate
15.	1	Thrust Plate
16.	9	Piston & Slipper Asy.
17.	1	Slipper Retainer Plate
18.	4	Spacer
19.	2	Retaining Strap
20.	4	Cap Screw
21.	1	Cylinder Barrel Asy.
22.	5	Dowel Pin (5/16" X 5/8" Long)
23.	1	Bearing Plate
24.	1	Valve Plate
25.	1	Brg, End Cover (Cup & Cone)
26.	var.	Shim (End Cover Brg Shims)
27.	1	Gasket (End Cover)
28.	1	End Cover (Standard Motor)
29.	2	Lifting Strap
30.	2	Hex Head Bolt
31.	6	Hex Head Bolt
32.	1	Square Cut seal
33.	2	Back-Up Washer
34.	2	O-Ring
35.	1	Valve Block Asy.
36.	4	Hex Head Bolt
37.	3	Gauge Port Plug & O-Ring
38.	4	Back-Up Ring
39.	3	O-Ring
40.	3	O-Ring
41.	2	Relief Cartridge, Hi-Pressure
42.	1	Relief Cartridge, Lo-Pressure
43.	2	Shuttle Valve
44.	2	Shuttle Spring
45.	2	Shuttle Valve Plug & O-Ring
46.	1	Shuttle Spool
47.	1	End Cover w/ Integral Shuttle & Lo-Pressure Relief valve.
48.	2	Shuttle Valve Plug & O-Ring
49.	2	Shuttle Spring
50.	2	Shuttle Valve
51.	1	Shuttle Spool
52.	1	Gauge Port Plug & O-Ring
53.	2	Gauge Port Plug & O-Ring
54.	4	Bolt, Hex Head
55.	2	Bolt, Socket Head
56.	1	Plunger
57.	1	Spring
58.	var.	Shim, Lo-Pressure Relief Valve
59.	1	Lo-Pressure Relief Valve Plug & O-ring

Var. - Shims Vary in Qty, Use as required, Item # 28 & # 47 used one or the other not both.

MOTOR VALVE BLOCK - DIS-ASSEMBLY

VALVE BLOCK / INTEGRAL SHUTTLE REMOVAL:

1. Position the Motor on its mounting Flange as shown in Figure 48. If the Motor has a Integral Shuttle and Low-Pressure Relief see Figure 49, Valve Block see Figure 48 loosen all of the Relief Valve Plugs in the Valve Block. Keep track of how many Shims are removed with each Relief Plug. Remove the four bolts that hold the Integral Shuttle valve or Valve Block to the Motor, Remove the Integral shuttle Valve or Valve Block (See Figure 48 or 49)

2. Removes O-Rings and Back-Up Rings f/ the Motor that is under Valve Block on top of Motor.

3. On Motor with Valve Block (Figure 48) use 1-3/8" Wrench to remove Valve Block Low Pressure and High Pressure Relief Valve Cartridge, The Low Pressure Relief will not have white Back-Up Rings only O-Ring in lower groove. High Pressure Relief Valves will have two white Back-Up Rings and one O-Ring in lower groove, This will help to ID Pressure Relief Valves. Low & High Pressure Relief Settings are Pre-Set at factory, The Stampings of three digit codes on Cartridge identifies setting. 1 St. Digit = 1000 Th., 2 Nd. digit = 100 Th. and 3 rd digit = 10 Th. (example Low Pressure Codes # 061 code = 160 PSI (11 Bar), 022 = 220 PSI (15 Bar), or High Pressure Codes # 500 = 5000 PSI (344 Bar), 400 = 4000 PSI (275 Bar).

On Motor with Integral Shuttle Valve (Figure 49), Unscrew Low Pressure Relief Valve, Note the Shims as you dis-assemble Low-Pressure Relief, Count Shims, as this is how many should be re-installed during re-assembly.

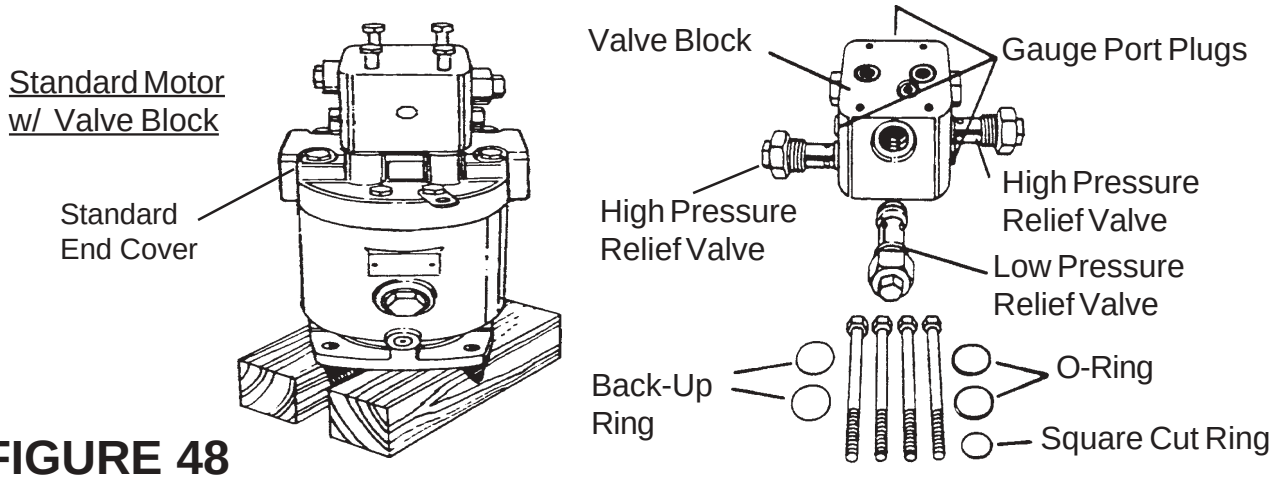


FIGURE 48

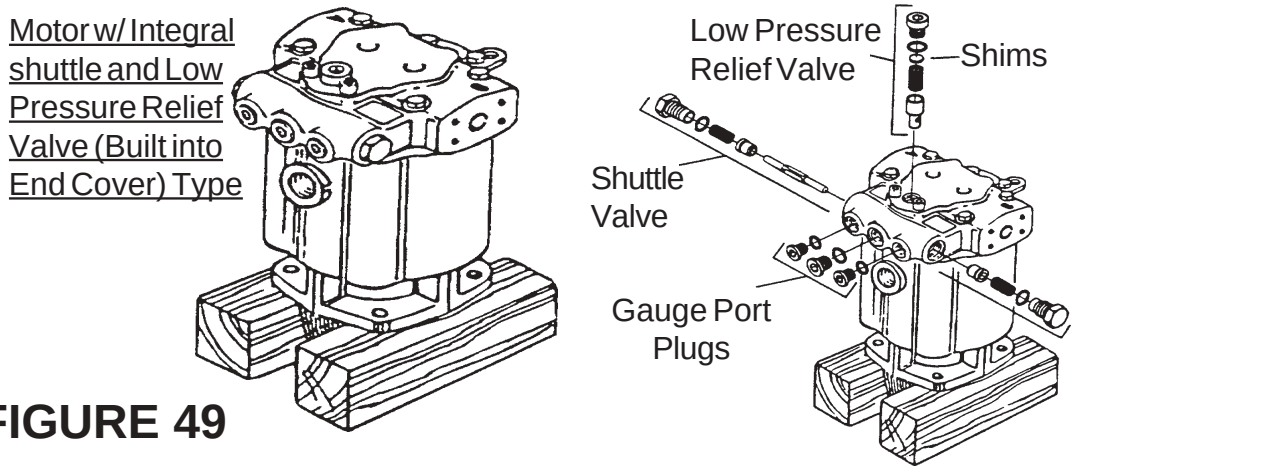


FIGURE 49

MOTOR VALVE BLOCK - DIS-ASSEMBLY

VALVE BLOCK DIS-ASSEMBLY: (On Standard Motor)

1. Use 1" Hex Wrench to remove Shuttle Valve Plugs, The remove Shuttle valve Plugs (Figure 50)
2. Remove Shuttle Valves and Shuttle Spools (Figure 50 & 51)
3. Remove Gage Port Plug Assemblies.

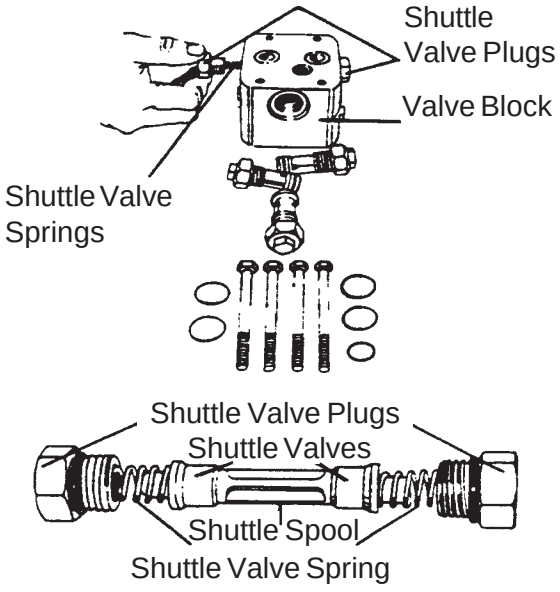


FIGURE 50

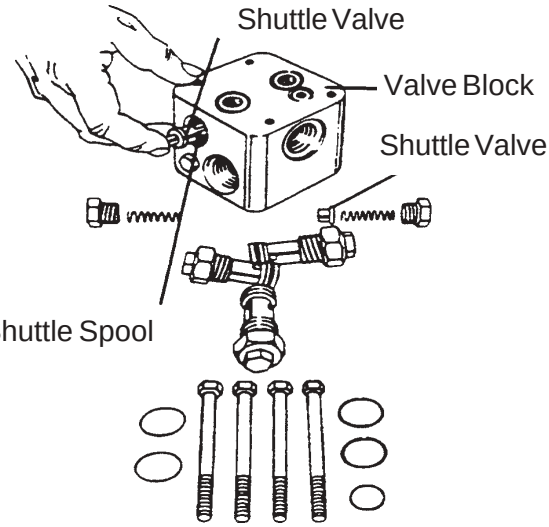


FIGURE 51

VALVE BLOCK RE-ASSEMBLY: (On Standard Motor)

1. Install 3 Gage port Plug Assemblies, Torque Plugs to 16 ft. lbs (22 nm) Figure 52
2. Install Shuttle Spool and Shuttle Valves in Valve Block. Figure 52
3. Install Shuttle valve Plugs and Shuttle Valve Springs. Torque to 68 ft. lbs. (92 nm) Figure 53

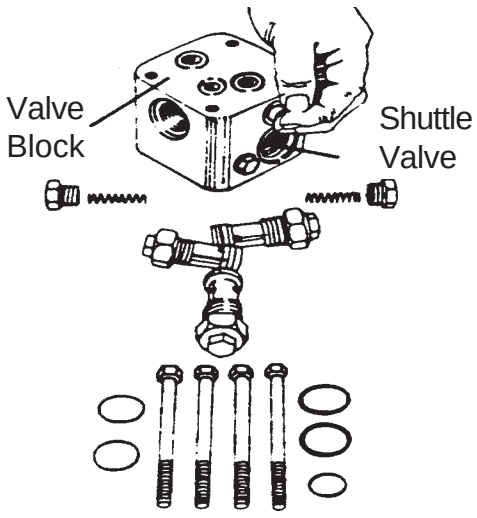


FIGURE 52

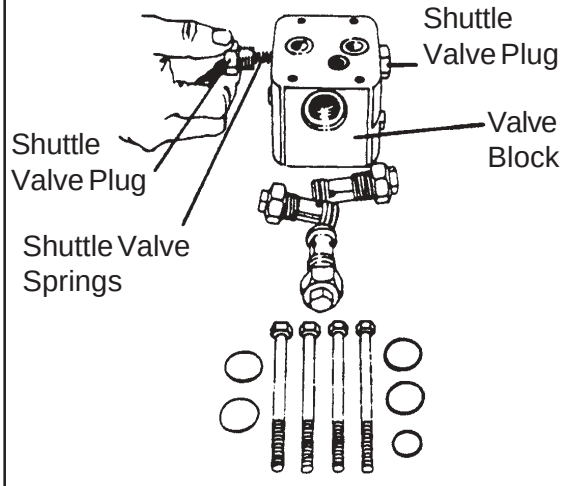


FIGURE 53

MOTOR VALVE BLOCK - RE-ASSEMBLY

4. Install 2 High Pressure Relief Valves as Shown in Figure 54, Torque to 25 ft. lbs. (34 nm)
5. Install Low Pressure Relief Valve as Shown in Figure 55, Torque to 75 ft. lbs. (100 nm).
6. Install Valve Block back on Motor if this all that was being repaired or set it aside for now if more work is being done on motor.

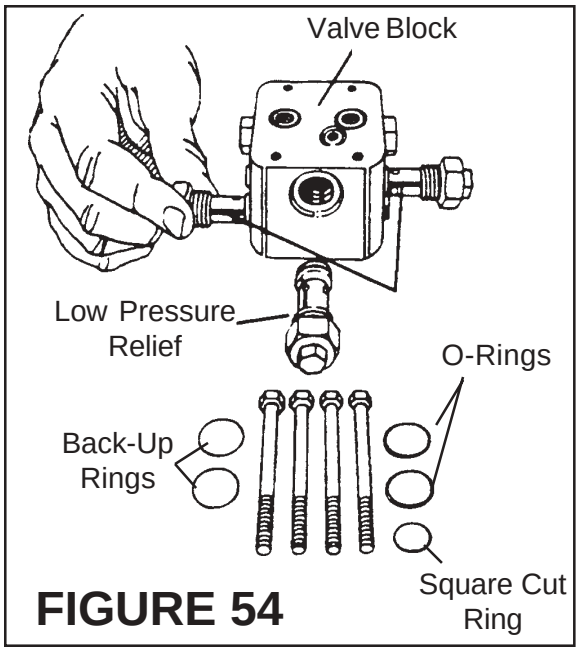


FIGURE 54

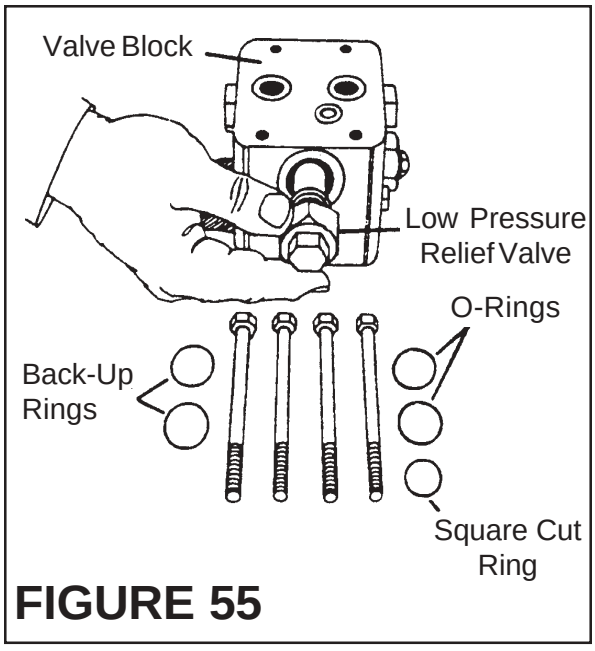


FIGURE 55

INTEGRAL SHUTTLE / LOW PRESSURE RELIEF VALVE (END COVER) RE-ASSEMBLY:
(On Machete Motor) See Figure 56

1. Install Low Pressure Relief Valve Make sure to install the same amount of Shims back into Relief Valve as was removed.
2. Install Shuttle Valves in End Cover
3. Install Gauge Port Plugs
4. DO NOT TIGHTEN ANY of these components at this time unless this is all that is being repair, If so go to Figures 75 and 76 later in this Manual for Torque Settings and more detailed Assembly instructions.
5. See Previous Page Figure 44, 45 and 49 on Dis-Assembly more details on the End Cover.

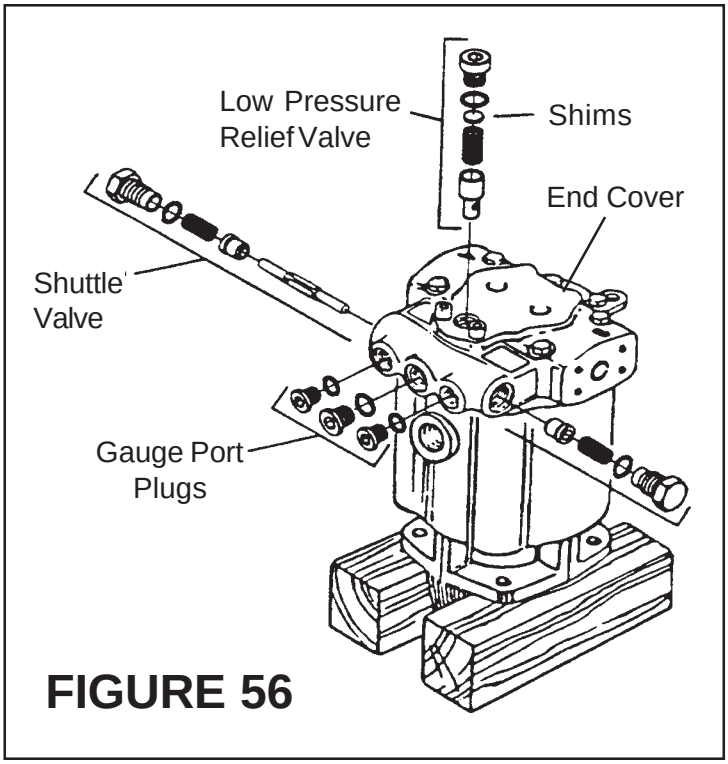


FIGURE 56

MOTOR - DIS-ASSEMBLY

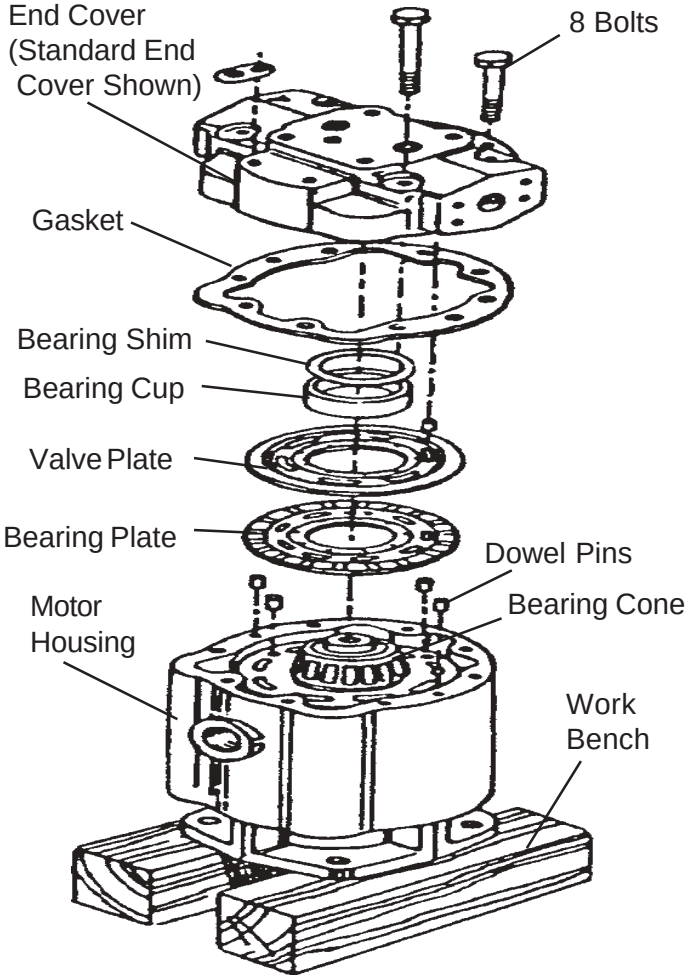


FIGURE 57

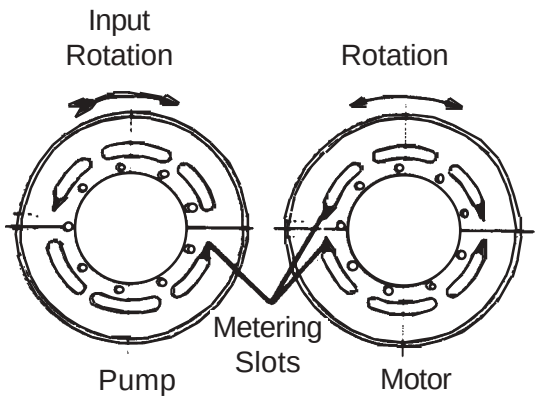


FIGURE 58

VALVE PLATES: Helpful Hint!

Shown above (Figure 58) is Pump and Motor Valve Plates for comparison, Pump Valve Plate (Left) has two Metering Slots and is Directional (Which is Clockwise). The Motor Valve Plate (Right) is bi-directional and has four Metering Slots, (Which allows for Clockwise or Counter Clockwise Rotation). Make sure correct Valve Plate is installed in Motor or Pump. HANDLE VALVE PLATES & BEARING PLATES with extreme care. Both Plates are lapped to extremely close tolerances for flatness.

END COVER DIS-ASSEMBLY: (Figure 57)
(On Standard Motor or Integral Shuttle & Low Pressure Relief Valve End Cover)

1. There are two different End Covers for this Motor, The Same procedure to remove the either the Standard End Cover or Integral Shuttle with Low Pressure Relief Valve End Cover from the Motor is the same. Check which one you have, See Figure 57 or Figure 56.
2. Remove 6 of the 8 Hex Bolts from End Cover (leave 1 tight at each end of cover), USE CAUTION, Internal Parts are Spring Loaded. To avoid internal Part Damage Slowly (Alternately) from one bolt to the other loosen the remaining 2 Bolts, Holding Pressure down on End Cover Slowly remove the other 2 bolts. KEEP PRESSURE on End Cover.
3. With pressure on End Cover start to release pressure and End Cover should start to rise, If it doesn't rise, Keep your hand on it and tap it with a hammer lightly to loosen it up from housing. Let End Cover rise till there is no Pressure pushing up. Remove End Cover.
4. Carefully remove Gasket and two End Cover Dowel Pins, DON'T drop any parts (See Valve Plate Above Comment), Valve Plate, Bearing Cup or Shims which May or May Not stick to End Cover.

Motor Dis-Assembly:

GENERAL RULES:

1. DO NOT Dis-Assemble anything till everything has been thoroughly cleaned.
2. Cleanliness is extremely important when repairing ANY HYDRAULIC Components. The Work Area, Tools and anything that comes in contact with components. Always clean parts in clean Solvent and Blow Dry with filtered moisture free Air is best. (DO NOT SPIN BEARINGS WITH COMPRESSED AIR WHILE CLEANING)
3. All Torque specifications are for Clean (Good Un-Damaged) threads. Bolts for Gasketed Surfaces should be re-torqued a second time.
4. Replace All Seal with new ones whenever unit is dis-assembled; always lubricate Seals (except metal sealing surfaces of Shaft Seal Assembly) with Petroleum Jelly (Vaseline), Use only clean recommended Oil when Re Assembling Motor.

SHAFT SEAL REMOVAL: (See Figure 47)

1. Use a Pair of Retaining Ring Pliers to remove Retaining Ring (Figure 47).
2. Insert Stationary Seal Puller into threaded hole of Stationary Seal Assembly to pull Seal Assembly from Output Shaft (Figure 47).
3. Use Rotating Seal Puller (Owatonna Tool Company Tool No. CAS 1844) to grip outside diameter of Bronze Rotting Seal, Remove Seal from Output Shaft.
4. O-Ring may remain in Rotating Seal Recess, If O-Ring is not found in Recess, Remove O-Ring from main Motor Shaft. You don't want this O-Ring left un-accounted for as this could cause a problem during re-assembly later.

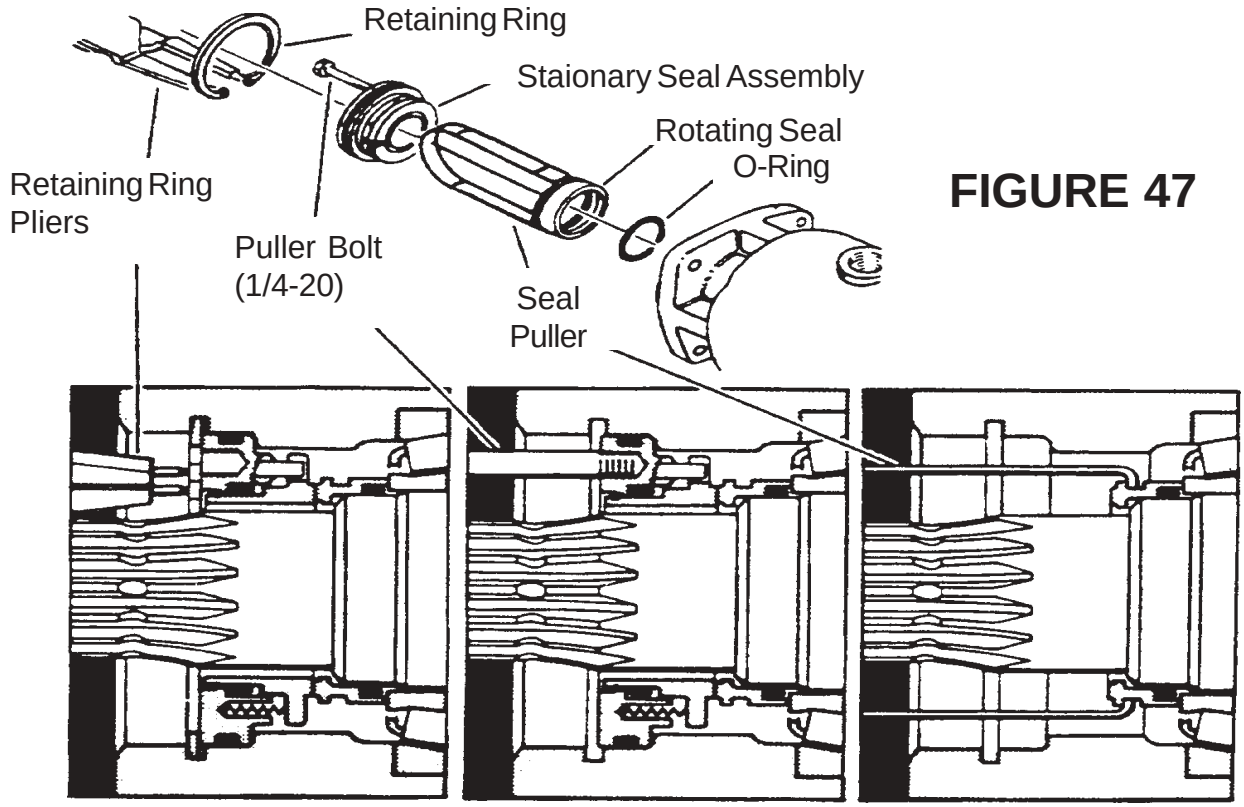


FIGURE 47

MOTOR - DIS-ASSEMBLY

BEARING CONE, OUTPUT SHAFT, CYLINDER BARREL & SWASH PLATE DIS-ASY:

1. Use of Low Clearance Bearing Puller is recommended for removal of end Cover Bearing Cone (Figure 59). The Bearing Puller pulls against Bearing Rollers, Not against Inner Race. It is designed to prevent Bearing Cone and Cylinder Barrel Face from being damaged, Close clearance between End Cover Bearing and Cylinder Barrel makes it difficult to use any other type Bearing Puller (See Recommended Tool List in previous pages of Motor Section for Bearing Puller information).

2. Use Lint free Cloth (or other Lint free Material) as a cover to prevent contamination from getting in while removing Bearing.

3. Install Bearing Puller and remove Bearing Cone from Output Shaft (Figure 59)

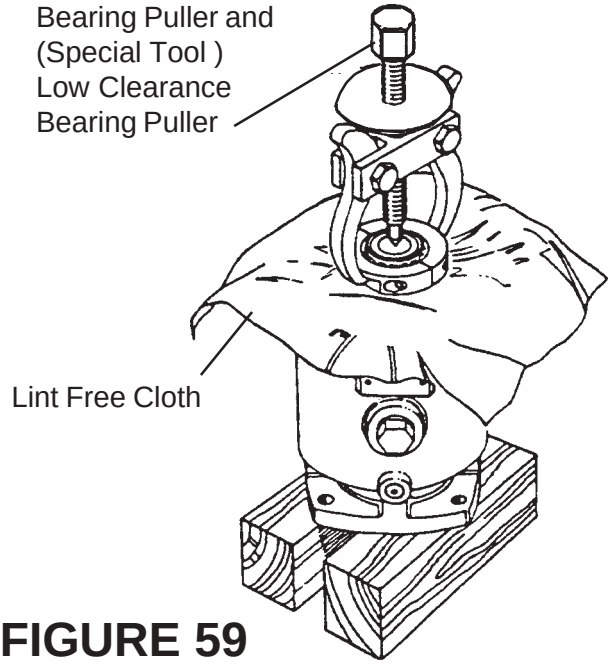


FIGURE 59

4. Carefully reposition Motor on its side (Figure 60). Using 1/4" Hex Bit Socket, Remove the two Cap Screws that retain Swash Plate in Housing. Remove and discard the Washers on these Cap Screws, DO NOT reuse them. Always use new Washers.

5. Push Output shaft Assembly inward to dislodge Swash Plate from its Pocket in Housing.

6. Carefully remove Cylinder Barrel Assembly in the Up position, Remove Output Shaft Assembly (Figure 61)

7. When Output Shaft Bearing Cone must be replaced, Use a Press to remove Cone from Shaft. You Must use Special Stop Limit Tool when installing new Bearing Cone on Output Shaft.

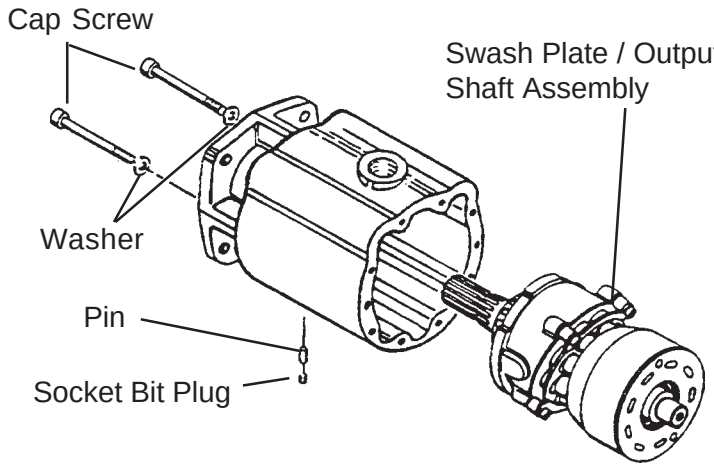


FIGURE 60

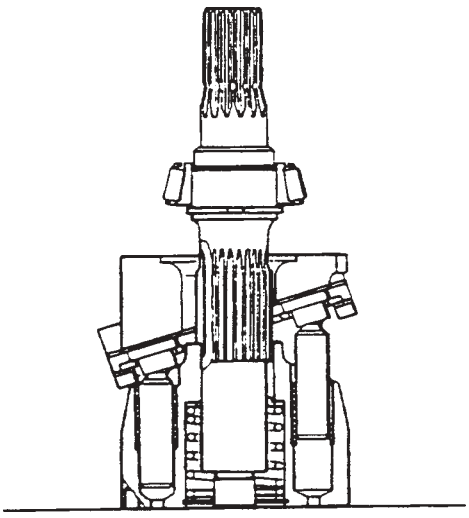


FIGURE 61

MOTOR - DIS-ASSEMBLY

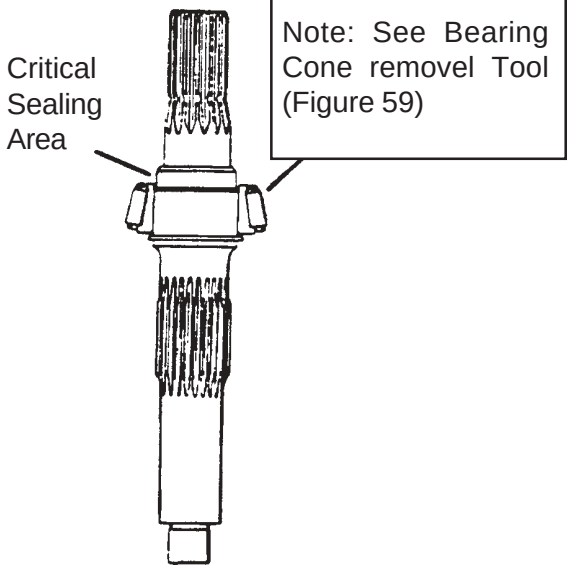


FIGURE 62

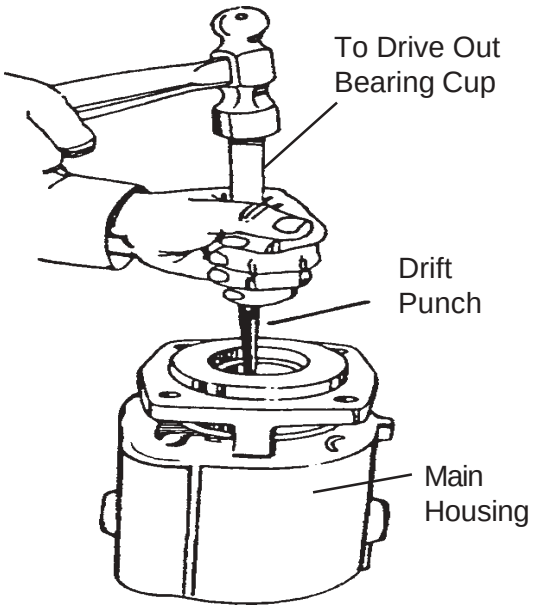


FIGURE 63

8. When removing or installing Bearing Cone, DO NOT damage Output Shaft Sealing area (Stepped area between Bearing Journal and Output Shaft Splines) This area is critical for sealing Output Shaft Seal (Figure 62).

9. Use suitable Bearing Puller or Punch to remove Bearing Cup from Main Housing (Figure 63)

10. Reposition Cylinder Barrel and Swash Plate so that Swash Plate is in down position. Use 1/4" Hex Key to remove Cap Screws from retaining straps on one side of Swash Plate. Loosen Cap Screws on other Retaining Strap; this will make it easier to remove Cylinder Barrel from Swash Plate (Figure 64)

11. Carefully reposition Cylinder Barrel and Swash plate in the Up position. Remove Swash Plate by lifting it slightly and sliding it over to dis-engage from retaining Strap.

12. Remove Cap Screws, retaining Strap, Spacers and Thrust Plate from Swash Plate (Figure 64).

13. Dis-Assemble Cylinder Barrel Assembly; Place it on a clean protective surface for inspection and cleaning.

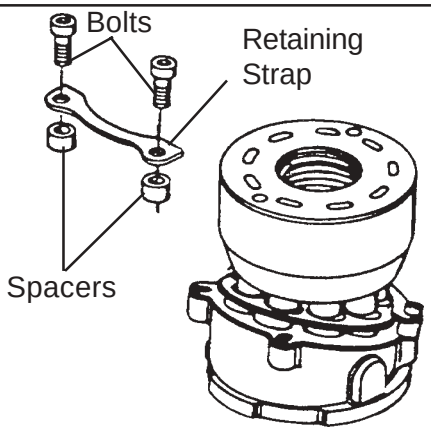


FIGURE 63

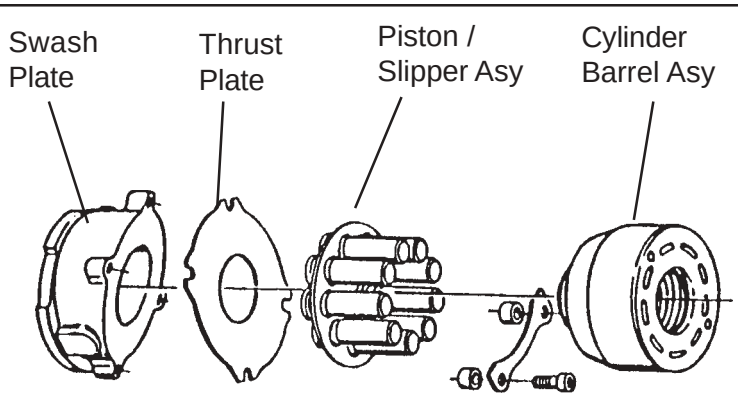


FIGURE 64

MOTOR - RE-ASSEMBLY

ROTATING GROUP RE-ASSEMBLY:

1. Before re-assembly of Fixed Displacement (Fixed Clearance) Motor, Clean all Parts and Assemblies in clean Solvent and Blow Dry with compressed Air. Inspect and Replace all Scratched or Damaged Parts. When Re-Working Parts DO NOT use Coarse Grit Paper, Files or Grinders on Parts.
2. Assembly Preparations that need to be done prior to Assembly, This will provide start up lubrication to Motor.
   A. Lubricate O-Ring with Petroleum Jelly (Vaseline) for retention during Assembly.
   B. Freely Lubricate all Bearings and finished Parts surfaces with Clean Hydraulic Oil.
3. Fixed clearance of Piston Slipper Flange and Slipper Retaining Plate (See Figure 66), **A.** Measure distance between the bottom of Retainer Strap to top of Thrust Plate this is the height of Spacer. **B.** Measure distance from top of Slipper Retainer Flange to top of Thrust Plate. **C.** Measure the distance between bottom of Retaining Strap and the top of Slipper Retainer Strap. You can also get this by subtracting distance in B from distance in A. Fixed Clearance MUST NOT exceed .008" (.20 mm). If fixed displacement exceeds this measurement replace worn parts. Example, (A.) Spacer Height - (B) Top of Slipper Retainer Plate to Top of Thrust Plate = (C.) Fixed Clearance not to exceed .008" (.20 mm)

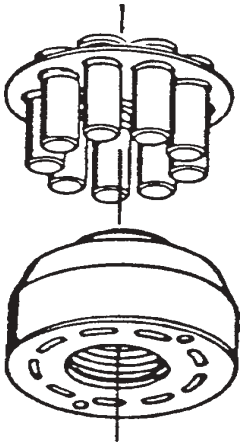


FIGURE 65

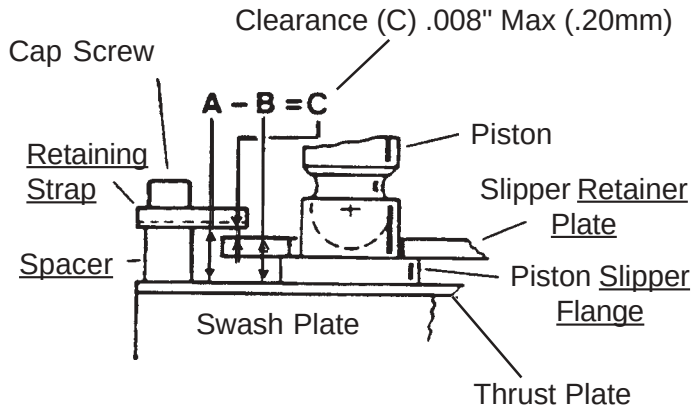


FIGURE 66

4. Lubricate and install Slipper Retainer Plate and Piston Slippers in Cylinder Barrel Assembly. After installation, Freely lubricate Brass Slipper Faces with Clean Hydraulic Fluid.
5. Before assembling Motor any further, You MUST check Fixed Clearance of Unit as shown in Figure 66, Do this by measuring Height of Retaining Strap Spacer with a Micrometer or Vernier Calipers. Spacers are critical to the unit design and may not be adjusted.

BEARING CONE / OUTPUT SHAFT ASY. & CYLINDER BARREL & SWASH PLATE RE-ASSEMBLY:

1. After checking fixed clearance, continue with assembly of Cylinder Barrel Swash Plate, Apply 1 or 2 drops of Loctite (No. 271 or equal) in first and second thread in each of the four holes (Figure 67). **CAUTION:** Loctited parts must contact only those surfaces intended for assembly, Wipe any excess Loctite from Swash plate with Non-Petroleum Base Solvent applied to a Lint free Cloth. DO NOT apply Loctite to threads more than 15 minutes before installing Cap Screws, If Locktite stands for more than 15 minutes, Repeat Loctite application (It will not be necessary to remove previously applied Loctite.
2. Lightly lubricate and then install Thrust Plate, Aligning Cap Screw Holes, Install Spacers, retaining strap and Cap Screws on one side of the Swash Plate. DO NOT tighten Cap screws at this time. (Figure 68)

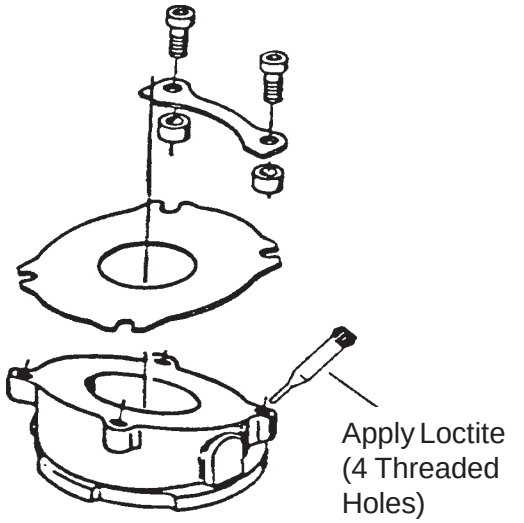


FIGURE 67

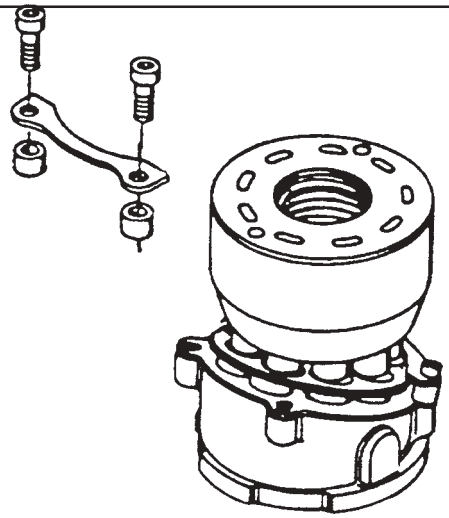


FIGURE 68

3. Place Cylinder Barrel Assembly on Clean, Flat Surface with Piston Slippers pointing upward, Carefully install Swash Plate on Cylinder Barrel by slightly lifting side without Retaining Strap. Slide Swash Plate over to engage installed Retaining Strap. Slide Swash plate over to engage installed Strap around Piston retainer.
4. Carefully reposition Cylinder Barrel and Swash Plate with Swash Plate in down position. Install remaining Spacers, Retaining Strap and Cap Screws in Swash Plate (remember Loctite Rule in Step 1). Tighten all four Cap Screws 16 to 19 ft. lbs. (22 to 26 nm)
5. An alternate method of checking fixed clearance is using a Feeler Gauge. If using this method, make sure Gauge is inserted between Retaining Strap and Slipper Retainer Plate Only. Piston Slipper faces could be damaged if Gauge is inserted between Piston Slippers and Thrust Plate.
6. Carefully reposition Cylinder Barrel Assembly and Swash Plate so that Cylinder Barrel Face is on Clean Flat Surface. Lubricate and install Output Shaft Sub-Assembly (Figure 62) in Barrel Sub-Assembly (Figure 68).

MOTOR - RE-ASSEMBLY

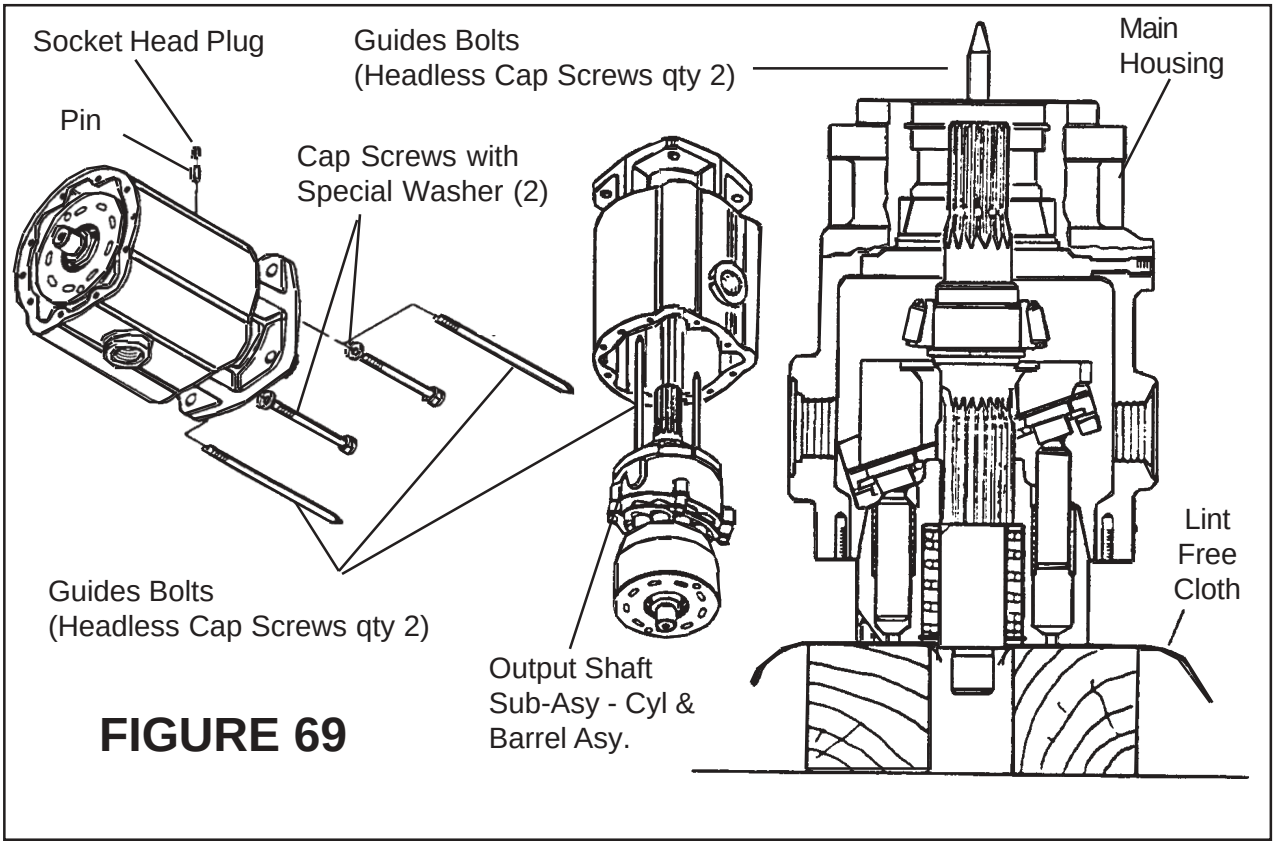


FIGURE 69

MAIN HOUSING RE-ASSEMBLY: (Figure 69)

1. Install two headless 5/16" Cap Screws (5 to 6") Long in Swash Plate. These Cap Screws can be made by sawing off Head and Grinding end to a smooth semi-blunt point. These Cap Screws will Guide Swash Plate into Pocket of Main Housing. These Headless Bolts are for assembly use only.
2. When installing Cylinder Barrel and Swash Plate into Housing, Align Dowel Pin in with notch in Swash Plate.
3. Carefully slide Housing over Output Shaft Sub-Assembly, Swash Plate and Cylinder Barrel Assembly.
4. Carefully Holding Cylinder Barrel Assembly in position in Housing, Reposition Motor on its side and remove the Headless Cap Screw and replace them with the retaining Cap Screw with NEW Special Washers on them, Do this by removing ONE Headless Cap Screw and replacing it then the other. ONLY snug the two cap Screws.
5. Tighten the two Cap Screws in increments alternating from one to the other till they are torqued to 20 to 24 ft. lbs. (27 to 33 nm).
6. After Assembly keep this Component covered to keep Dust or other Contaminates out.

MOTOR - RE-ASSEMBLY

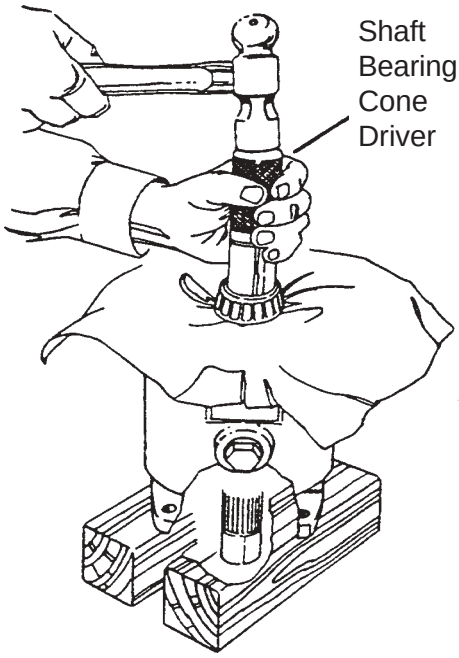


FIGURE 70

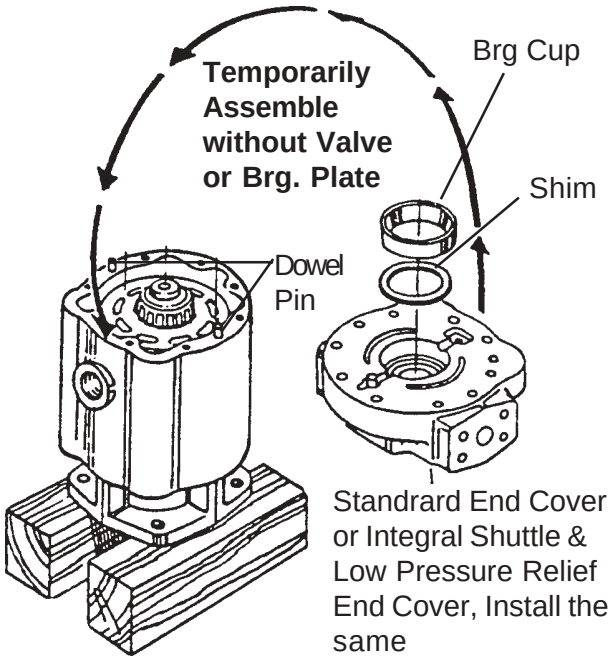


FIGURE 71

END COVER & END COVER BEARING RE-ASSEMBLY:

1. Position and support Motor on Mounting Flange as shown in Figure 71, Support the Output Shaft in a slightly raised position. Use a Press or Bearing driver and install Bearing Cone onto Output Shaft as shown in Figure 70. Bearing Cone MUST seat against shoulder of Output Shaft. REMEMBER: Do not install Bearing Cone unless Output Shaft is supported on Bottom.
2. Install two Dowel Pins in Main Housing and Install Gasket on End Cover (Figure 71)
3. Lubricate and install Bearing Cup Shims and Bearing Cup into End Cover, Be sure Bearing Cup and Shims are seated completely in End Cover (Figure 71)
4. Check Output Shaft Sub-Assembly endplay by installing End Cover without installing either Valve or Bearing Plates. This removes Cylinder Barrels tension against Output Shaft.
5. Install Cap Screws in End Cover and slowly and evenly tighten them. Torque Cap Screws to 39 ft lbs.
6. Place and support Motor Assembly on End Cover, Gently tap Output Shaft inward with Hammer.
7. Install Magnetic Base Indicator on Mounting Flange with Gauge on Output Shaft end (Figure 72). Use Pliers to grip Output Shaft as low as possible. Pry Upward to determine Shaft EndPlay. Indicator must read .002" to .007" (.05 to .17 mm) Shaft endplay. If endplay is incorrect, adjust by adding or removing Shims under Bearing Cup in End Cover.
8. After adjusting endplay, Reposition Motor on mounting flange, remove End Cover (Figure 73)
9. Install two Dowel Pins in face of Cylinder Barrel Sub-Assembly, Freely lubricated Bearing Plate with clean Hydraulic Fluid, Align Bearing Plate with Dowel Pins (Figure 73) and install it on Cylinder Barrel Assembly
10. Install Valve Plate Dowel Pins in face of End Cover. Using Petroleum Jelly, Lightly coat side of Valve Plate facing End Cover. This will retain plate during Assembly. Install Valve Plate over Bearing Cup, Aligning it with Dowel pins, Valve Parts must rest flat and be flush with End Cover.

MOTOR - RE-ASSEMBLY

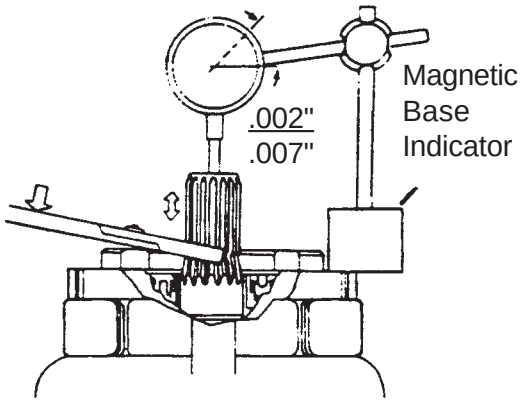


FIGURE 72

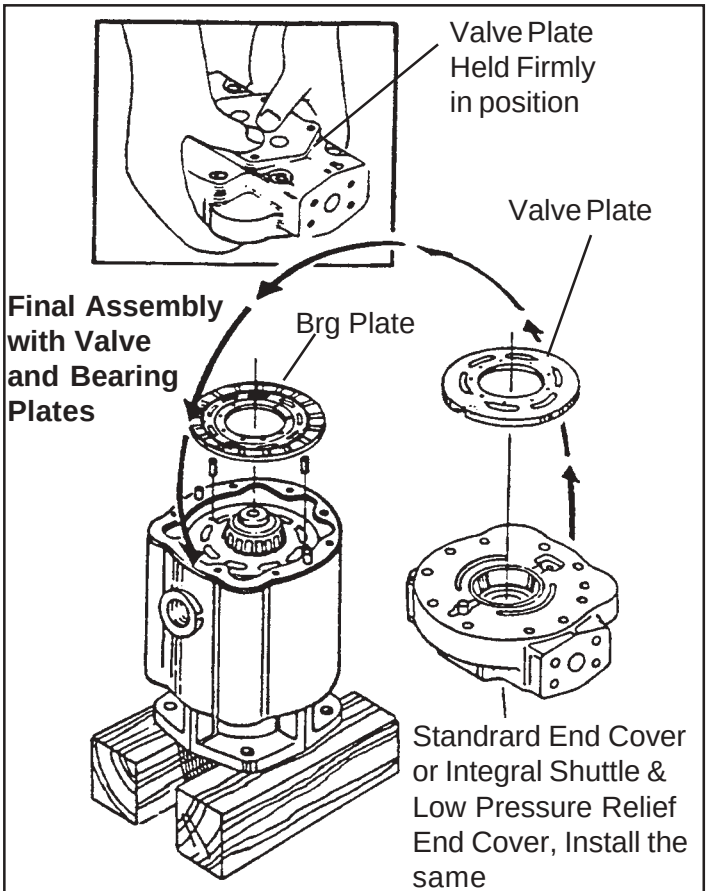


FIGURE 73

11. Hold Valve Plate firmly in position. Install End Cover on Housing. (Figure 73)
12. Install Cap Screws in End Cover, Slowly and evenly in a star pattern tighten them. Torque Cap Screws to 39 ft. lbs. Then a second time go back and recheck Torque making sure they are 39 ft. lbs. (53 nm) using the star pattern.
13. IMPORTANT: Get the New Shaft Seal. The New Shaft Seal is coated with a Rust Preventative that MUST be removed before installation. Clean the Seal Parts with a suitable solvent then Blow Dry. The Metal to Metal Sealing Surfaces are CRITICAL; The Solvent MUST EVAPORATE without leaving a residue. DO NOT touch the Sealing surfaces after cleaning.
14. Lubricate Inner O-Ring of Rotating Seal. Then install Rotating Seal with Seal Puller (Owatonna Tool Co. No. CAS-1844). Ensure that Rotating Seal O-Ring is placed inside the Rotating Seal before assembling onto the Drive Shaft.

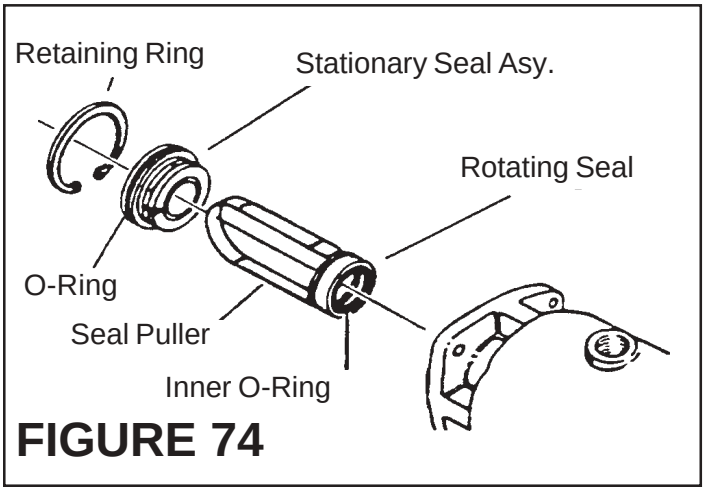


FIGURE 74

15. Lubricate O-Ring Seal of Stationary Seal assembly (Figure 74). Then install Stationary Seal Assembly .
16. Use a No. 5 or No. 7 retaining Ring Pliers to install Retaining Ring, Be Sure to install Retaining Ring with Beveled Side Out.

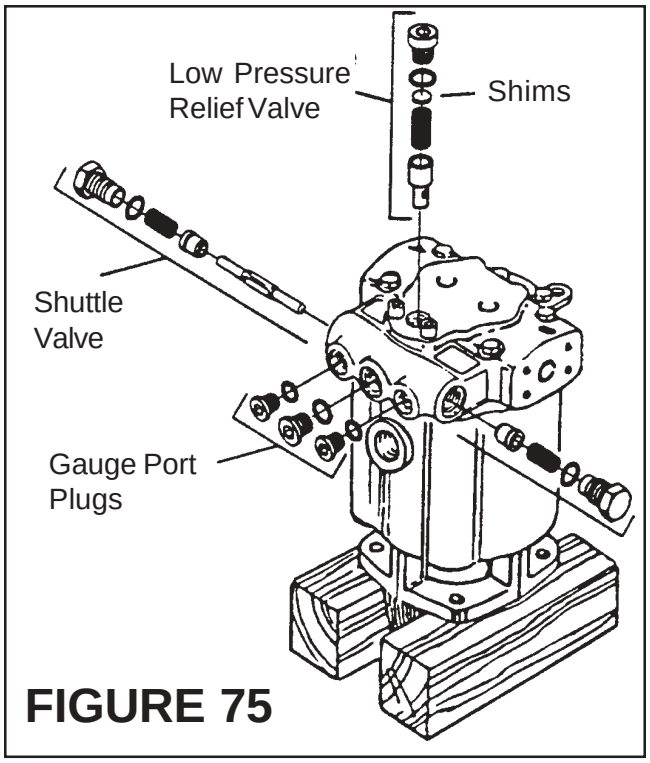


FIGURE 75

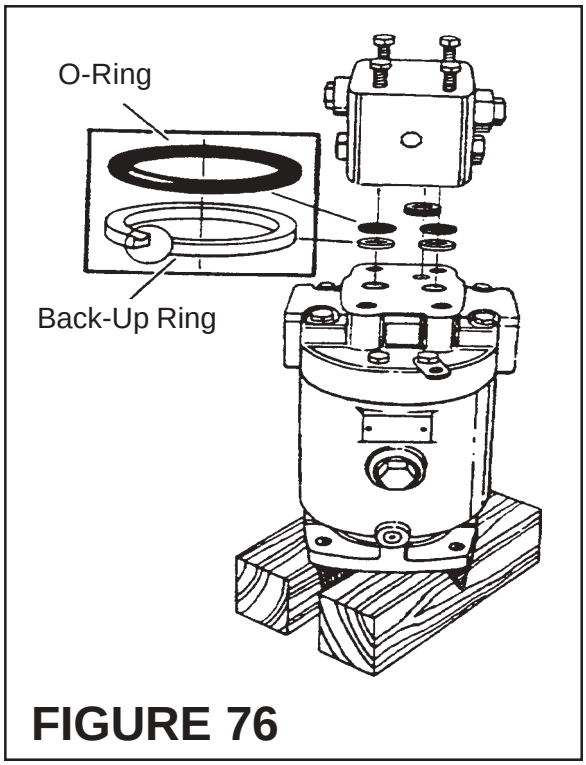


FIGURE 76

INTEGRAL SHUTTLE AND LOW PRESSURE RELIEF VALVE INSTALLATION: (Figure 75)

1. If you have not assembled this yet (See Figure 56 on previous Pages) assemble Shuttle Valve and Low Pressure Relief Valve now, See Figure 75.
2. Install the Gauge Port Plug Assemblies, The two outer Ports have smaller plugs. Torque all three plugs 25 to 31 ft. lbs. (18 to 23 nm).
3. Lubricate and install the Shuttle Spool, (Figure 75) it slides into hole between Shuttle Valve Plugs into the End Cover. Make sure the Shuttle valves are installed correctly, With the smaller ends facing the center of the Spool.
4. Install the Shuttle Valve Springs and Plugs (Figure 75). Torque Plugs 68 to 82 ft. lbs. (92 nm).
5. Install the Low Pressure Relief Valve Plunger and Spring. Lubricate and insert the Shims in the relief Valve Plug, Remember use same amount of Shims that was taken out. Install New (Lubricated) O-Ring on Plug, Install Plug over Spring making sure the Shims are not dislodged. Screw the Plug in and Torque it 68 to 82 ft. lbs. (92 nm).

VALVE BLOCK INSTALLATION: (Figure 75)

1. Valve Block should already be Assembled (See Figures 52, 53, 54 and 55 on previous pages).
2. Install O-Rings and Back-Up Rings on the Valve Block, The High Pressure Ports require an O-Ring and Back-Up Ring. The O-Ring goes on first, then the Back-Up Ring as shown in Figure 76. Install the Square Cut Ring in Low Pressure Port of Valve Block. Note: DO NOT damage O-Rings and Back-Up Rings. Use clean Petroleum Jelly to hold O-Rings in place during block Installation.
3. Install Valve Block on End Cover, install four Hex Hex Bolts, and Torque them 28 ft. lbs. (38 nm)
4. There is a Valve Block Seal Kit # 02972094 that will included these O-Rings and Back-Up Rings in it, These need to be replaced any time the Motor is removed.

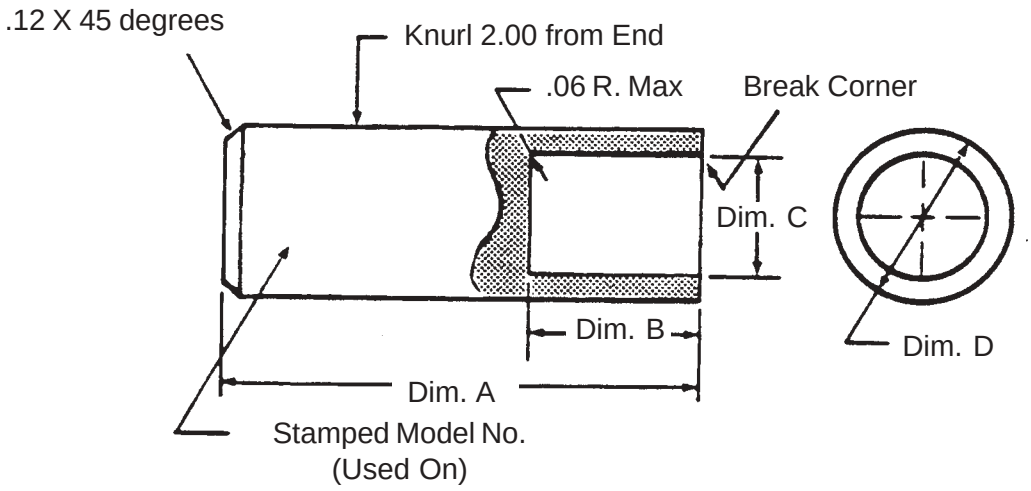
MOTOR - TORQUE SPECIFICATIONS

TORQUE SUMMARY SPECIFICATIONS:

Component Where Used	Model (C.I.D) 3.3, 3.9, 4.6 C.I.D.	5.4, 6.4 C.I.D.
End Cover Bolts	39 ft. lbs. (53 nm)	63 ft. lbs. (85 nm)
Gauge Port Plugs	25 ft. lbs. (34 nm)	25 ft. lbs. (34 nm)
Relief Valve, (Low-Pressure)	75 ft. lbs. (100 nm)	75 ft. lbs. (100 nm)
Relief Valve, (High Pressure)	25 ft. lbs. (34 nm)	25 ft. lbs. (34 nm)
Relief Valve, (Feathering)	25 ft. lbs. (34 nm)	25 ft. lbs. (34 nm)
Shuttle Valve Cap	68 ft. lbs. (92 nm)	68 ft. lbs. (92 nm)
Socket Pipe Plug	16 ft. lbs. (22 nm)	16 ft. lbs. (22 nm)
Swash Plate Cap Screws	24 ft. lbs. (32 nm)	24 ft. lbs. (32 nm)
Swash Plate Retaining Strap	19 ft. lbs. (26 nm)	26 ft. lbs. (26 nm)
Valve Block Mountin Bolts	28 ft. lbs. (38 nm)	28 ft. lbs. (38 nm)

MOTOR - TOOL DESCRIPTION

SHAFT BEARING CONE DRIVER
(End Cover End)

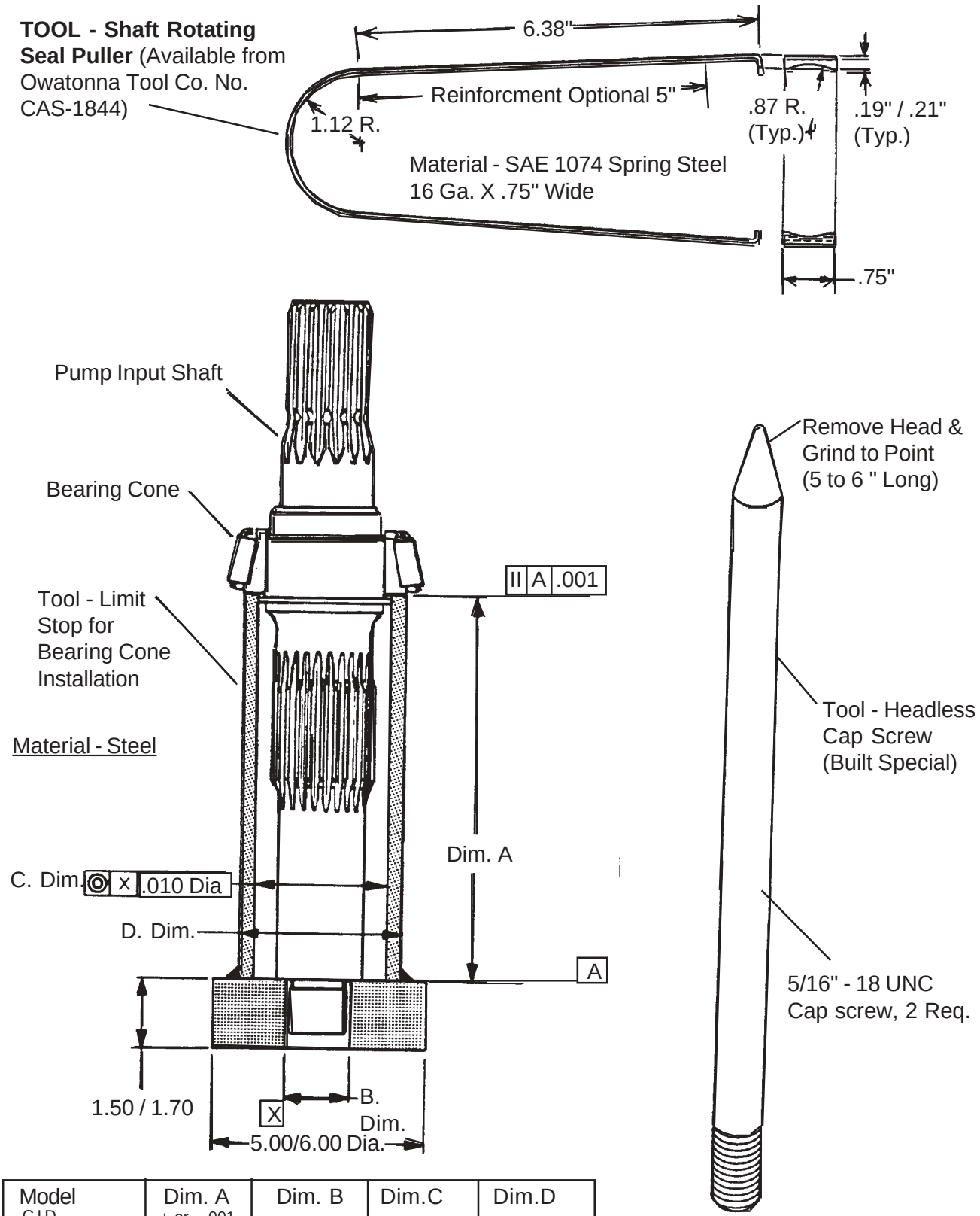


Material C.R.S. Harden to Rc 50 - 55

Model (C.I.D)	Dim. A	Dim. B	Dim. C	Dim. D
3.3, 3.9, 4.6	4.0	1.5	1.01	1.25
5.4, 6.4	4.0	1.5	1.30	1.48

FIGURE 77

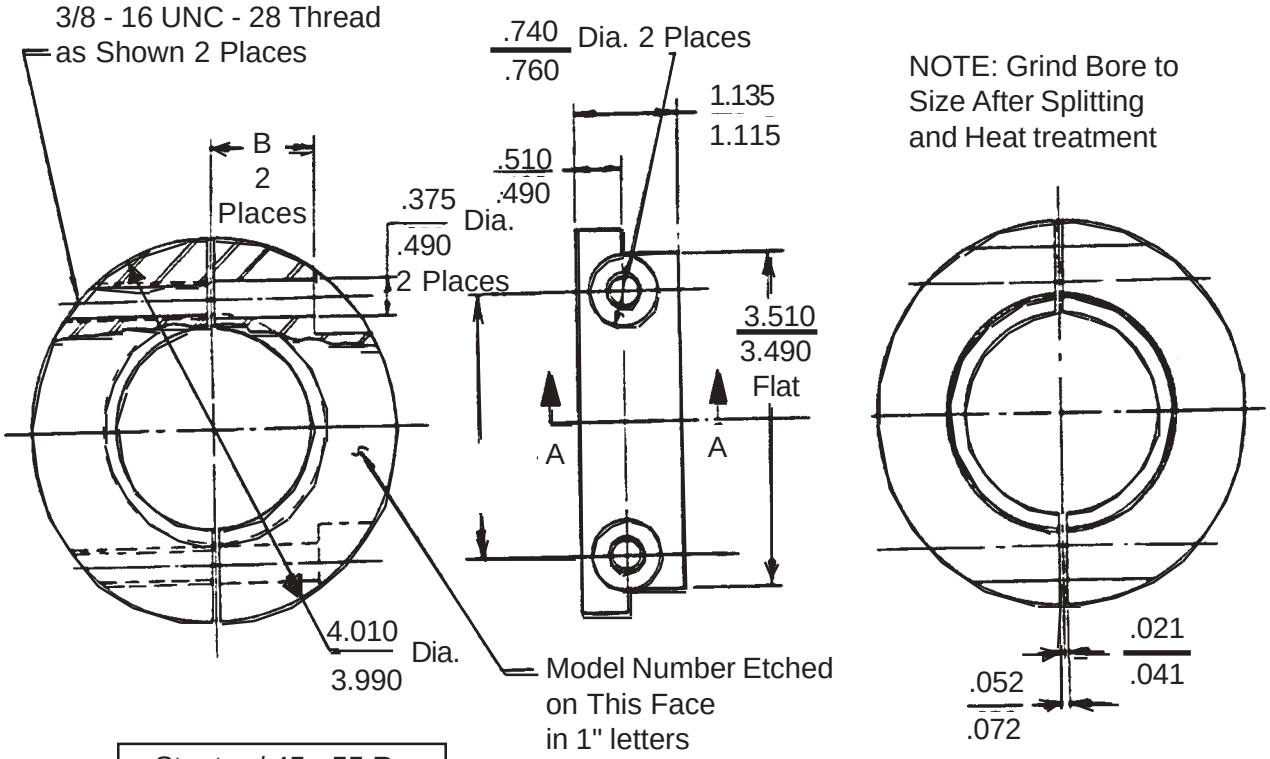
MOTOR - TOOL DESCRIPTION



Model C.I.D.	Dim. A + or - .001	Dim. B	Dim.C	Dim.D
3.3, 3.9, 4.6	5.803	1.00/1.20	2.20/2.30	3.00 Min.
5.4, 6.4	6.682	1.30/1.32	2.25/2.35	3.00 Min.

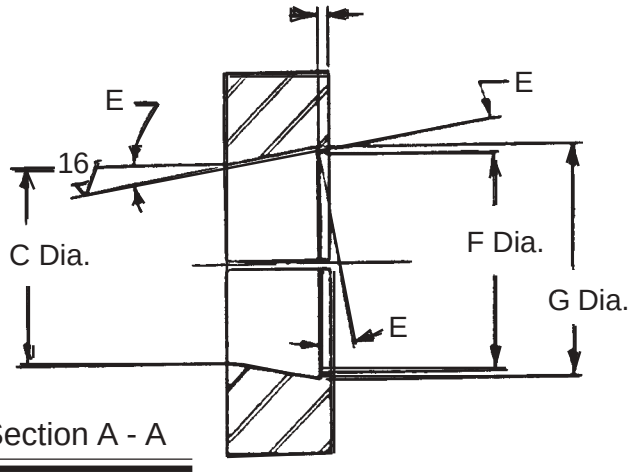
FIGURE 78

LOW CLEARANCE BEARING PULLER



Stenter / 45 - 55 Rc
Cone Bearing Puller

	Displacement Cu. in. / Rev	
	3.3, 3.9, 4.5	5.4, 6,4
B	1.050 / 1.070	1.115 / 1.135
C	1.565 ref.	1.603 ref.
D	.135 / .129	.141 / .135
E	13 deg.	20 deg.
F	1.907 / 1.913	2.223 / 2.229
G	2.020 / 2.026	2.318 / 2.324
H	2.622 / 2.628	2.747 / 2.753



Section A - A

FIGURE 79

NOTES

Section 7

BRAHMA

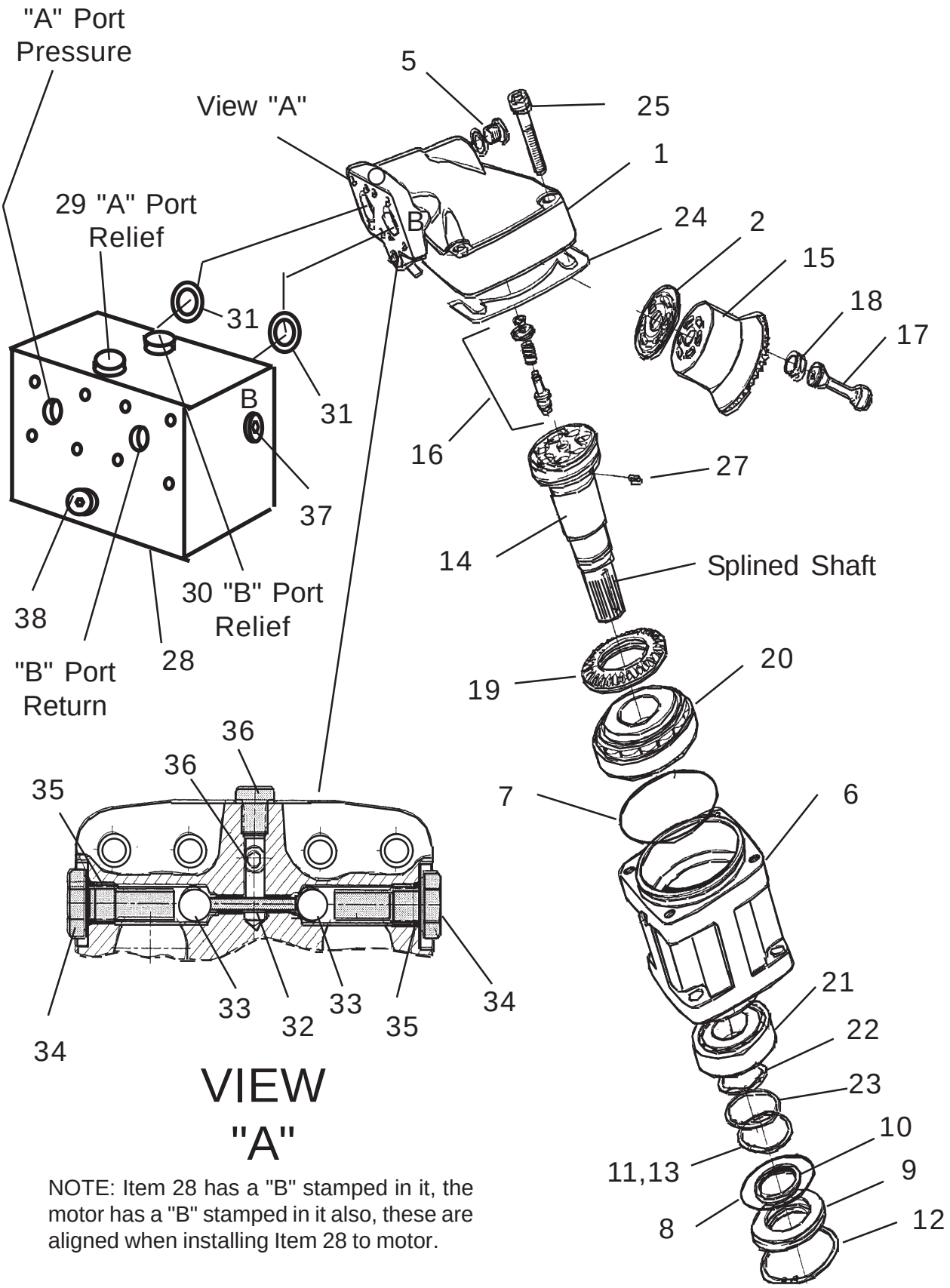
Motor Circuit Section
Rotary Mower Head
(New Style)

MOTOR P/N 02979881 (Rotary)

Parts Location & Service Instructions

This Section is for Motor Asy P/N 02979881

MOTOR P/N 02979881 - PARTS LOCATION



NOTE: Item 28 has a "B" stamped in it, the motor has a "B" stamped in it also, these are aligned when installing Item 28 to motor.

MOTOR P/N 02979881 - PARTS LOCATION

Rotary Head

Item	Part No.	Qty	Description
	02979881	-	Motor Asy
1.	02980529	1	Barrel Housing Asy.
2.	02980530	1	Vlalve Plate (*)
4.	02980536	1	Nozzle
5.	02980537	1	Plug Asy. Hexagon
6.	02980538	1	Bearing Housing
7.	02980539	1	O-Ring (*) (**)
8.	02980540	1	O-Ring(*) (**)
9.	02980541	1	Seal Carrier
10.	02980542	1	Shaft Seal (*) (**)
11.	02980543	1	Spacer Washer
12.	02980544	1	Retaining Ring
13.	02980545	1	Retaining Ring
14.	02980546	1	Shaft Asy
15.	02980548	1	Cylinder Barrel (*)
16.	02980549	1	Barrel Support
17.	02980550	7	Piston Asy. (*)
18.	02980551	21	Piston Ring
19.	02980552	1	Ring Gear
20.	02980553	1	Bearing, Roller
21.	02980554	1	Bearing, Roller
22.	02980555	a/r	Spacer Washer
23.	02980556	1	Retaining Ring
24.	02980557	a/r	Shim 0.5
	02980558	a/r	Shim 0.2
	02980559	a/r	Shim 0.4
	02980560	a/r	Shim 0.6
	02980561	a/r	Shim 0.8
	02980562	a/r	Shim 1.0
	02980563	a/r	Shim 0.7
25.	02980564	4	Bolt, Socket Head
26.	02980565	1	Safety Valve
27.	02980547	1	Guide Pin
28.	02980571	1	Relief Manifold
	02980570	a/r	Relief Valve Seal Kit
29.	02960568	1	Relief Valve, 280 Bar (A-Port)
30.	02980569	1	Relief Valve, 330 Bar (B-Port)
31.	02980237	2	O-Ring
33.	02980532	2	Ball
34.	02980533	2	Plug, Hexagon
35.	02980534	2	O-Ring
36.	02980535	2	Plug, Asy.
37.	02980572	2	Plug Asy.
38.	02980573	1	Plug Asy.
39.	02980566	1	Rebuild Kit (*)
40.	02980567	1	Seal Kit (**)

(**) These parts are included in Seal Kit

(*) These parts are included in Rebuild Kit

MOTOR P/N 02979881 - SPECIFICATIONS

Motor P/N 02979881 Specifications [3]

		European Standards		United States Standards
Displacement.....		80.4 (Cm / Rev)	or	4.9 (Cu. In. / Rev
Motor Operating Speed.	Max Intermittent...	5,200 rpm	or	5,200 rp
	Max Continous....	4,000 rpm	or	4,000 rp
	Min Continous.....	50 rpm	or	50 rpm
Motor Torque (Theor.).....		128 NM (at 100 Bar)	or	94 ft.lbs. (at 1450 psi)
		614 NM (at 480 Bar)	or	453 ft. lbs (at 6960 psi)
Motor Input Flow.....	Max Intermittent....	418 L/min	or	110 gpm
	Max Continous....	322 L/min	or	85 gpm
Operating Pressure.....	Max Intermittent....	480 Bar	or	6960 psi
	Max Continous.....	420 Bar	or	6100 psi
Maximum Case Pressure.....		10 bar (at 1500 rpm)	or	145 psi (at 1500 rpm)
Fluid Contamination Level.....		18/13 (ISO Code 4406)	or	18/13 (ISO Code 4406)
Motor Shipping Weight.....		26 kg	or	57 lbs.

Specifications Subject To Change Without Notification

MOTOR P/N 02979881 - PARTS LOCATION

General Information:

The Motor P/N 02979881 is Sperical Piston design. This motor is used on the Rotary Head. This is a high Torque Motor, with heavy duty roller bearings. See Figure 1 below for component location.

1. Barrel Housing
2. Valve Plate
3. Cylinder Barrel
4. Piston with Piston Ring
5. Timing Gear
6. Tapered Roller Bearing
7. Bearing Housing
8. Shaft Seal
9. Output / Input Shaft

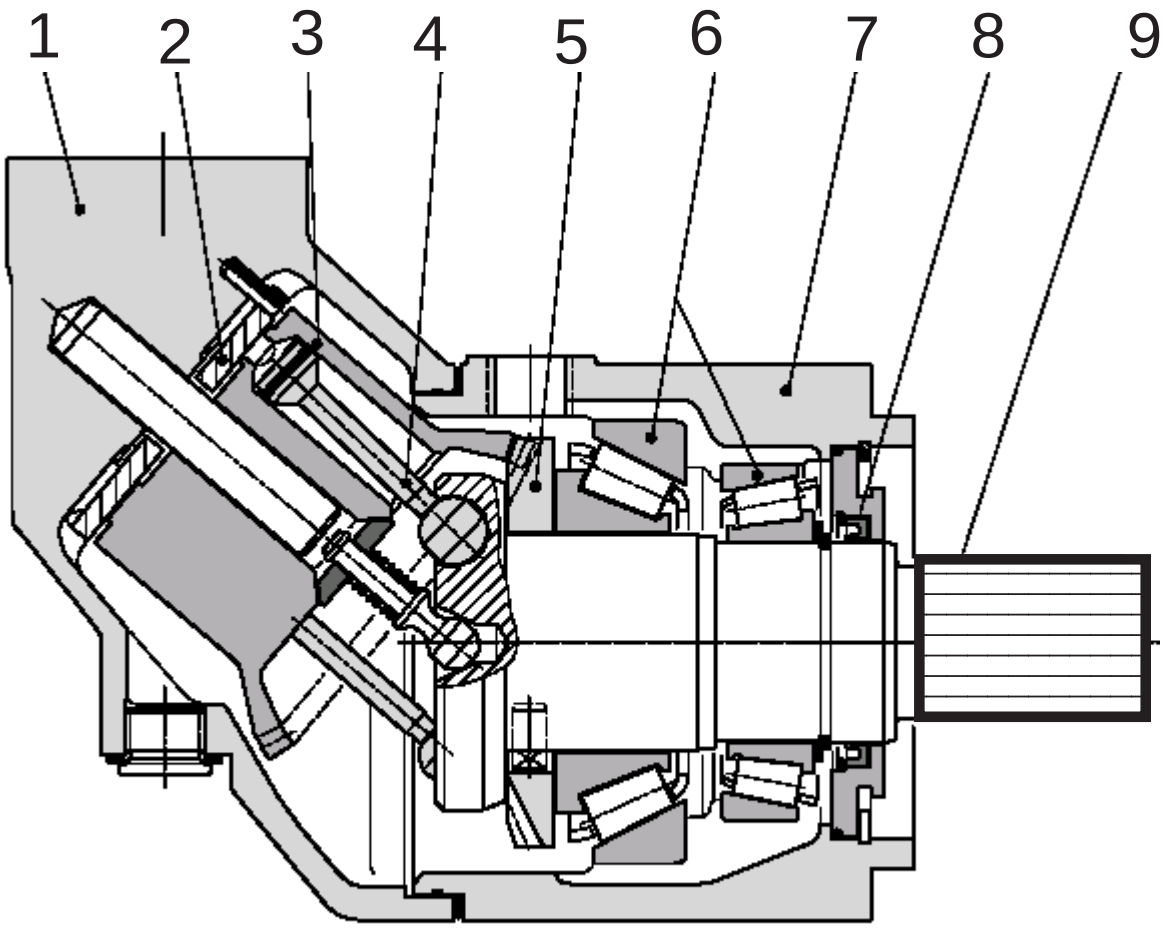


Figure 1 Motor Assembly

MOTOR P/N 02979881 - DISASSEMBLY

Motor Disassembly:

1. Clean Outer Surface Motor , hose and deck surfaces Before removing any components. Motor and hoses must be completely clean, dry the exterior of the motor and hoses. Make certain that you have proper containers to catch any oil that will drain out. Plug all hoses that are removed and plug all opening of motor fittings. Make certain the work area and all tools are clean. No contamination can be allowed to get into system. Refer to the previous parts page for part location in disassembly instructions, It works well to print a copy and have it laying to one side as you read these instructions. Instructions should be read all the way through prior to beginning disassembly

2. Remove Barrel Housing. Clamp Motor in a vise as shown in figure 1. There are 4 bolts (item 25) located on top of the Barrel Housing Assembly (item 1). Remove these four bolts. Lift Barrel Housing (item 1) as shown in Figure 2. Use caution to make certain the valve plate (Item 2) doesn't fall out when lifting the Barrel Housing off. By lifting straight up you should be able to use your finger to make certain the valve plate (item 2) does not fall out and get damaged. Make a note of which side of Valve plate is up and which side is down, this will be important during reassembly.

3. Remove Cylinder Barrel. Remove the Shim (item 24) and set it aside. Lift the Cylinder Barrel up and out (See Figure 4), This will leave the barrel support components (item 16) sticking up out of the shaft. Support components (item 16) are an assembly of four parts. The pistons (item 17) will also be sticking up. Make certain all the removed components are laid in a clean area.

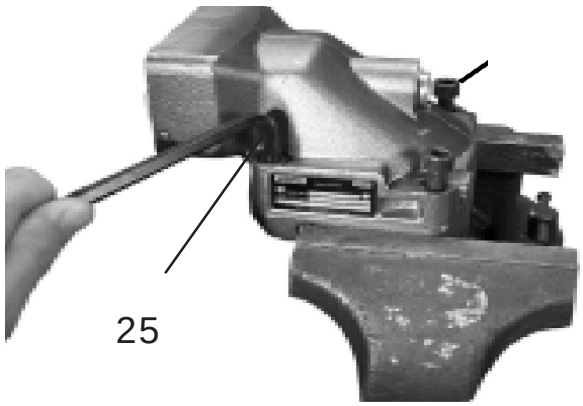


Figure 2

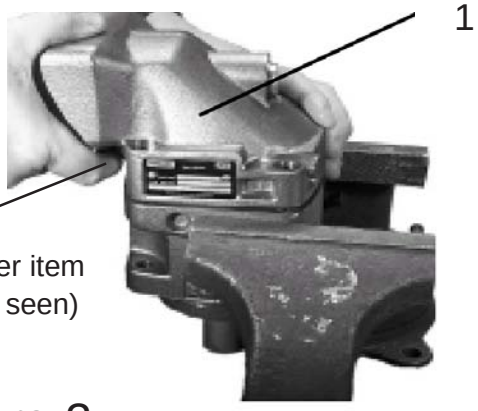


Figure 3

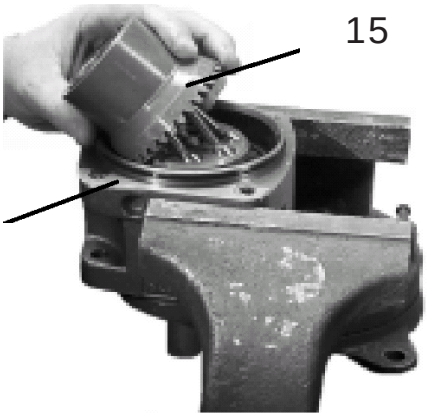


Figure 4

MOTOR P/N 02979881 - DISASSEMBLY

Motor Disassembly: Continued

4. Lift Out Barrel Support . Lift the barrel support out (item 16), make certain that all the parts in barrel support are accounted for. (See Figure 5)

5. Remove the Pistons (item 17), there are 7 pistons and 21 piston rings (item 18) that will be removed. There are 3 piston rings per piston. (See Figure 6)

6. Remove Bearing Housing Sealing O-Ring. There is an O-Ring (item 7) that is used to seal barrel housing assembly (item 1) to bearing housing (item 6). Remove this O-ring (See Figure 7) This will leave Shaft Assembly (item 14) still in Bearing housing (item 6)

7. Remove Retaining Snap Ring. Remove the Bearing Housing Assembly from vise and turn it over so the shaft end is pointing upward and re-clamp it into vise as shown in figure 8. Using internal Snap Ring pliers to remove the snap ring that retains the seal carrier (item 9). Note: Smooth Shaft shown, actual shaft is splined in this motor.

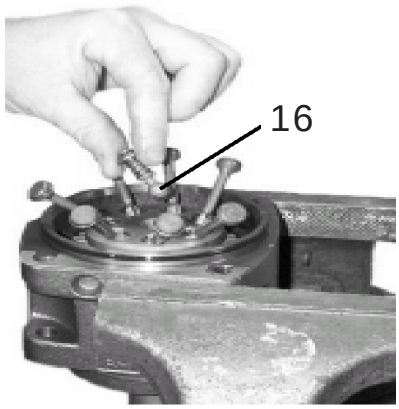


Figure 5

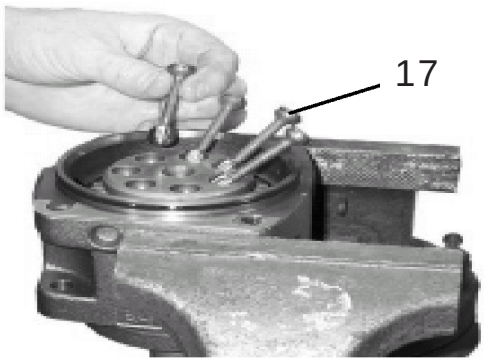


Figure 6

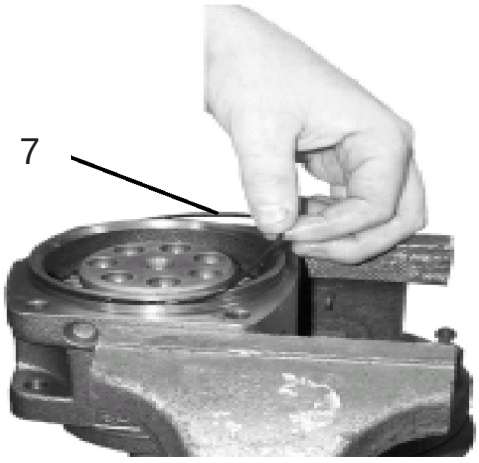


Figure 7

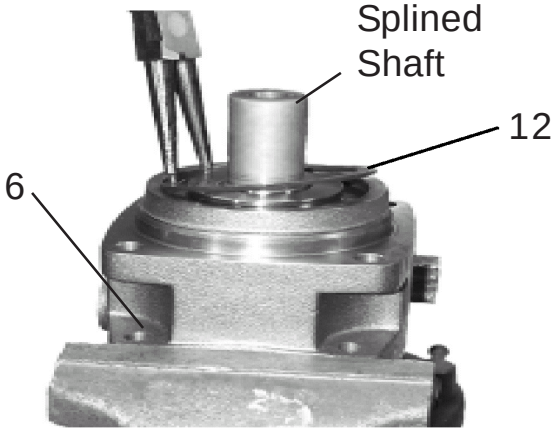


Figure 8

MOTOR P/N 02979881 - DISASSEMBLY

Motor Disassembly: Continued

8. Remove Seal Carrier . Using small pry tool lift seal carrier (item 9) up and slide it off of shaft as shown in Figure 9.

9. Remove sealing O-Ring. There is an O-Ring (item 8) under seal carrier that you can reach and pull out. (See Figure 10)

10. Remove External Snap Ring From Shaft,. Looking down on the shaft as shown in Figure 11, there are spacer washers (items 11, 13 & 22) and external snap ring. Make certain to make a note of where they are located and how many there are. Use snap ring pliers to remove retaining ring, do not pry it off of shaft as this would scratch the shaft.

11. Remove Spacer Washer. Under the Snap Ring. Remove any spacer washer under the snap ring, noting their quantity and location. (See Figure 12). Make certain to keep all Spacers in the same order they came off.

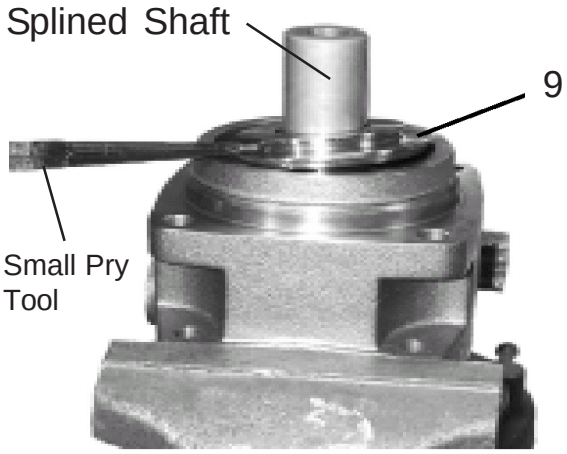


Figure 9

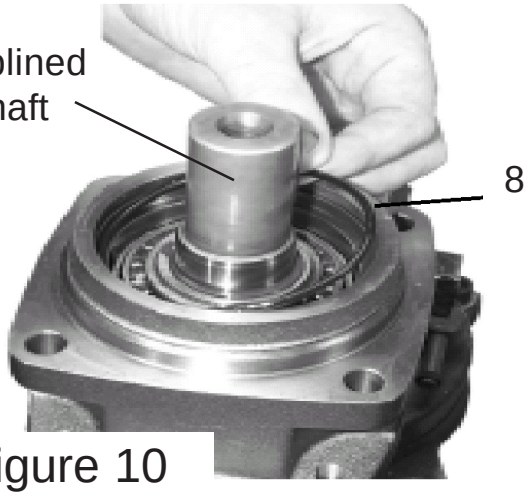


Figure 10

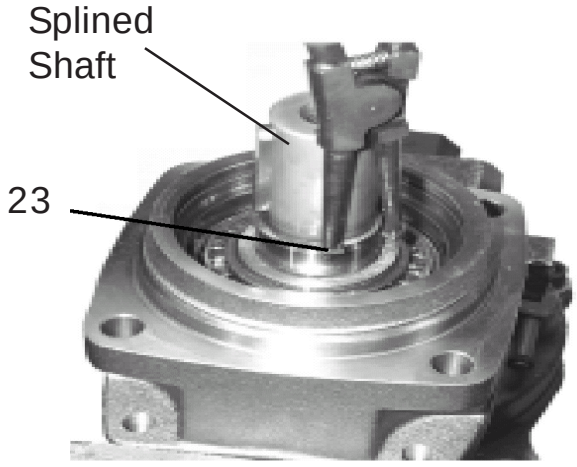


Figure 11

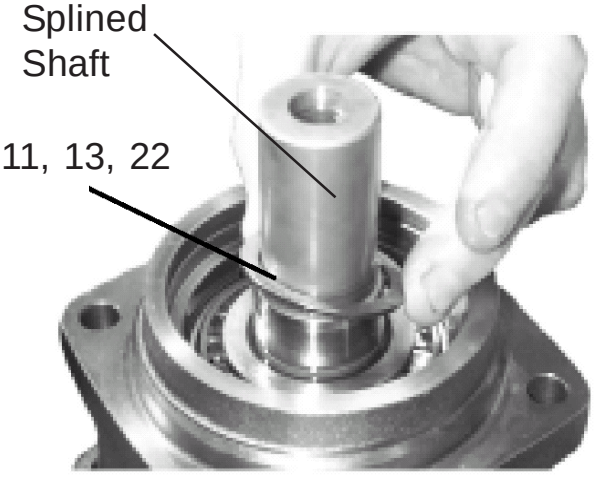


Figure 12

MOTOR P/N 02979881 - DISASSEMBLY

Motor Disassembly: Continued

12. Remove Shaft. Remove Bearing housing from Vise and move to a press. Set the Housing in press where the bottom is open as the shaft will come out the bottom,. (See Figure 13) Make certain you support the shaft in a way that will not allow it to fall out when pressed and hit the floor. It will not take a lot of pressure to remove shaft so you should be able to catch it with your hand.

13. Remove Small Lower Bearing Cone. The lower bearing cone (item 21) will lift out of the housing once the shaft is removed. (See Figure 14)

14. Remove the Bearing Cups from Bearing Housing (item 6). This will only need to be done if they are being replace. Using a hammer and a mandre, tap the small bearing ring off. (See Figure 15 & 16) The Bearing Cups will drive out from the opposite side of each other. The lower bearing cup is tapped from the top and the upper Bearing cup will be tapped from the bottom side of the housing.

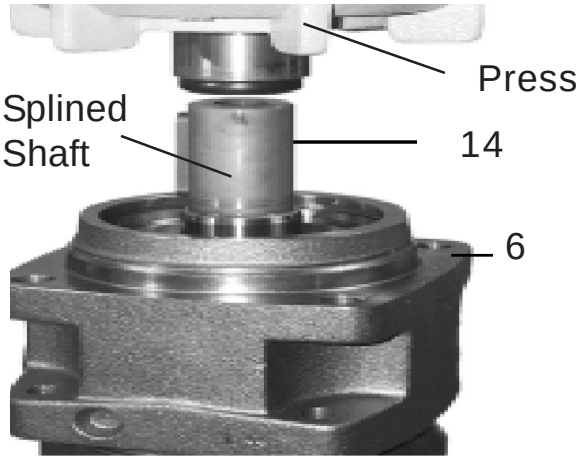


Figure 13

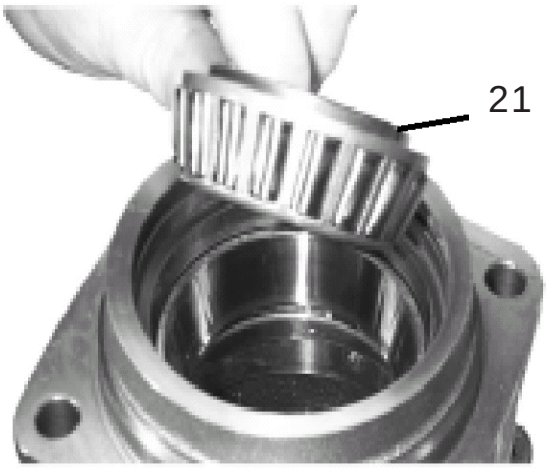


Figure 14


Figure 15


Figure 16

Motor Disassembly: Continued

15. Remove Gear and Upper Bearing Remove upper bearing cone and gear at the same time. Sit Shaft down over a tube that will support the gear (item 19). Using press on Shaft (item 14) , Shaft will slide down through the gear and bearing at the same time. Make certain to support Shaft in such a way it will not fall through and hit the floor. (See Figure 17) Figure 16

16. Inspect all parts. The Motor is now disassembled. Inspect all of the disassembled part for wear and damage. Replace worn and/or damaged parts. After cleaning and washing parts keep them in clean area. If the motor is to remain disassembled for any period of time, lightly coat the surfaces of the parts with hydraulic oil and store them in a closed container to prevent the parts from rusting or becoming contaminated.

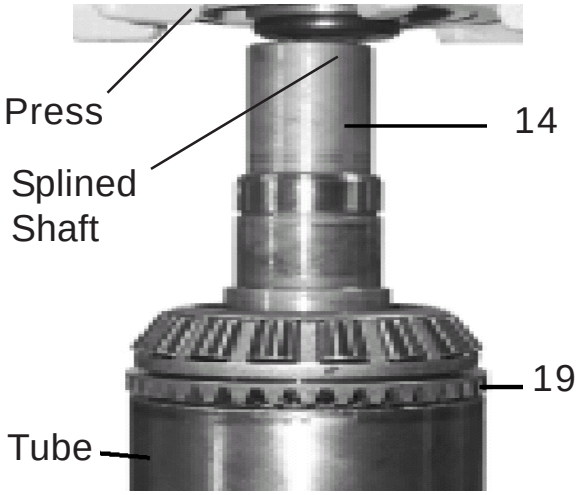


Figure 17

MOTOR P/N 02979881 - ASSEMBLY

Motor Assembly:

1. Install Gear & Bearing Cone on Shaft. Install Gear (item 19) down over shaft (item 14), make certain Gear is on in correct direction and the guide pin (item 27) is installed. Slide Bearing Cone (item 20) down onto Shaft with small part of Bearing Cone up as shown in Figure 18. Using a tube sleeve (tool shown in last figure of this section) press Bearing cone and Gear down onto shaft with a press. The tube must only contact the inner edge of the bearing. See Figure 40 at the end of this section for tool dimensions.

2. Install Bearing Cups into Bearing Housing. This will need to be done if the bearing cups were removed. Install bearing cups (1/2 of item 20) into Bearing housing using a press and tube that is close to the size of the bearing cup. Make certain the Bearing cups are completly seated. (See Figure 19)

3. Install Shaft Assembly into Bearing Housing. Install the Shaft Assembly (Shaft, Gear and Bearing) into the Bearing housing. Slide the Lower Bearing cone down over Shaft. You will need to support shaft while pressing Bearing Cone onto shaft, make certain to support it with something that will not damage it or get contamination on it. Using a tube and a press to push bearing down until it is seated in Bearing cup, Press Bearing Cone on until the proper Bearing preload is achieved. Proper Bearing Preload is the removal of the slack in the bearing, remove end play.

4. Remove Bearing Housing with Shaft From Press. Remove assembly from press and reinstall it into the vise as was done during disassembly process. Install it with the spline end of the shaft pointing up.

5. Install The Lower Bearing and Spacer Washers. Press lower bearing onto shaft until Zero End play is achieved. Install Lower bearing spacer washer (item 22) Quantity will vary as these shim type spacer washer are used to maintain zero bearing end play. Start with the same quantity that was removed and check. Adjust quantity as required to achieve proper bearing load. (See Figure 21)

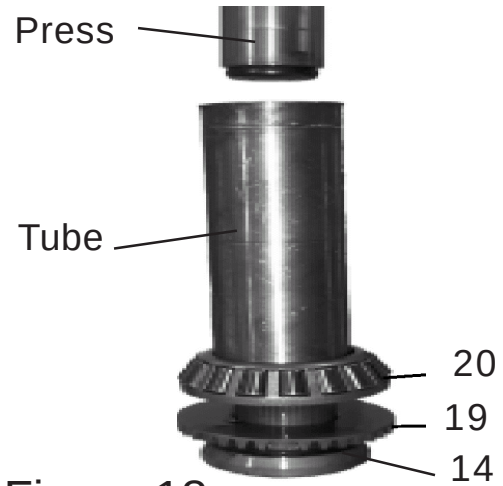


Figure 18

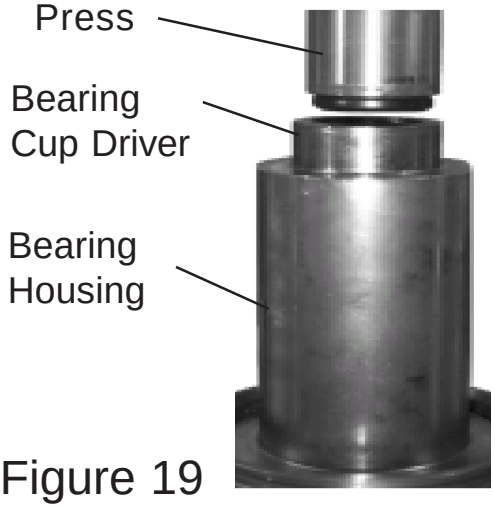


Figure 19

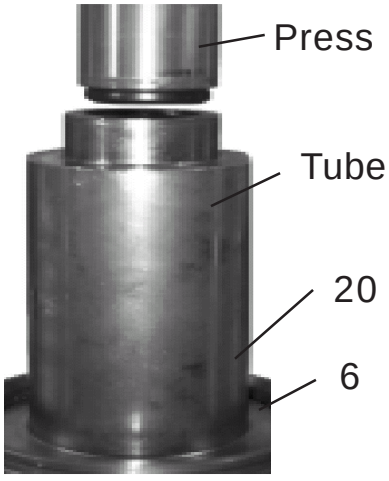


Figure 20

Motor Assembly: Continued

6. Install Bearing Retaining Ring. This is an external snap ring (item 23). Use snap ring pliers to slide snap ring down over shaft. (See Figure 22). Check Bearing load after snap ring is installed to make certain shaft has zero end play with bearings, If end play is not correct, the snap ring will need to be removed and the quantity of spacer washers will have to be changed.

7. Install O-Ring Seal. Install the O-Ring seal (item 8) into Bearing housing making certain it is straight and seated into housing. (See Figure 23)

8. Install Seal into Seal Carrier. Drive the old Seal out of Seal Carrier (See Figure 24) Install new seal (item 10) using a seal driver. Coat the ID of seal with a light coat of oil. (See Figure 25)

9. Install Seal and Seal Carrier. The Seal Carrier (item 9) has a shaft seal (item 10) that is installed into it. This needs to be installed before Seal carrier is installed into Bearing housing. (See Figure 26)

10. Install Seal Carrier Retaining Ring. Using Internal Snap Ring Pliers Install the retaining ring (item 12) into bearing housing. This will complete the lower end assembly. (See Figure 27) Remove the bearing housing from the vise and turn it over. Reinstall it into the vise with the gear end up. (See Figure 28)

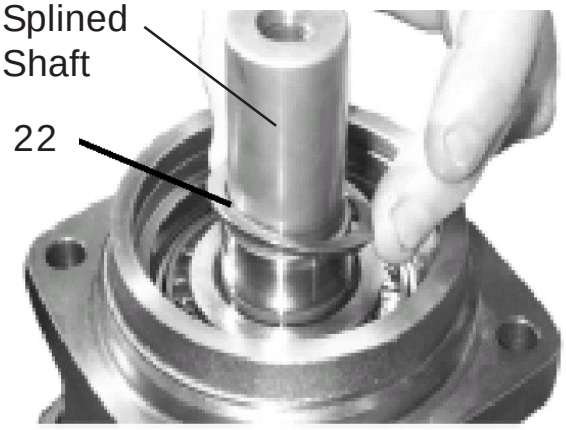


Figure 21

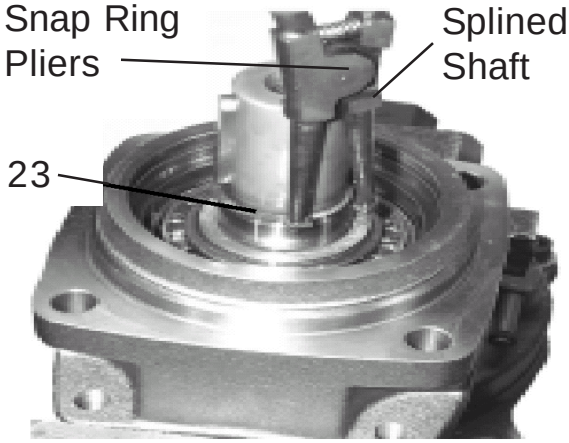


Figure 22

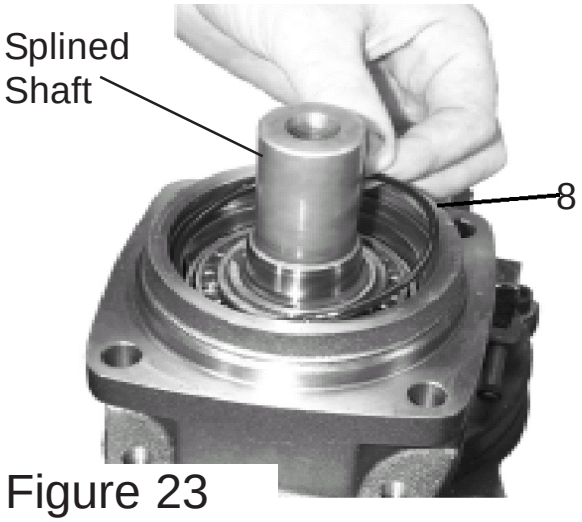


Figure 23

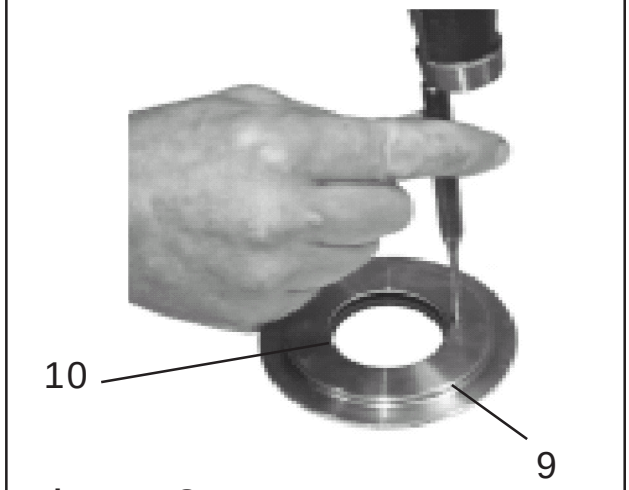


Figure 24

Motor Assembly: Continued

11. Install O-Ring Seal. Install the O-Ring Seal (item 7) into bearing housing (See Figure 28).

12. Install Pistons & Piston Rings. Coat the pistons (item 17) with hydraulic oil, make certain all 7 pistons have 3 rings (item 18) each on them. (See Figure 29). Piston will lay over to the side as shown in figure 29 but will slip down into the holes as shown in Figure 30.

13. Install Barrel Support. The Barrel Support (item 16) is a 4 piece assembly that installs in the center of the shaft, make certain all components of the barrel support is installed. (See Figure 30)

14. Install Shims. Install the bearing housing shims (item 24) onto bearing housing (See Figure 31), These shims are various thickness and the quantity required will vary, start with the same amount and thickness that was removed.

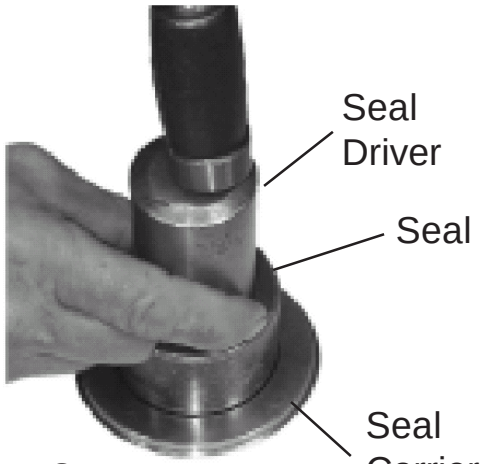


Figure 25

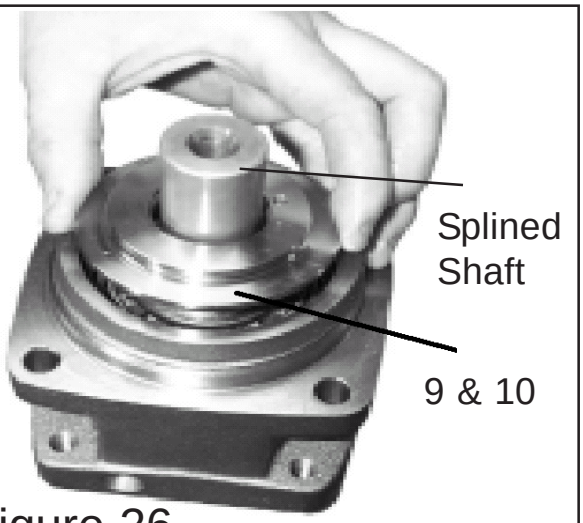


Figure 26

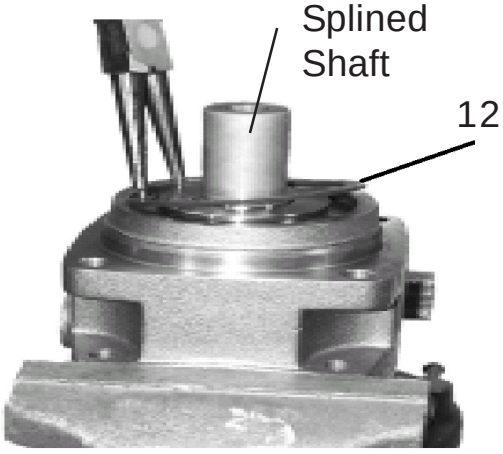


Figure 27

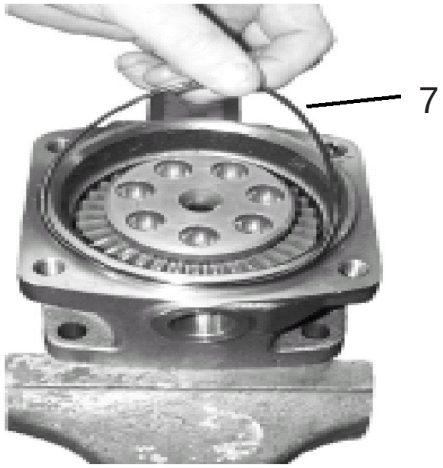
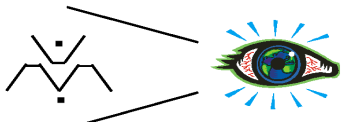


Figure 28

Motor Assembly: Continued

15 Install Cylinder Barrel. When installing the **cylinder barrel (item 15), it must be timed.** There are punch marks on the Shaft Gear and the gear of cylinder barrel, these marks must be aligned as shown below. (See Figure 32) Set this assembly aside for now.



16. Install Valve Plate, Coat Valve plate (item 2) with a coat of grease (See Figure 33) will be to hold valve plate in housing during assembly. With the Barrel Hosing assembly in vise install the valve plate into it. This plate must be installed with the correct side down and the correct side up. (See Figure 34). Note the location of the notch in OD of valve plate.

17. Install Barrel Housing. Clamp Bearing housing and Shaft assembly back into the vice. With the barrel housing assembly turned up as shown in figure 35. Make certain the Valve plate (item 2) is installed inside the barrel housing and facing the correct direction. Make certain the Shims (item 24) are still installed on the Bearing housing. Sit the barrel housing (item 1) down over the bearing housing (item 6). Install the four bolts (item 25), and Torque these four bolts using an alternating pattern to 75 ft. lbs. +/- 7 ft lbs (See Figure 36)

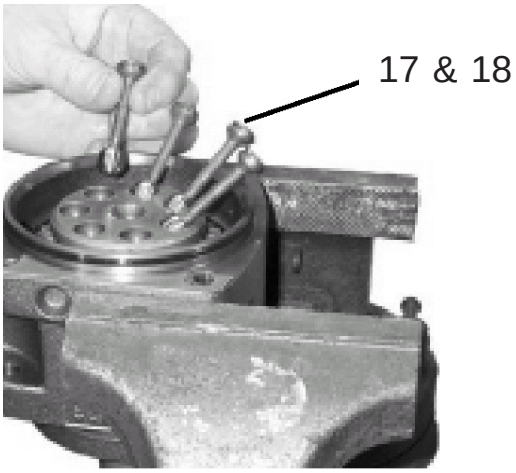


Figure 29

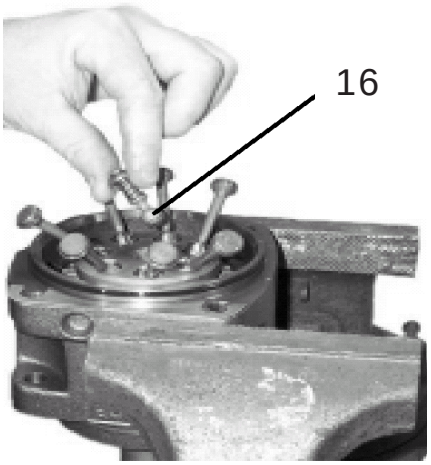


Figure 30

Figure 31

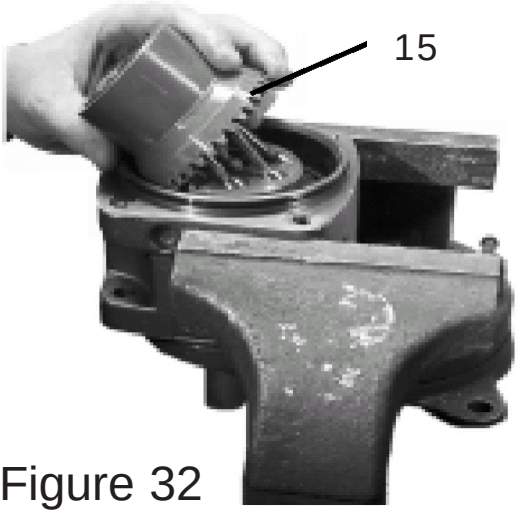


Figure 32

Motor Assembly: Continued

18. Install Relief Manifold. It would not have been required to remove the Relief Manifold (item 28) to disassemble the motor, it could have been left attached to the Barrel Housing Assembly (item 1) . If it was removed, inspect the O-Rings (item 31) and replace if nessacary. The reliefs (item 29 & 30) would not have had to be removed, but if they were make certain to replace them the same way they were removed, there is a Relief Valve Seal Kit (See item 28) available as repair parts. (See Figure 37)

19. Inspect all assembly steps done and make certain every thing is clean, all opening should be plugged and remain plug until hoseconnections are attached.

20 If only replacing Seal as a repair See Figure 8 & 9 in disassembly section and Figures 24, 25, 26 & 27 in the assembly section.

It will be required to remove Seal Carrier Retaining Ring, Pull Seal Carrier out of pump Bearing Housing and remove seal from seal carrier. Make certain to check the O-Ring Seal under seal carrier, it should be replaced when seal carrier is removed and reinstalled. Reverse procedure to reinstall seal carrier. (See Figure 38 & 39)

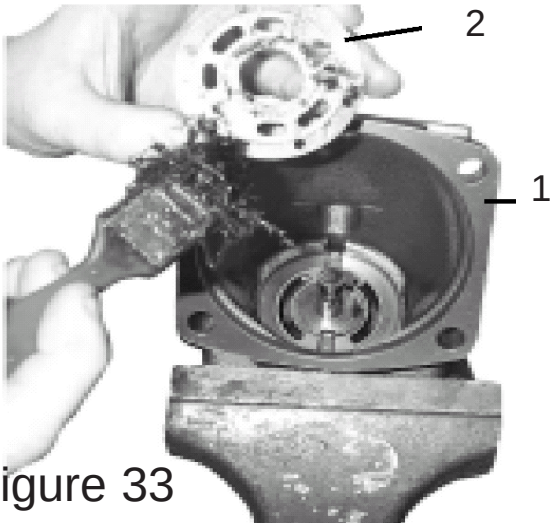


Figure 33

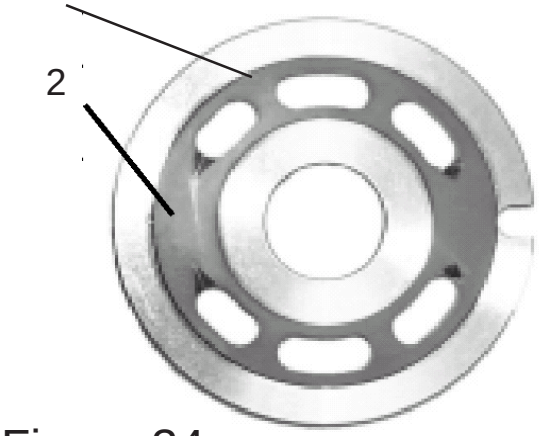


Figure 34

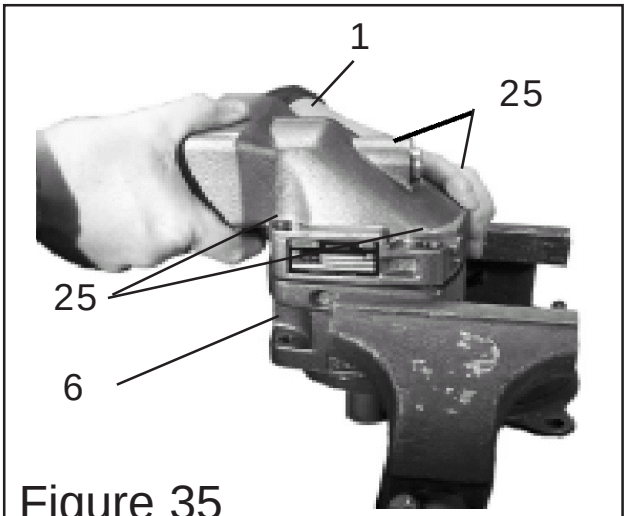


Figure 35

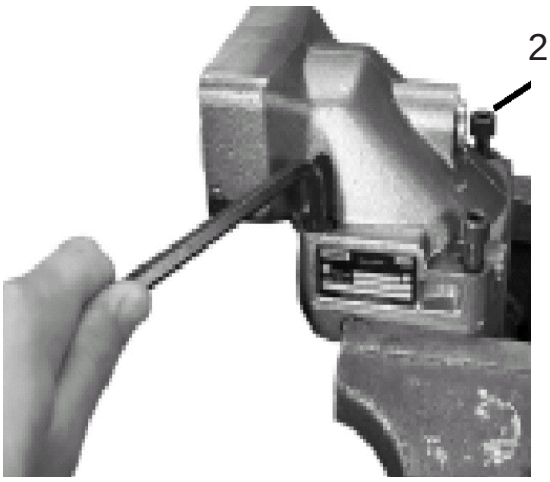


Figure 36

Motor Assembly: Continued

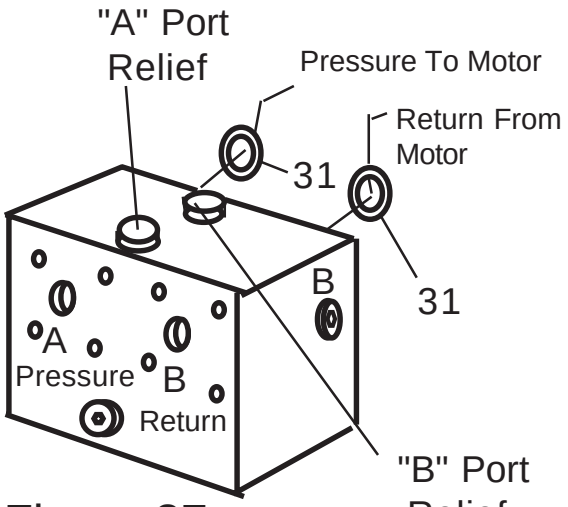


Figure 37

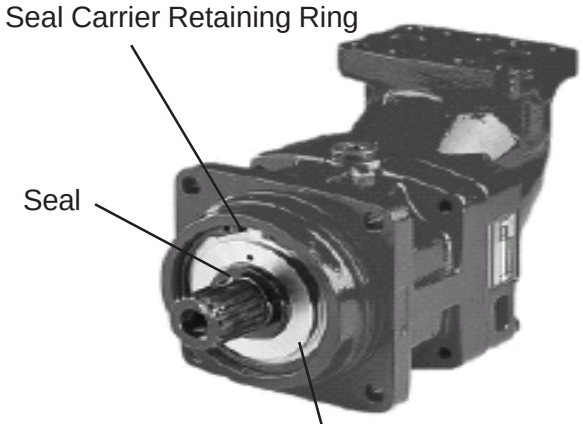


Figure 38

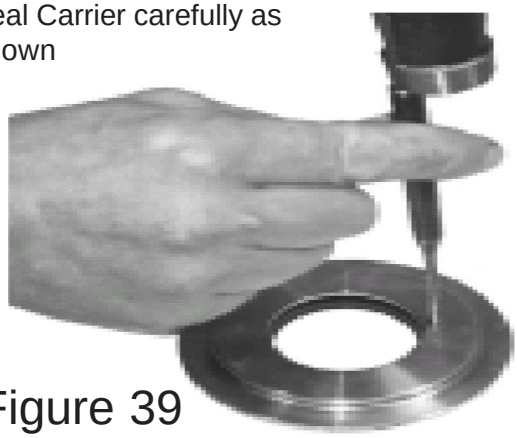
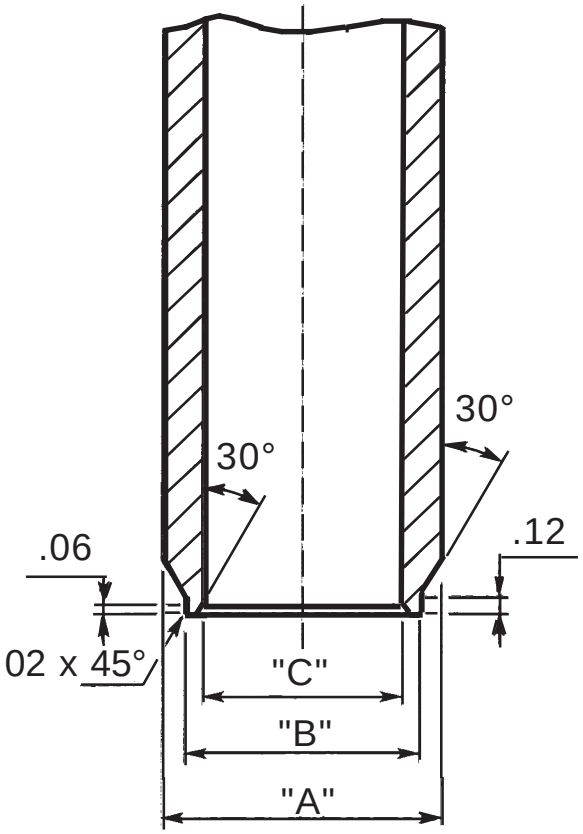


Figure 39

This tool can be machined from tubing to create a bearing driver to install bearings on motor shaft.



Diminsions

"A"	=	2.91" + 0 / -.04
"B"	=	2.75"
"C"	=	2.441" + .008 / - 0

Figure 40

NOTES

Section 8

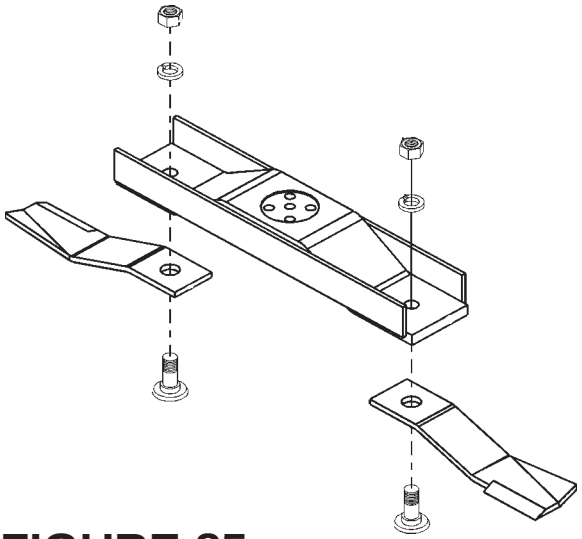
BRAHMA

Spindle Repair Section (Rotary Head Only)

Procedures: Remove Blade Bar

1. Clean all components of Boom and Head, Remove all Dirt and any other material that may contaminate components as being dis-assembled or after it has been disassembled.
2. Move Tractor to Level and Firm Ground, Concrete Floor is Best.
3. Swing the Boom to the Side of the Tractor; Extend Boom out till fully extended. Stand Head Up so Blade Bar is facing out away from Tractor in the folded up position.
4. Fully apply the Park Brake on Tractor.
5. Place all Gears in Tractor in the Neutral Position.
6. Shut Off Tractor, remove Key and disable Tractor so it cannot be started till you are ready to have it started.
7. This procedure can be done with head connected to Boom or with it removed, But if removed you will have to lift Head to remove Blade Carrier Assembly.
8. Remove Blade Bar or Pan Assembly. Use Caution the Blade Carrier is very heavy Do Not remove the retaining bolts till it is secure to where it will not fall. An easy way to support Blade Carrier when removing it is to only remove 2 of the 4 retaining bolts. Get 2 long bolts with same size and threads but longer than what was removed, cut the heads off of these 2 longer bolts and screw them in where you removed the 2 retaining bolts. This will support Blade carrier while you remove the other 2 bolts, this allows the Blade carrier to slide off. The four Blade Bar Retaining Bolts are Torqued to 400 ft. lbs. and are tight. It may be required to hold Blade Bar when removing them, This can be done by connecting a Chain to Blade Bar and securing it to Deck. Make Note of the length of the four Blade Carrier Retaining Bolts in center Blade Bar (See Figure 85), Never put Bolts back in that are longer or Shorter they will damage Spindle Shaft.
9. It will not be required to dis-assemble Blade Carrier Assembly once it has been removed from Spindle. But if you do dis-assemble it the Blade Carrier Mounting Bolts must be torqued to 400 ft. lbs., Blade Bolts Torque to 400 ft. lbs. These Torque Values are based on Clean, Lubricated and undamaged threads. These Components must be torqued back to these setting when re-assembled.

Bar Carrier Assenbly for Rotary head



Pan Carrier Assenbly for Rotary head

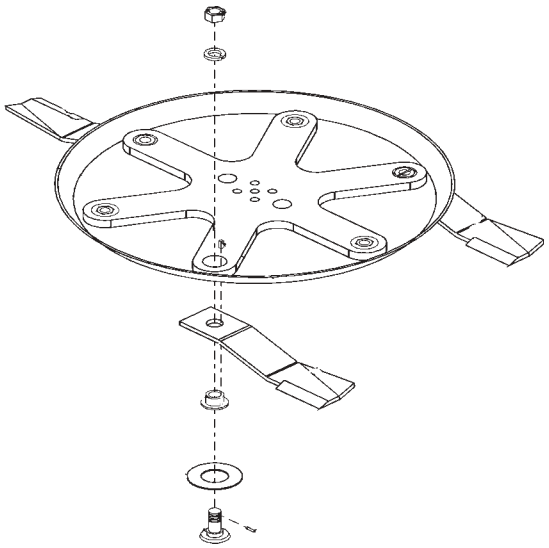


FIGURE 85

SPINDLE - REPAIR

Procedures: Remove Motor and Spindle

1. Remove the Motor Hold Down Tie Rod Nuts. Hold Down Plate only used on old style motor, new style will not use hold down plate.On the Top side of motor that are screwed on to Motor Hold Down Tie Rods (See Figure 86), It may be required to hold Ties Rods, This can be done with a Pipe Wrench or other round surface gripping Tool. See Hydraulic Motot sections to determine which motor you have, These type motors only used on rotary heads only.
2. On Older Models remove the four Bolts in the Center of the Motor Hold Down Plate, On Later Models the four Bolts are in a recess under Hold Down Plate and are not visible till Plate is removed. On the later models these four Bolts will not have to be removed. These four bolts hold Valve Block on top of Motor, After you Lift the Hold down Plate off you will need to secure this Block to the top of Motor with alternate Bolts or it will fall off (on older Models). USE EXTREME CAUTION when removing Valve Block, make sure no foreign material gets into Ports, Also All O-Rings and Back-Up Rings will have to be replaced if this Valve Block is taken loose. See earlier steps about cleaning.
3. Remove the four Bolts that Retain Motor to Spindle, Working Motor side to side lift it away from Spindle. If the Head is standing up on side Oil may run out of Spindle when seal of Gasket is broken, be ready to catch it in a container. It will not be necessary to remove Hoses or connections to motor, you will be able to set motor aside with Hoses connected.
4. Remove Spindle from deck, There are six bolts that hold Spindle down to Deck, remove these Bolts and Nuts to remove Spindle from Deck. You will need someone on bottom side of Deck to hold the Bolts as you take the Nuts off. Spindle will lift off deck from top of Deck.
5. Move Spindle to work Bench; Older Models used a 000 Grease (Thick Oil) that will Drain Slowly, the later models use a Grease that will not drain at all. It is Best to remove grease when Spindle has been dis-assembled.

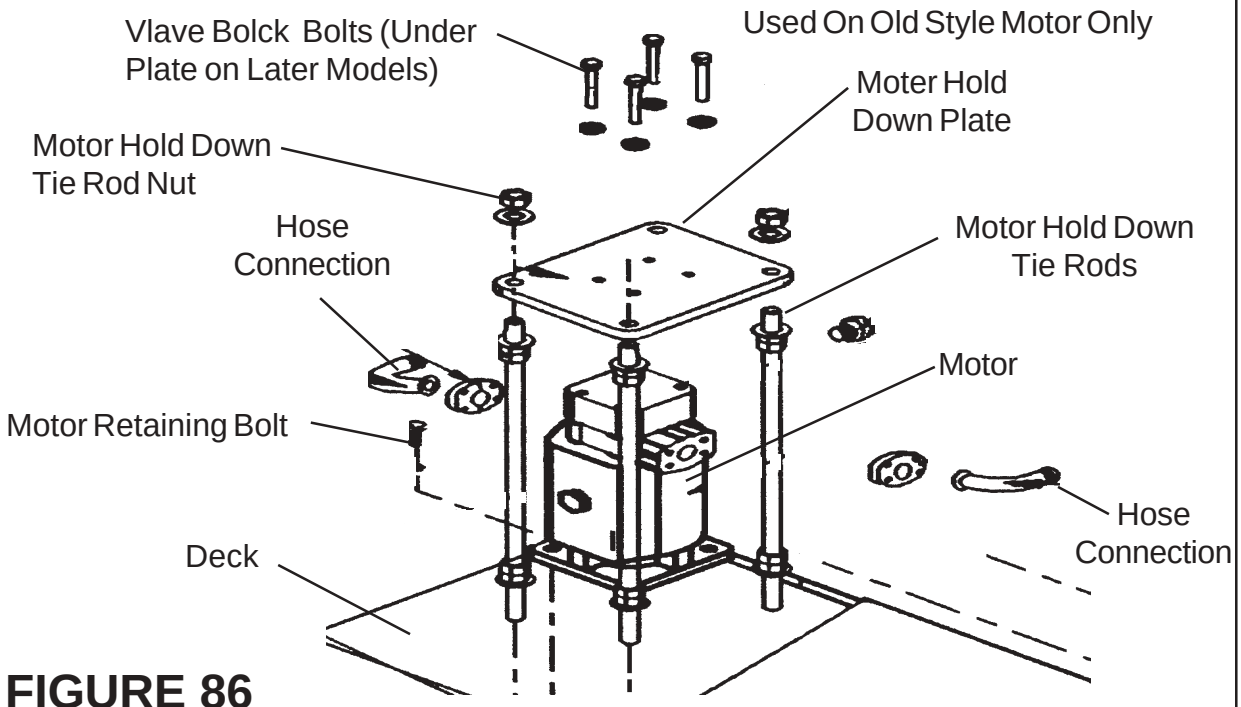


FIGURE 86

Procedures: Dis-Assemble Spindle

1. Spindle Dis-Assembly, (See Figure 87) The Spindle Shaft is held in with 2 notched round Nuts and a Tabbed Locking Washer, first use small Blunt Chisel to bend tab out away from Notch on Round Nut, Using Tabbed Socket (consult your local Tool supplier) un-screw outer Locking Nut, Lift tabbed Washer off Shaft, un-screw lower Bearing Adjusting Nut. It is best to replace Tabbed Washer with new one.
2. Remove Spindle Shaft, Because of fit of Upper Bearing Cone it will be required to Press Shaft out through bottom of Housing, This should not take a great deal of effort but some. Put a soft Metal Pin (Brass) into top hole of Shaft, (Do Not put one in that will be too big and get stuck). Using Press; push Pin and Shaft Down, It will come out through bottom of Housing.
3. Remove Bearing Cones, Upper Bearing Cone will have stayed in Housing, reach in from to top to remove it, Lower Bearing Cone should have come out and still be on Spindle, For Cleaning and inspecting this Bearing Cone should be removed. You may need a Bearing Puller to remove Lower Bearing Cone from Shaft.
4. Remove Lower Seal from Housing, Discard Old Seal Do Not re-use it only install new Seals.
5. Remove Bearing Cups, Bearing Cups will need to be driven out of Housing with a driver or Pressed out, But they do Need to come out straight, DO NOT DRIVE them out from one side only, keep equal force all the way around them when taking them out or Housing could be damaged.
6. Cleaning Housing, Clean the Housing completely, No Oil or Grease left in it, Completely inspect all areas of Housing, Bearing Cup Bore, Seal Bore, Flanges, Inner and Out surface of Housing for scratches, cracks, Burrs (especially Seal Area for Burrs), Always Dry Parts after Cleaning, Make sure there is no Solvent residue on them that will pollute lubricant, After Cleaning if Parts are not to be assembled right a way put a coat of Oil over ID of Housing and over Gasket area at the top to prevent rust, Un-painted Clean steel will rust very rapidly if left dry of Oil. Keep it covered to keep dust and dirt from collecting on oiled surface.

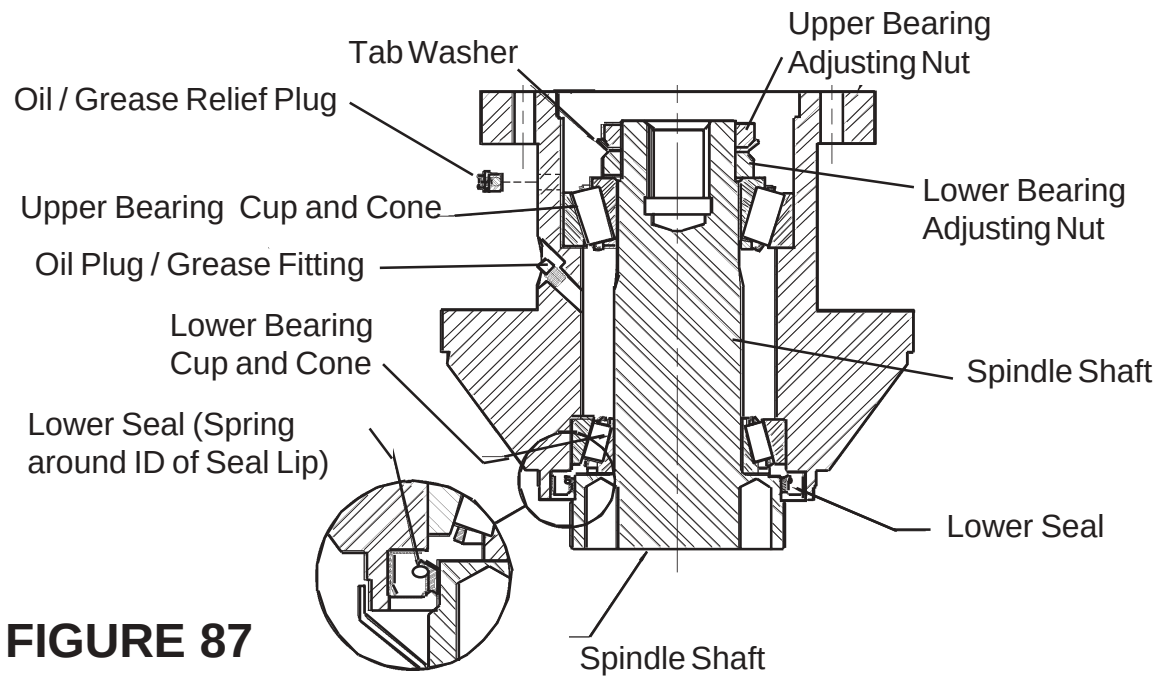


FIGURE 87

SPINDLE - REPAIR

Procedures: Re-Assemble Spindle

1. Spindle Re-Assembly, (See Figure 88) Make sure Housing is Clean and in Good Shape.

2. Install Bearing Cups, Using a Driver or Press install Upper and Lower Bearing Cups, Make sure they are seated completely into Housing.

3. Install Lower Seal, Inspect Lower Seal area one more time, Make sure there are no burrs around surface, Install lower Seal Using a Driver (consult your local Tool supplier), After installed coat ID of Seal with light coat of Grease.

4. Install Lower Bearing Cone, Inspect Spindle Shaft Condition. Lower Bearing Cone is installed on Spindle Shaft and pressed down till seated on bottom lip on Shaft. Be careful pressing Bearing on, do not damage Bearing. Coat lower Bearing with light coat of Grease.

5. Install Spindle Shaft, Put light coat of Grease on Seal area of Shaft, this will help Shaft go into Seal. Insert Spindle Shaft with lower Bearing Cone installed on it into Spindle Housing from the Bottom, Use Caution when lower part of Shaft reaches lower Seal. work shaft into seal carefully.

6. Install Upper Bearing Cone, Support Spindle Shaft from Bottom and Press (New type is press on and Older type pushed on) Upper Bearing Cone on to Spindle Shaft, Don't press on Bearing Rollers or Cage as this will damage Bearing. It is installed till it is seated into Bearing Cup, Remember to keep Spindle Shaft supported at bottom.

7. Install lower Bearing Adjusting Nut with chamfer up, Tighten Nut till it contacts Bearing Cone, But do not torque at this time. Clamp Spindle to Bench (or Vise) so that Spindle Shaft can rotate. Tighten till it takes 25 in. lbs. to rotate Spindle Shaft, Tap Shaft with a Hammer to make sure Bearings seat straight and recheck Rolling Torque (must be be 25 in. lbs. of rolling Torque).

8. Install Tabbed Washer on to Spindle, Inner tab in slot and Outer tabs facing up.

9. Before Installing Top Nut with chamfer on Nut facing down, Make sure Shaft is locked (Clamped) so it will not Turn in Spindle Housing, Torque this top Nut to 100 ft lbs. Bend the Tab of the Locking Washer to fit into one of the Grooves on top nut. Recheck Rolling Torque of Shaft, it should be 25 in lbs. Rolling Torque.

10. Install Grease Plug in bottom hole and Grease Relief Plug in the upper hole. Note: When grease is cold it could force bottom Seal out of Housing. Let grease warm before filling begins. Excessive Pressure of Air Grease Gun could force Seal out, Use low Pressure.

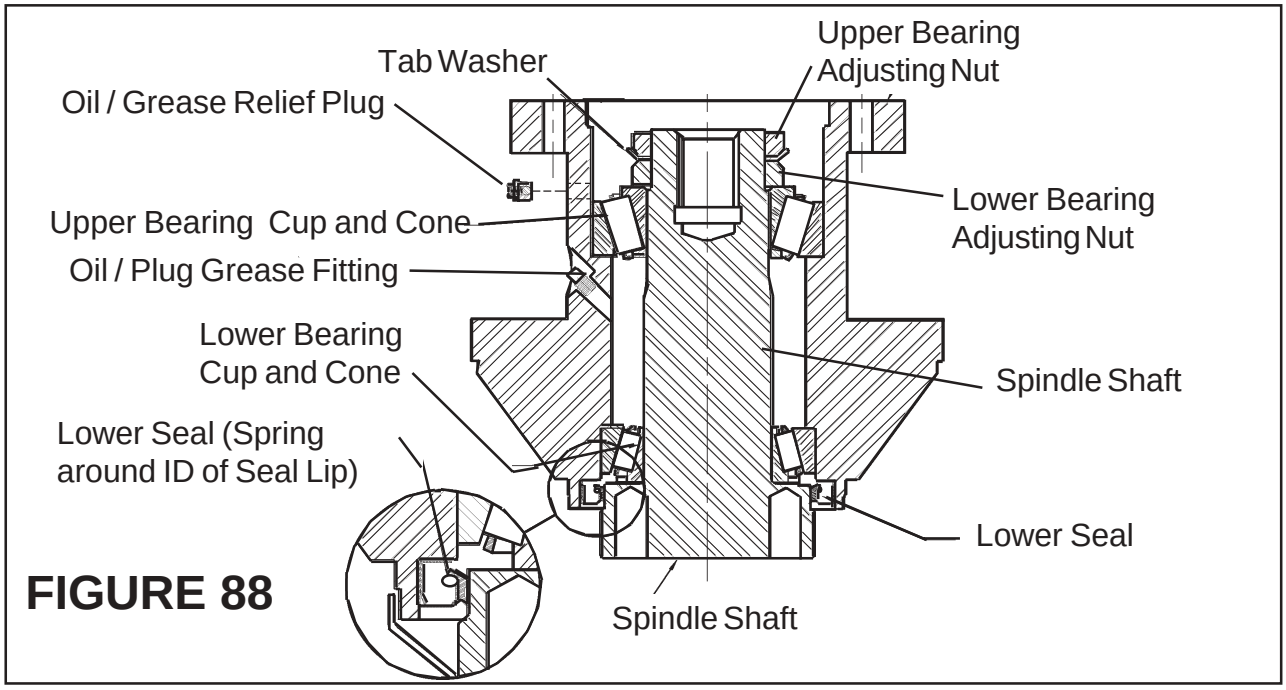


FIGURE 88

SPINDLE - INSTALLATION

Procedures: Install Spindle, Motor and Blade Carrier

1. Install Spindle on Deck, Slide Spindle into Deck from Top Side, Install Hardened Washers on Bolts then Insert eight 3/4" Retaining Bolts up from Bottom of Deck, Install the eight Locknuts on Bolts. Torque these Bolts in an alternating Pattern to 300 to 320 ft. lbs. DO NOT leave off hardened Flat Washers, Use Lock Nuts only, do not use Lock Washers,
2. Install Spindle Housing Gasket, Install Spindle Gasket on top of Spindle. Make sure old Gasket was removed and not stuck to Bottom of Motor.
3. Install Motor onto Spindle Housing, Set Motor down onto Spindle making sure Motor sets down flat and is fully seated against Spindle Housing. Make sure Motor is installed correctly, Look at the four Bolts that hold the Valve Body on, Notice two bolts are 2-1/2" (center) apart and the other two are 2-1/4" apart; the two that are 2-1/4" apart goes to the front (toward Door), This is important that Motor be installed correctly so Case drain comes out in right place. The Valve body bolts torque 25 to 30 ft lbs. in an alternating pattern. Insert the four 1/2" retaining Bolts that holds Motor to Spindle, Tighten these four Bolts till Motor seats against Spindle Housing, If Motor will not sit Flat against Housing DO NOT force it, Something is wrong, Check everything or you could break Flange off of Motor. torque the four 1/2" bolts 100 to 110 ft. lbs.
4. Fill Spindle with Grease, Make Sure that Spindle Grease Relief Plug is installed, Fill Spindle with Grease, (Older Models had Oil in them, These older models can be filled with Grease). Fill with Grease till it comes out the Relief Plug. When grease is cold, removing Grease relief Plug will help to prevent Seal from blowing out during filling, replace plug after filled with grease. Wipe away excess Grease.
5. Install Motor Plate (Old Style), Note: This Plate has a front and Back and MUST be installed correctly for the four bolts that go down through the Plate to hold the Valve Block to fit, See Figure 91 on next page or read step 3 above. If working on an older model where the Four Bolts for the Valve Block went through the Motor Plate (see Figure 86), remove the temporary Bolts you installed to hold Valve Block on. Install New O-Rings and Back up Rings on Valve Block. Install Motor Plate down over Tie Rods; Install the four Bolts into Motor Plate that goes through Valve Block and tighten them down. DO NOT tighten the Nuts on the Tie Rods yet. Note to convert old style Motor Plate to new style, use a 13/16" Drill Bit and drill out (Recess) the 4 holes to a depth of 5/8" minimum, this will allow plate to sit down over Bolt Heads for Valve Body on top of Motor.
6. Install Motor Plate (Later Style), Note: This Plate has a front and Back and MUST be installed correctly for the four bolts that go down through Valve Block to fit into the four recessed holes on the under side of Plate. See Figure 91 on next page or read step 3 above. If working on new Style the four Bolts that retain the Valve Block on top of Motor should not have been removed. Set Motor Plate down over Tie Rod Bolts, Make sure all the Washer are on and Plate is setting square. DO NOT tighten the Nuts on the Tie Rods yet.
7. Tightening Nuts on Ties Rods will require measuring and adjusting the Upper Nuts under Plate, As the Tie Rods were not remove this measurement should not be far off, BUT they MUST be correct, so using the next two pages and drawings as a guide and instructions, Tighten and adjust Plate Retaining Nuts as Shown. If you are installing components new then, The tightening procedure will have to be done from beginning for the Motor Plate and Tie Rods.
8. Install Blade Bar Carrier, As Bar Blade Carrier was only removed and not dis-asembled it should only be a matter of bolting the Assembly on and Torqueing it down? If Bar Blade Carrier was Dis-Assembled it will have to be assembled and components Torqued as specified, See Figure 85 on previous Pages. Blade Bar Assembly Bolts MUST be torqued to 2000 ft. lbs., There are four of these Bolts, 2 long and 2 short, They MUST be torqued BEFORE Blade Bar is bolted to Spindle. The Blade Bolts must be torqued to 400 ft. lbs. and Roll Pin Installed. The Blade Bar Retaining Bolts (Socket Head Bolts) and lock washer must be installed, These will torque to 400 ft. lbs.
9. After Assembly is completed check all steps to be sure they are completed, Test run Head then Stop and recheck all components including Grease Level in Spindle. Spindle temperature can reach 200 F. after running, so do not check the Temperature by touching it.

SPINDLE - MOTOR PLATE (Old Style Motor)

USED ON OLD STYLE MOTOR ONLY

60" MACHETE HEAD MOTOR PLATE ATTACHMENT

1. Before installing the rods run two nuts on each end of the rods down 2". Place a hardened Flat Washer on each end (See FIGURE 89**)**.

2. Place the straight rods in the holes marked 1 through 4 (See FIG URE 90).

3. Once the rods are in the holes through the Buck Plate align the rods through the holes on the mount plate and place the mount plate on top of the relief block. The valve block bolts on top of the motor is not equally spaced.Make sure the pockets align accordingly. (See FIGURE 91).

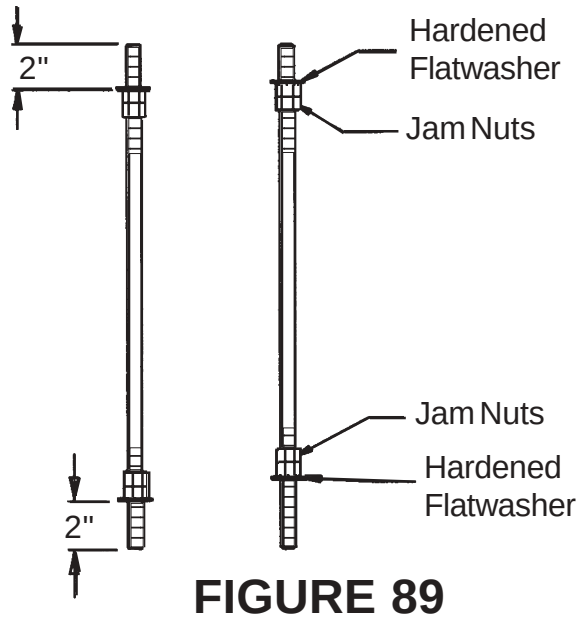


FIGURE 89

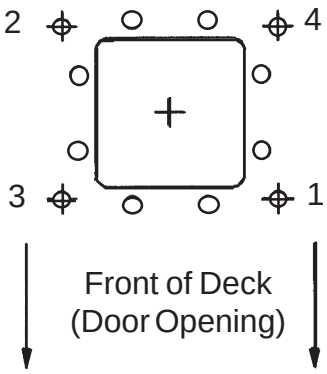


FIGURE 90

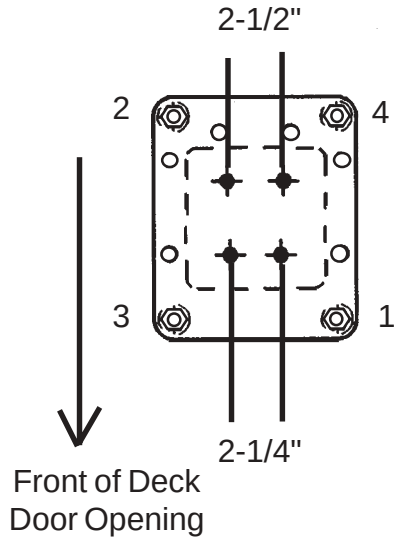


FIGURE 91

4. Place thread locking compound on the threads and install the Hardened Washers and Toplock Nuts on the Rods extending through the bottom of the deck. Torque these rods to 230 Ft-Lbs. (See FIGURE 91).

5. Measure the distance that the rods extend through the top mount plate, this needs to be 7/8" to 15/16". To get this height adjust the two jam nuts by the buck plate. Once the required distance is achieved place thread locking compound on the threads and lock the two nuts together. (See FIGURE 92).

SPINDLE - MOTOR PLATE

6. Check to make sure the Flat washer is not contacting the bottom of the mount plate. There should be a 1/4" gap between the Flat Washer and the mount plate, (See FIGURE 93).

7. Place Thread Locking Compound on the threads and install the Hardened Flat Washers and Toplock Nuts. Torque these Nuts to 100 Ft.-Lbs. in three increments and following the positions 1 through 4. Example: torque to 35 ft lbs, 70 ft. lbs. then to 100 ft. lbs. Re-check torque values after reaching the final torque. (See FIGURE 94).

8. Place Thread Locking Compound on the threads and run the Hardened Flat Washers and Jam Nuts up tight against the bottom of the Mount Plate. Lock Jam Nuts together. (See FIGURE 95).

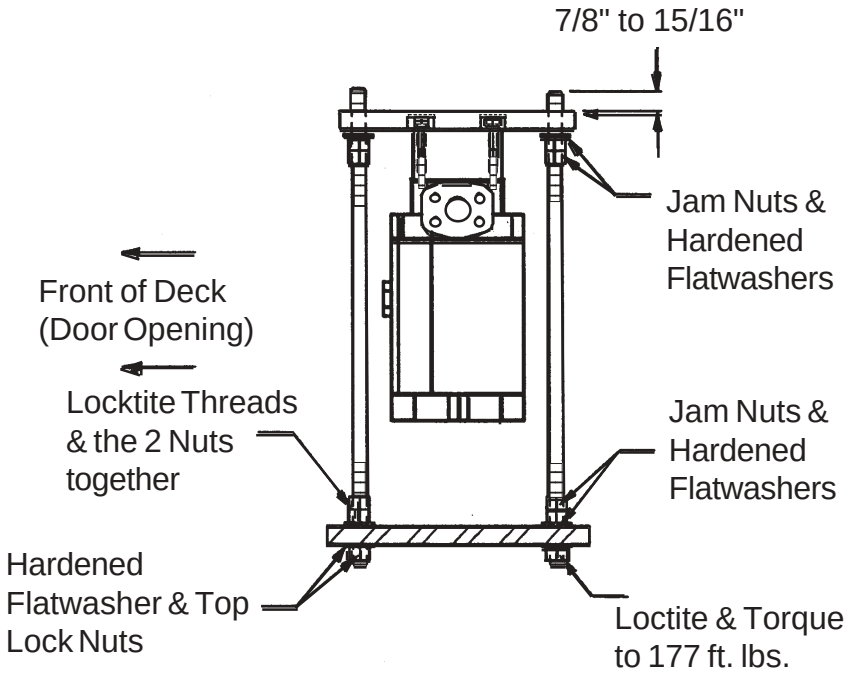


FIGURE 92

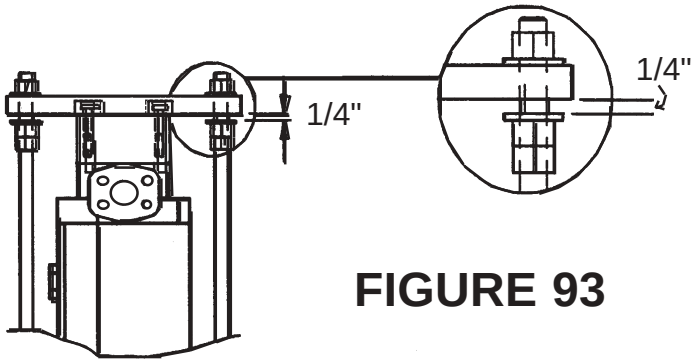


FIGURE 93

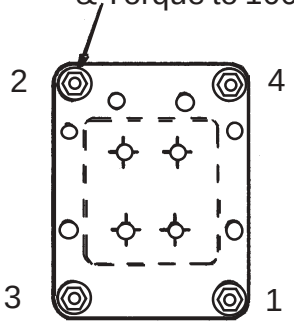


FIGURE 94

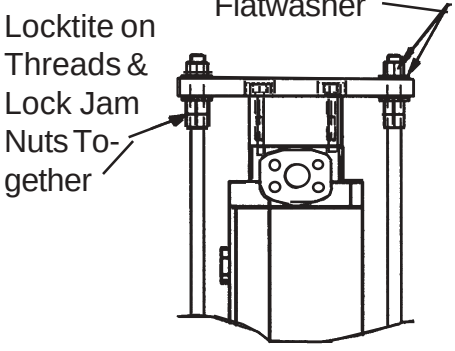


FIGURE 95

Section 9

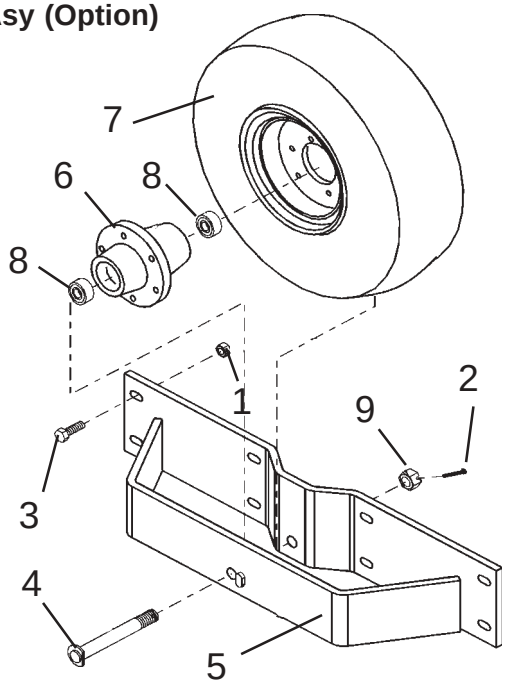
BRAHMA

Optional Components (Rotary Head Only)

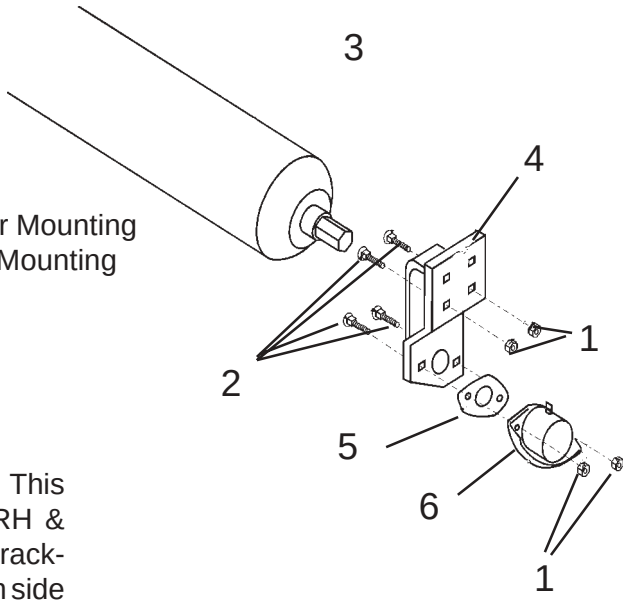
Rotary Head Optional Components

ITEM	PART NO.	QTY	DESCRIPTION
	02966070	**1**	**Guage Wheel Deep Deck Asy (Option)**
1	00001800	8	Nut, Toplock
2	00606000	1	Pin, Cotter
3	02892000	8	Bolt
4	02965675	1	Pin
5	02966238	1	Weldment Wheel Mounting
6	373024D	1	Hub Assembly
7	373024H	1	Tire and Wheel Asy
8	37302C2C	2	Bushing
9	5DR12160	1	Nut, Slotted

Gauge Wheel is optional order component, This assembly bolts to the side of the deck on the RH side skirt. Wheel assembles to bracket as shown.



ITEM	PART NO.	QTY	DESCRIPTION
	703262	**1**	**Roller Kit (Option)**
1	00001800	8	Nut, Toplock
2	000516	8	Bolt, Carriage
3	107784	1	Roller
4	107380	1	Weldment - Right Roller Mounting
	107182	1	Weldment - Left Roller Mounting
5	002037	2	Seal
6	703976	2	Bearing



Rear Roller Kit is optional order component, This assembly bolts to the rear of the deck on the RH & LH side skirt. Assemble Bearings and roller to brackets befor bolting brackets to side skirts. Holes in side skirt is for adjusting roller height up and down.

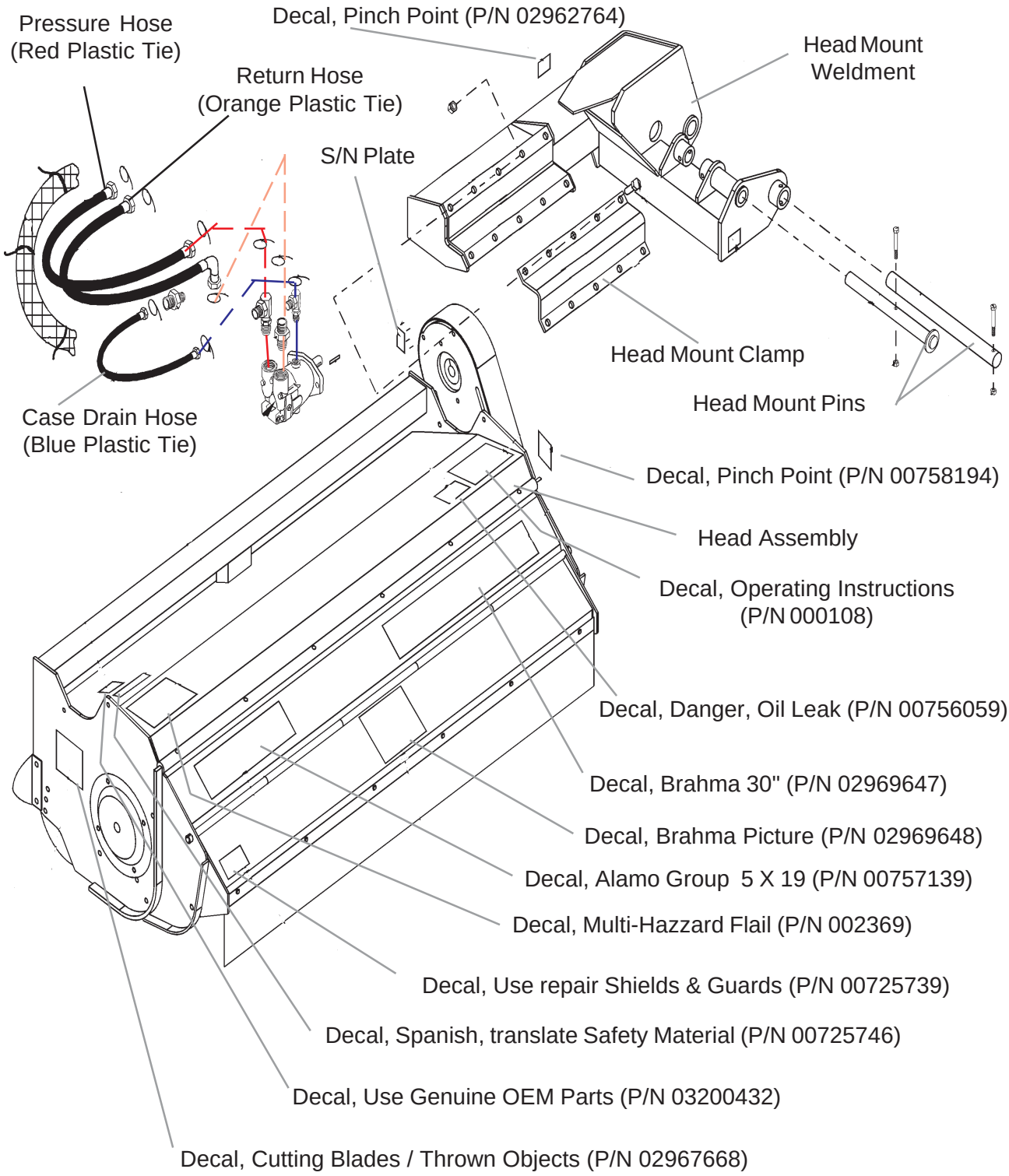
Section 10

BRAHMA

Flail Head Components

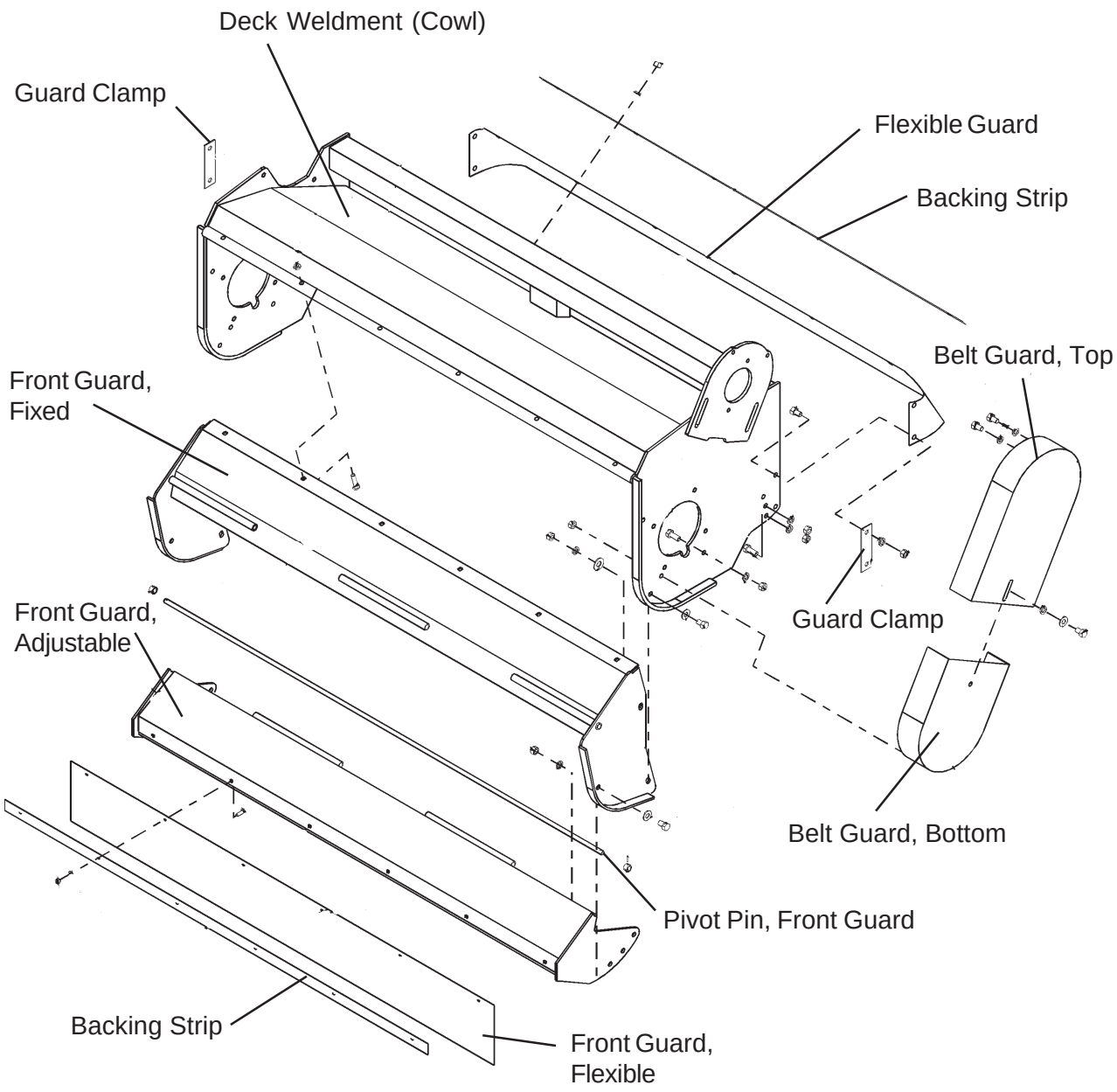
HD1500 & HD2000 Head

Deck Assembly (Flail Head)



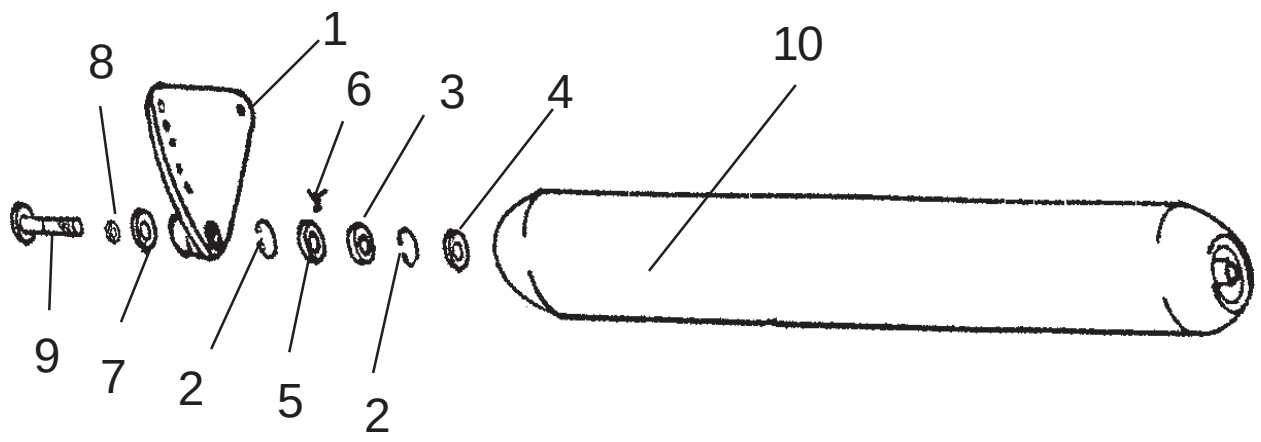
All Decals should be maintained to where they are readable, if they are not they should be replaced before operating the mower. Decals should be located as shown above for easy view by operator. All shields and guards must be installed and maintained in good condition before operating mower. If shields and guard are not installed or in good serviceable condition, do not operate mower until they are repaired or replaced.

Deck Sub-Assembly (Flail Head)



Shown Above is the deck subassembly with components un-assembled. Drawing above will not list Hardware (Nuts & Bolts) or subassembly part numbers, for sub-assembly part numbers see Parts Manual. Deck Weldment is shown without cutter shaft, rear roller or belt drive. These components are shown in the following pages. It is easier to install cutter shaft and roller before installing the above components.

Roller Asy (HD1500 & HD2000 Flail Head)

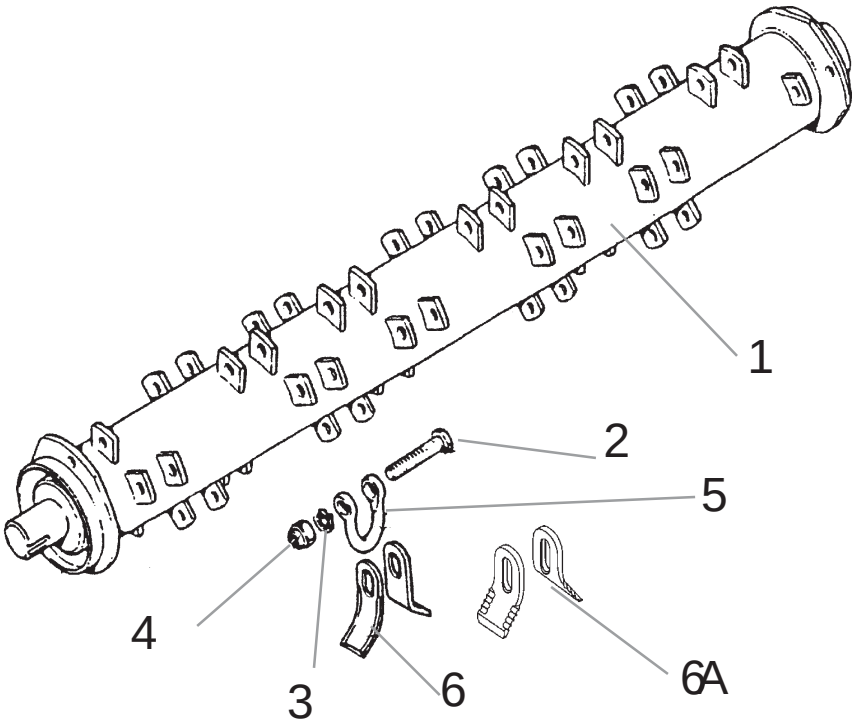


Item	Part No.	Qty.	Description
	72.740.02	**--**	**Roller Asy, Complete (for HD1500 Flail)**
	76.155.01	**--**	**Roller Asy, Complete (for HD2000 Flail)**
1	09.898.01	1	Bracket Left (Not Shown)
	09.898.02	1	Bracket Right (Shown)
2	05.959.05	4	Circlip
3	03.007.02	2	Bearing
4	04.164.04	2	Seal
5	41851.01	2	Flange
6	05.953.01	4	Grease Fitting
7	05.234.01	2	Washer
8	05.625.10	2	Setscrew
9	05.282.03	2	Spring Washer
10	09.878.05	1	Roller Weldment, (for HD1500 Flail)
	09.878.07	1	Roller Weldment, (for HD2000 Flail*)

Qty listed above for bearing and mounting brackets are for RH & LH end

Shown Above is the rear roller assembly. The bearings and mounting brackets need to be installed onto the roller before attempting to mount the roller to the deck. The rear roller is adjustable for height. The bolts that mount item one above has one single mounting hole and five adjustment holes. Install the single mounting bolt, then pivot the mounting bracket on the single bolt until the hole aligns in the series of holes this will give the desired roller height. Item 1 has a LH and a RH bracket and will not interchange from end to end.

Cutter Shaft (HD1500 & HD2000 Flail Head)

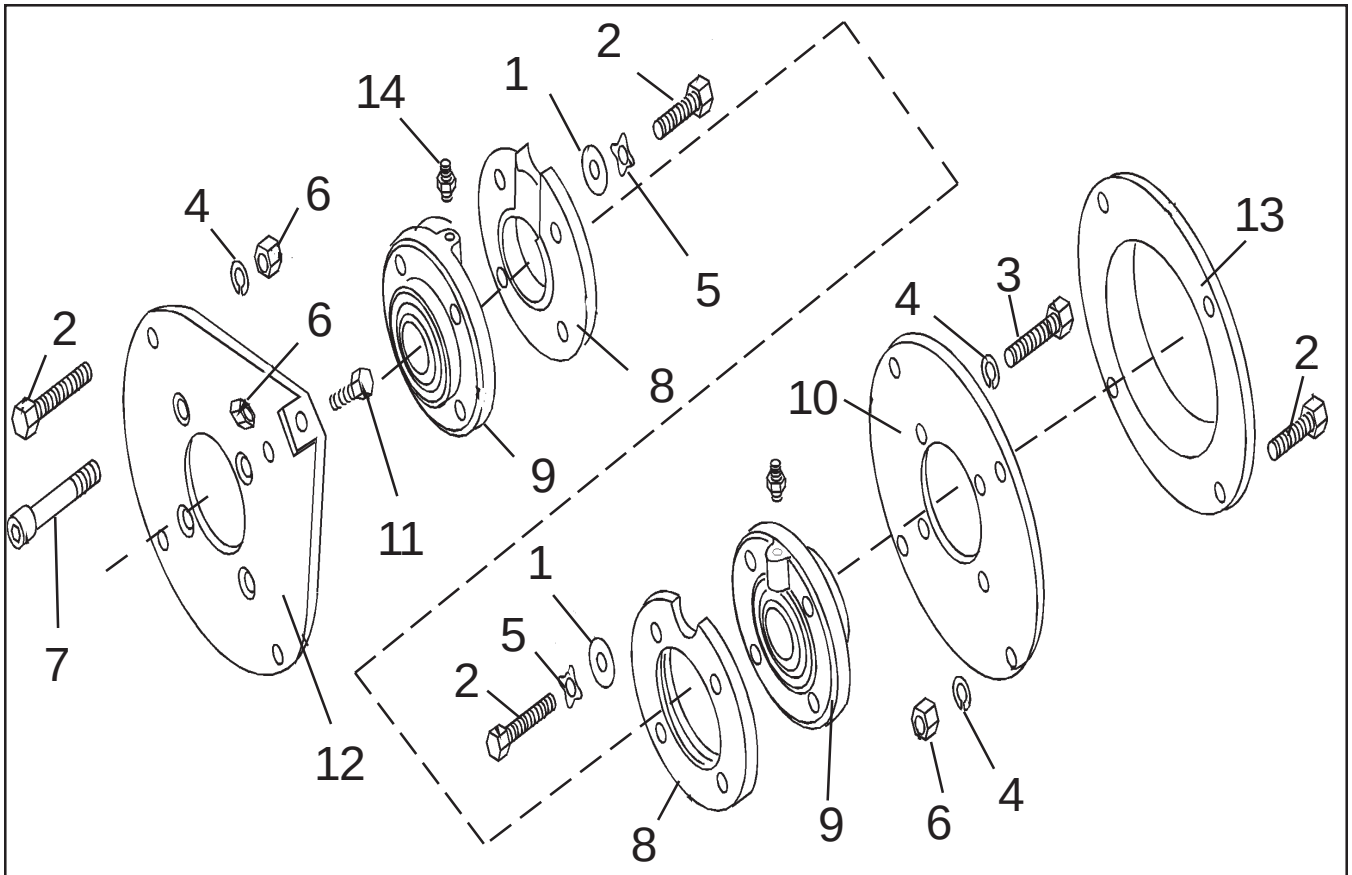


ITEM	PART NO.	QTY	QTY	DESCRIPTION
1	09.666.01	1	-	Shaft Asy 1500 Head
	41458.01	-	1	Shaft Asy 2000 Head*
2	05.775.10*	40	54	Bolt
3	05.282.08*	40	54	Washer
4	05.968.06*	40	54	Nut
5	09.517.01	40	54	Shackle
6	09.528.01	80	108	Flail
6A	02975613	80	108	Serrated Flail (Optional Knife)

* - P/N 41.167.01 Set Assembly

Shown Above is the cutter shaft and knife components. The cutter shaft has a LH and a RH end, the LH end will have a longer bearing shaft in it. The cutter shaft will have to be installed with the longer shaft on the LH side only. The Knives are hung from a shackle with a bolt and nut. The knives will hang from shackle. The knives are reversible, the knives has option of smooth or serrated edges. DO NOT mix knives with types as a weight balance problem may occur. When replacing knives do not use old and new knife on same shackle as this will affect balance. If to many knives are missing in one place or if to many knives are replaced in one spot this could affect shaft balance and cause unit to vibrate. If mower vibrates when running do not run mower until vibration problem has been repair, running mower with excess vibration will damage mower deck and components severely.

Cutter Shaft Bearing Asy (HD1500 Flail)

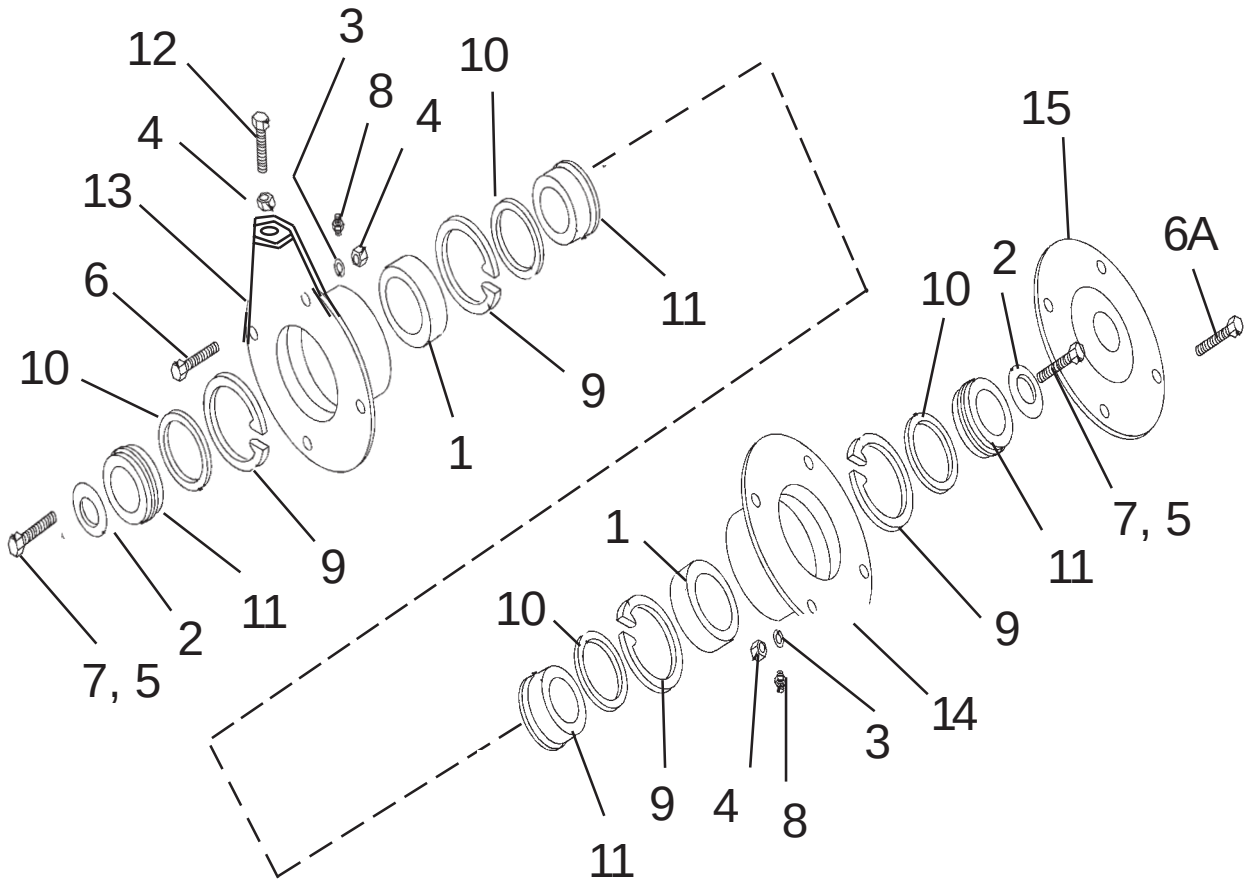


Item	Part No.	Qty	Description
1	02.824.01	2	Washer
2	05.264.23	10	Bolt, Hex Head M12 X 30 MM
3	05.264.25	4	Bolt, Hex Head M12 X 40 MM
4	9100206	12	Lockwasher, 12M (Replaces P/N 05.282.03)
5	05.283.03	2	Shakeproof Washer
6	05.286.03	10	Nut, 12M Plain
7	05.345.05	4	Bolt, Socket Csk M12-P1.75 X 40 MM
8	06.219.01	2	Disc-Shield
9	06.221.01	2	Bearing Asy
10	09.584.01	1	Plate - Bearing (Non Drive End)
11	09.585.01	1	Bolt - Adjusting (Drive End)
12	09.586.01	1	Plate - Bearing (Drive End)
13	09.588.01	1	Guard - (Non Drive End)
14	05.953.03	2	Grease Fitting

Installing the cutter shaft bearing is different from the HD1500 and the HD2000 head, check to make certain which you have before working on the cutter shaft. Note the drive end of the cutter shaft will have a longer bearing shaft than the non-drive end. The HD1500 has bolt together bearing housing and shield. The HD2000 Bearing is retained in the bearing housing with the circlips. If unable ti ID Flail head measure the cuter shaft length, HD1500 is 1500 mm cut (59") and the HD2000 is 2000 mm (78"), this will help ID Flail Head.

Cutter Shaft Bearing Asy (HD2000 Flail)

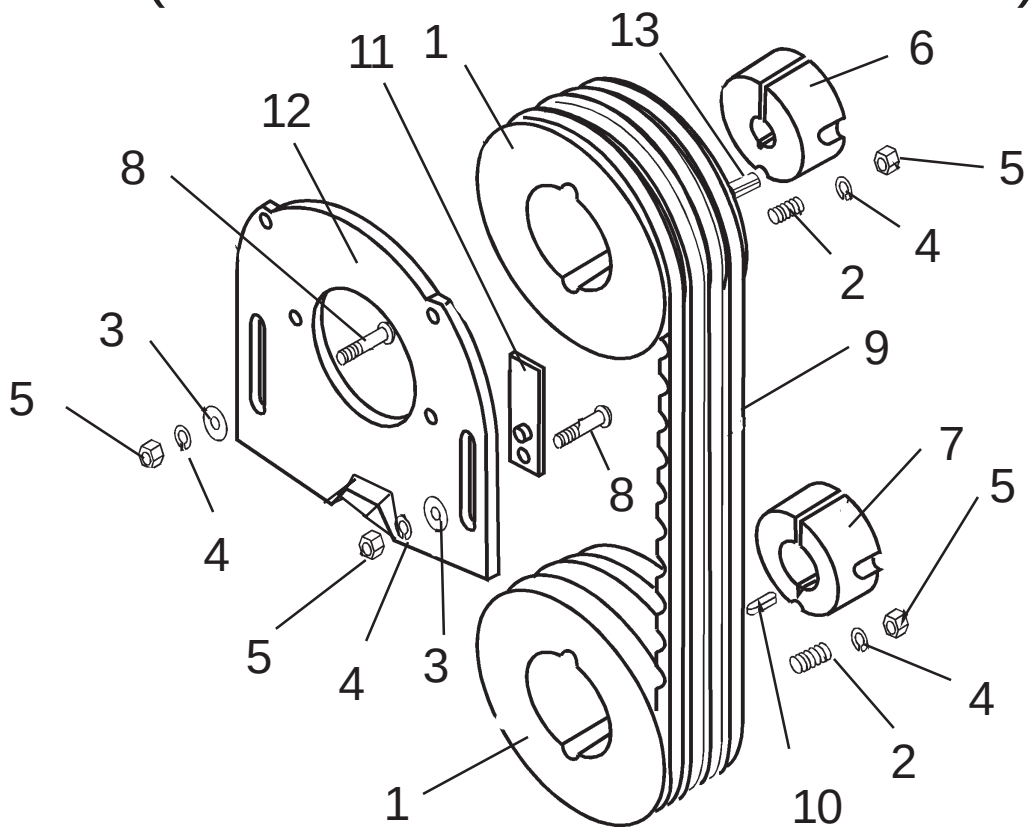
(HD2000 Flail Head)



Item	Part No.	Qty	Description
1	04.163.04	2	Bearing
2	04.252.01	2	Washer
3	05.282.03	8	Spring Washer
4	05.286.03	10	Nut, M12-P1.75
5	05.283.04	2	Washer
6	05.264.23	4	Bolt, Hex Head M12-P1.75 X 30 MM
6A	05.264.24	4	olt, Hex Head M12-P1.75 X 35 MM
7	05.264.33	2	Bolt, Hex Head M12-P1.75
8	05.953.03	2	Grease Fitting
9	05.959.07	4	Circlip
10	06.909.01	4	Seal
11	06.910.01	4	Collar
12	09.585.01	1	Bolt, Hex Head M12-P1.75 - (Adjusting Bolt)
13	41456.01	1	Bearing Housing, (Drive End)
14	41457.01	1	Bearing Housing, (Non-Drive End)
15	41461.01	1	Guard, (Non-Drive End)

Belt & Pulley Drive Assembly

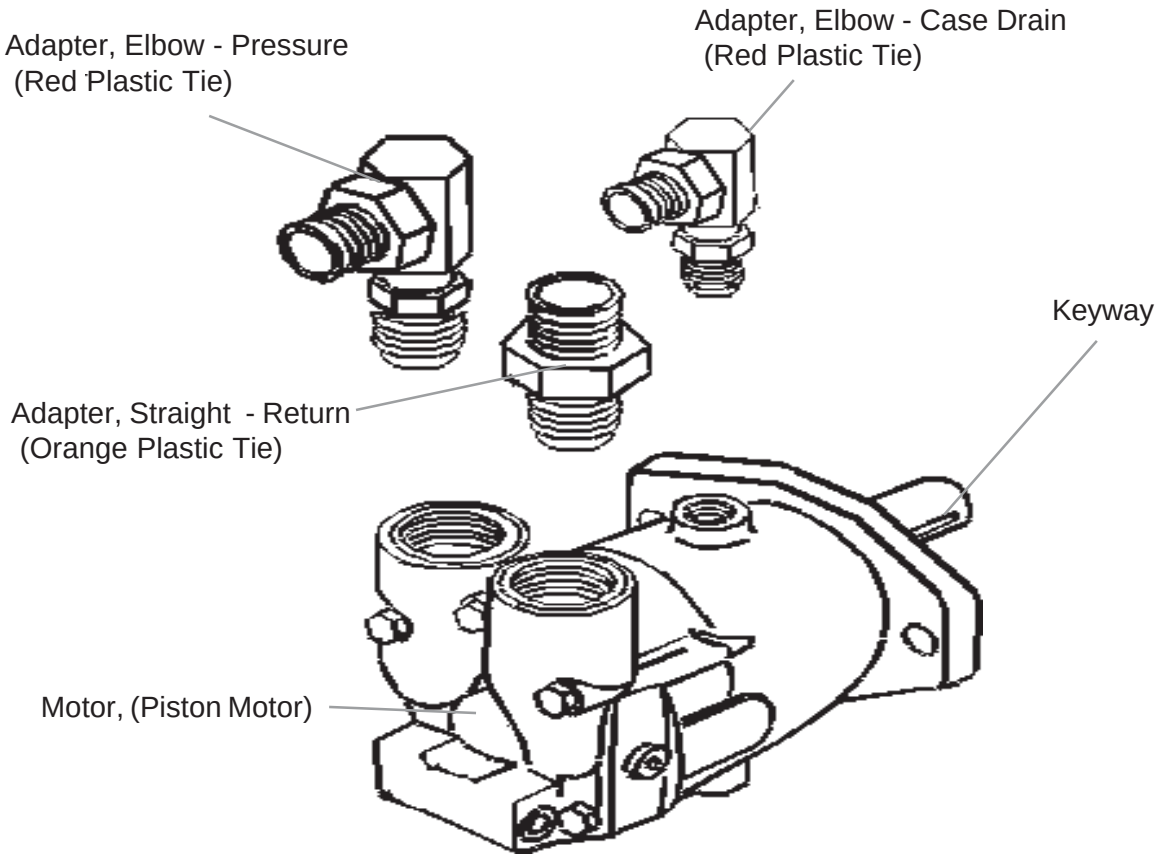
(HD1500 & HD2000 Flail Head)



Item	Part No.	Qty	Description
	76.154.01	**1**	**Pully Asy (for 1500 Head)**
	76.115.01	**1**	**Pully Asy (for 2000 Head*)**
1	03.795.02	2	Pulley
2	04.282.17	2	Stud
3	05.281.03	2	Washer
4	05.282.03	4	Spring Washer
5	05.286.03	4	Nut
6	05.424.02	1	Taperlock
7	05.424.18	1	Taperlock for 1500 Head
	05.424.17	1	Taperlock for 2000 Head*
8	05.625.12	2	Screw
9	05.299.53	3	Belt
10	05.960.16	1	Key
11	09.587.01	1	Plate - Cover
12	41342.01	1	Plate
13	02964954	1 ref	Key, Motor
14	09.589.01	1	Guard - Top (Top Half) Not Shown
15	09.590.01	1	Guard - Bottom (Bottom Half) Not Shown

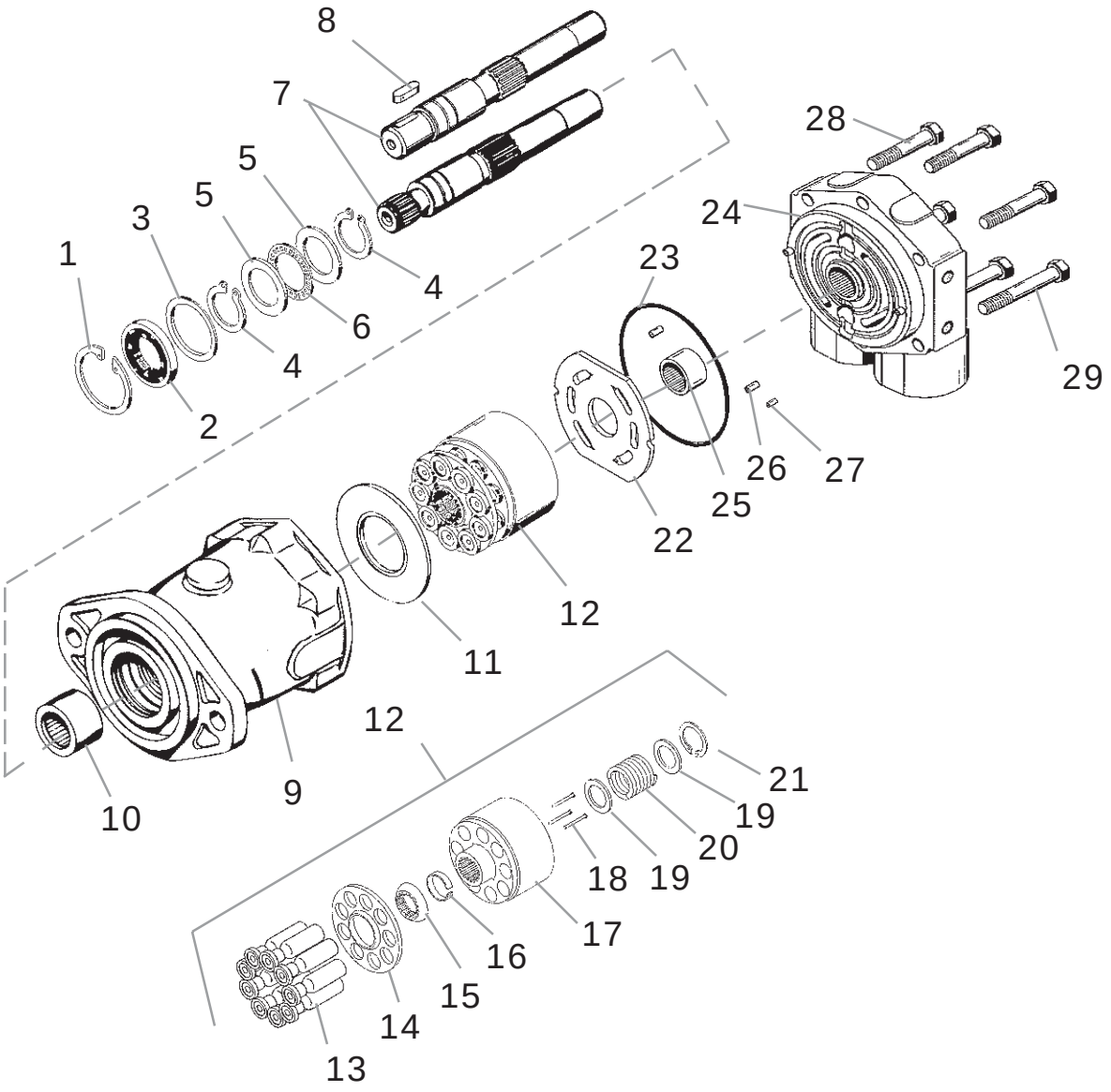
Motor - Hydraulic Fittings

(HD1500 & HD2000 Flail Head)



When flail head is shipped the motor is not assembled to it. The motor is shipped as a component and must be installed. The mower head will have a bracket bolted to it that supports the drive belt and pulley, this bracket bolts to the deck the same as the motor would and has the upper pulley and pulley taper lock attached to it. The belt cover will need to be removed, check to make certain the belt tension motor mounting plate is loosened so the belt tension can be released, this can be done by loosening the two plate mounting bolts and the belt adjusting bolt. Do not strike the motor mounting plate with a hammer as it could be damaged by the hammer. Remove the upper pulley taper lock and the upper pulley from the shipping bracket. Install the motor and re-install the belts, pulley and taper lock onto the motor. Note when connecting the hoses to the motor make certain the color code of plastic ties on the hoses are connected to the motor in the correct order.

Motor - Components (Flail Head)



NOTE:

Items 28 and 29 are two different length bolts, there are three of each length. The longer bolts item 29 go in where the ports are on the back plate, USE CAUTION DO NOT MIX up these bolts. These bolts must go back into the same holes they came out of.

* Item 1, 2, 4 & 23 are included in seal repair kits.

Motor - Components (Flail Head)

Item	Qty	Description
1.	1	* Retaining Ring
2.	1	* Shaft Seal
3.	1	Washer
4.	2	* Retaining Ring
5.	2	Thrust Race
6.	1	Thrust Bearing
7.	1	Driveshaft
8.	1	Key
9.	1	Housing Assembly (includes Item 10)
10.	1	Needle Bearing
11.	1	Camplate Insert
12.	1	Rotating Kit Assembly (Includes Items 13 thru 21)
13.	9	Piston Assembly
14.	1	Spider
15.	1	Spider Pivot
16.	1	Pin Keeper
17.	1	Piston Block
18.	3	Pins
19.	2	Washer
20.	1	Spring
21.	1	Retaining Ring
22	1	Valve Plate
23.	1	* O-Ring, 2.38 mm X 101.6 mm (3/32" X 4")
24.	1	Backplate Assembly (Includes Items 25 thru 27)
25.	1	Needle Bearing
26.	2	Roll Pin
27	1	Roll Pin
28.	3	Bolt, Hex Head (Short Bolt)
29.	3	Bolt, Hex Head (Long Bolt)

Note:* Items 1,2,4 & 23 are included it seal repair kit.

Motor Dis-Assembly & Re-Assembly Instructions:

The following pages explain the dis-assembly, inspection, cleaning and re-assembly of the hydraulic motor used on the Flail Head mowers. The item numbers referred to in this section will match to the drawing item numbers shown and listed on these pages. The motor assembly P/N 83 012 95 is the motor used as of the print date of this manual (05/05).

Motor - Dis-Assembly (Flail Head)

Hydraulic System Cleanliness:

Cleanliness is extremely important when repairing this motor or any hydraulic component. Work in a clean area, **before disconnecting hydraulic lines and /or remove motor assembly, the unit must be cleaned.** The fittings, motor, hoses and all areas around them must be cleaned. DO NOT disconnect any hoses and/or fittings while cleaning.

Tools Needed:

Tools recommended for Dis-Assembly and Re-Assembly

Item	Qty	Description
1.	1	1/2" Socket
2.	1	Rachet Wrench
3.	1	Torque Wrench, 68 N*m (50 ft. lbs)
4.	1	Soft Face Hammer
5.	1	Internal Retaining Ring Pliers (Straight 2.3 mm (.090 in.) Tip)
6.	1	External retaining Ring Pliers (Straight 1.8 mm (.070 in.) Tip)
7.	1	Seal Driver or Similar Tool
8.	1	Petroleum Jelly (Example Vaseline)

Motor Dis-Assembly:

1. When removing motor from the flail head. Clean the area around the motor, hoses and fitting completely. This will keep outside contamination out of the components. When the hoses and/or fittings are removed keep all hydraulic opening sealed (capped) to prevent contamination from entering hydraulic system. This is very important! When dis assembling the motor use caution not to damage the aluminum housing by scratching the interior or cracking the housing by tightening to tight in vise.

2. Clamp the drive shaft end of the motor in a protected jaw vise with the hex head bolts up. Remove the six bolts (item 28 & 29) making notice the length of the bolt removed and where it was removed from (remember these bolt are two different lengths and must not be mixed up when re-assembled).

3. Use a soft face Mallet and cautiously tap the backplate (item 24) to loosen and remove the backplate from motor housing. Make certain not to hit it so hard that the housing is damaged.

4. Remove Valve Plate (item 22) and O-Ring (item 23) from backplate. It is not necessary to remove roll pins in backplate.

5. Remove motor from vise and remove rotating assembly (item 12) from motor housing.

6. If pistons (item 13) did not come out with piston block, remove them along with spider (item 14) and spider pivot (item 15).

7. The dis-assembly of the piston block assembly (item 12) is not required unless the pins (item 18) or spring (item 20) are possibly damaged.

CAUTION: (Step 7)
The following procedure should be used if the spring is to be removed from the piston block. The spring (item 20) is highly compressed and the retaining ring (item 21) should NOT be removed without compressing the spring (item 20).

The following parts will be needed to dis-assmble the piston block:
2 ea. 3/8" ID X 1-1/8" OD Flatwasher
1 ea. 3/8"-NC X 3-1/4" Bolt, Hex Head
1 ea. 3/8"-NC Hex Nut

Place one flatwasher over the 3/8" X 3-1/4" bolt and place this through the center of the piston block (item 17). Place the other flatwasher over the bolt and let it rest on the three pins (item 18). Screw the 3/8" hex nut onto the bolt and compress the spring (item 20) inside the piston block (item 17). Use a pair of retaining ring pliers and remove the internal retaining ring (item 21). remove the nut, bolt and the two flatwashers. Remove the washer (item 19), spring (Item 20), second washer (item 19), three pins (item 18) and the pin keeper (item 16).

8. Remove the complete insert (item 11) from the housing (item 9). Use extreme caution not to mar the finish that makes contact with the pistons.

9. Remove retaining ring (item 1) from the housing. Press shaft (item 8) from housing (item 9) and remove shaft seal (item 2) and washer (item 3).

10. Remove retaining ring (item 4) from shaft, remove thrust washers (item 5) and remove thrust bearing (item 6).

11. Shaft Seals and O-Ring should be discarded and replaced with new ones when reassembly, save the old one for reference and size for comparison to new ones.

12. Inspect all bolt holes and outer housing ro cracks and/or other damage.

13. Inspect the ports for damage and all threads for damage.

Motor - Inspection (Flail Head)

Motor Inspection:

1. Check the condition of the needle bearings (item 25) in backplate (item 24) and replace if needed.

2. Inspect valve plate (item 22) on the bronze side next to the piston block for wear. A smooth surface is required. DO NOT lap valve plate bronze surface. Replace valve plate if any wear exist.

3. Inspect the piston block (item 17) surface that makes contact with the valve plate. This surface should be smooth and free of deep scratches. DO NOT lap piston block.

4. The pistons (item 13) should move freely in the piston block bore. If they are sticky in the bore, examine the bore for scoring or contamination.

5. Examine the OD of the pistons for finish condition. They should not show wear or deep scratches. Inspect the shoes for a snug fit on the ball end of the pistons and a flat smooth surface that comes in contact with the camplate. DO NOT lap piston shoes**.**

6. Examine the spider (item 14) for wear in the pivot area.

7. Examine the Pivot (item 15) to insure smoothness and no sign of wear.

8. The polished finish on the shoe surface of the camplate insert (item 11) should show NO signs of scoring.

9. Inspect the Shaft (item 7) for wear in the seal, bearing and spline areas.

10. Inspect thrust bearing (item 6) and washers (item 5) for wear.

11. Check the condition of the needle bearing (item10) in housing (item 9) and replace if needed.

12. DO NOT let the components of this motor lay out in the open exposed to dust and moister while waiting for parts. Clean all components and coat with light coat of approved hydraulic oil and store in clean sealed enviroment.

Motor - Re-Assembly (Flail Head)

Motor Re-Assembly:

1. The work area where the assembly process is to take place and all tools used in the assembly process must be clean and free of any contamination that might come in contact with the components. Clean all parts in suitable solvent (non-petroleum based recommended) before attempting any assembly. All parts must be dried of solvent, it is recommended to dry them with clean filtered compressed air. If any towels are used they must be a lent free type, any lent on the components can cause problems. Inspect all parts for serviceability during the cleaning process. Lubricate all the components after cleaning and drying with a clean coat of approved hydraulic oil.

2. If necessary to replace the needle bearing (item 10)., install new needle bearing (item 10) in housing (item 9) with Numbered End Of Bearing Outward.

3. Install retaining ring (item 4) on shaft (item 8). Install thrust washer (item 5), thrust bearing (item 6) and second thrust washer (item 5). Secure with second retaining ring (item 4).

4. Install the shaft (item 7) in housing (item 9). Install the washer (item 3), a new shaft seal (item 2) and retaining ring (item 1).

5. Install camplate insert (item 11) with the lettering side of insert to the front of the housing. Use petroleum jelly to hold in place during assembly.

6. If piston block was dis-assembled complete the following step: Compress the pin keeper (item 16) and install in the spline of the piston block. Install the three pins (item 18) with head end to the inside of the block and placed in the special grooves of the piston block spline.

7. Install the washer (item 19), Spring (item 20) and second washer (item 19) in the piston block. Use the two 3/8" ID washers, the 3/8" X 3-1/4" bolt and 3/8" nuts to compress the spring (item 20) and retain with the retaining ring (item 21). Make certain the retaining ring is seated correctly then remove the 3/8" bolts, washers and nuts that were used to compress the spring.

8. Install the pivot (item 15), spider (item 14) and the piston assemblies (item 13) on the piston block (item 17). Install rotating assembly (item 12) into housing assembly over shaft. The piston shoes MUST make contact with the camplate insert. Make certain all parts are in their proper position before proceeding further.

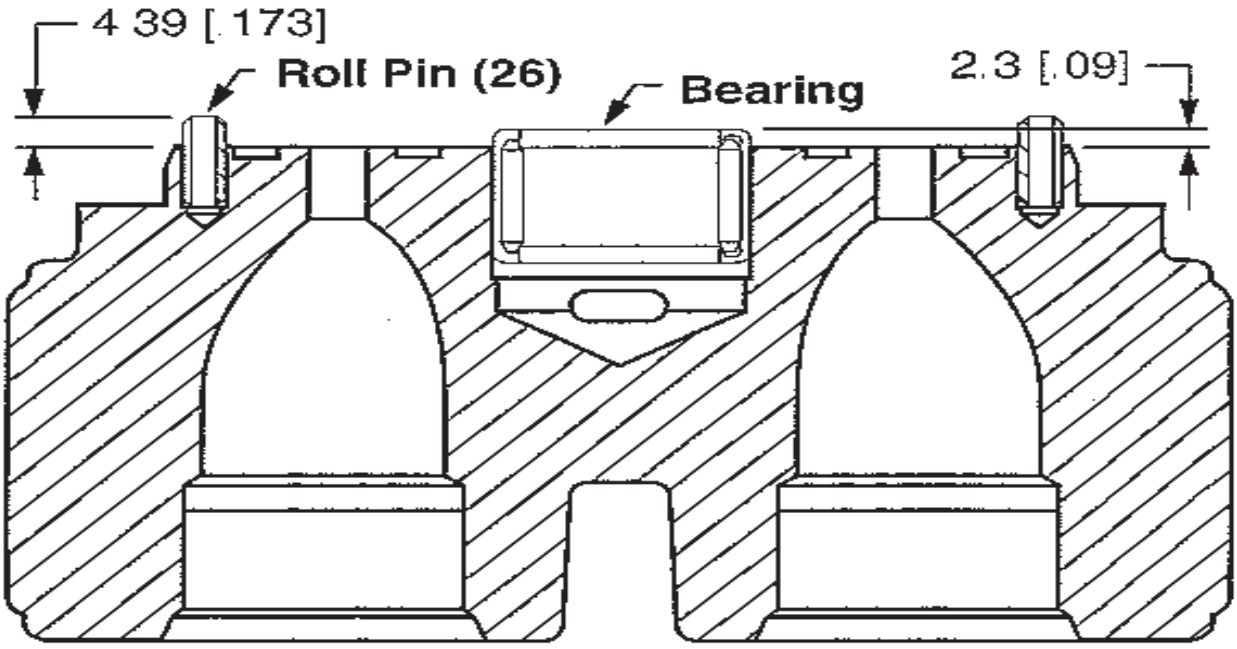
9. Clamp Motor assembly in a protected jaw vise with the open end up.

10. If roll pins were removed install them back into the correct holes (some times pins stay in housing and sometimes in the cover) so they will not interfere with each other. The roll pins must be installed to dimensions shown (See Figure showing Roll Pins & Cover on next page) and with opening of roll pin orientated away from needle bearing within 5 degrees of bearing center line.

Motor - Re-Assembly (Flail Head)

Motor Re-Assembly:

11. To replace bearing (item 25) in backplate (item 24). Press bearing down to the dimension shown protruding from back plate with number end of bearing facing up next to valve plate



Roll Pin and Bearing Installation

12. Apply small amount of petroleum jelly to the steel side of valve plate (item 22) to hold in place for installation. Place the valve plate (item 22) in position onto the back plate (item 24), with steel side against backplate, bronze colored side against piston block.

13. Placing new O-Ring (item 23) onto back plate, install backplate assembly (item 24) onto housing assembly (item 9). Make certain valve plate stays in position while installing backplate, if backplate is not sitting completely down on dowl pins it is possible valve plate slipped. Check this do not force back plate down with excess force as damage could result.

14. Insert the backplate retaining bolts (item 28 & 29), remember there are two different length bolts. Make certain the bolts are inserted into the correct holes. Tighten theses bolts in a criss-cross pattern in increments to 15 to 18 ft. lbs torque (20.3 to 24.4 N*m)

15. Fill motor case half full of approved hydraulic oil and re-install motor on mower head. Make certain to connect the hoses back the correct way or mower will run the wrong direction.

Motor - Trouble Shooting (Flail Head)

Trouble Shooting Suggestions:

In trouble shooting a pump and motor system it is necessary to isolate the pump from the motor. This will determine which unit is actually malfunctioning. A worn pump or motor will both give the same system indication. Therefore, it is advisable to first run a pressure and flow check on the pump. Making sure the pump is performing at its operating specifications. The following list of trouble shooting suggestions are based on the assumption that the pumps flow and pressure are found to be within operating specifications.

1. Problem: Motor turns while unloaded but slows down/or stops if load is applied:

A. Cause:..... Scored Valve Plate.
Correction:... Remove Backplate and examine bronze surface of valve plate; if scored, replace valve plate.

B. Cause:..... Scored or worn piston shoes.
Correction:... Dis-Assemble motor, examine condition of shoes on pistons' replace rotating kit assembly as a complete set. DO NOT lap pistons.

C. Cause:..... Low Pressure.

Correction:... Check relief valve for proper pressure setting; adjust or replace relief valve.

2. Problem: Motor will not run:

A. Cause:..... Severely Scored internal parts
Correction:... Dis-Assemble motor completely. Inspect all parts, clean all parts, replace all worn or damage parts. Flush hydraulic system if any evidence of contamination.

3. Problem: Motor will not hold load when system is in neutral position:

A. Cause:..... No Make up fluid from charge pump
Correction:... Check charge pump

B. Cause:..... Scored valve plate or piston shoes.
Correction:... Dis-Assemble motor and examine valve plate and piston shoes, replace as required.

4. Problem: Excessive case drain flow from motor:

A. Cause:..... Excessive internal wear in motor.
Correction:... Dis-Assemble motor, inspect parts and replace as necessary. Case drain flow should not 2 gpm (7.6 L/m) at full pressure.

NOTES

Section 11

BRAHMA

Possible Failure Causes & Solutions

Possible Failure Cause and Solution Section

NOTE;

This Section is written to give a POSSIBLE CAUSE of a problem and the POSSIBLE SOLUTION of a problem, it is also to aid in finding problems and to correct problems. There may be more than one cause to a problem as there may be more than one solution. Inspection and testing by you at the Unit site can diagnose these problems, This section cannot be used as absolute diagnose of a problem as well as not to give the absolute solution. It can only suggest where to check and what to repair.

General:

Cracks in mowing Decks or Booms can be generally attributed to Severe Usage and/or Vibration caused by an imbalance in the rotating parts. It should be remembered that vibrations occur as a result of operation when cutting Heavy Material or hitting stationary object that cause a component to bend, break or lose pieces etc. In some cases it may be the result of a design or application, this is something that will have to be determined through investigation of circumstance.

Simply welding up a Crack will not usually yield a satisfactory repair; simply welding may cause another weak spot during welding process. The condition that caused crack may still be present. It is usually advisable to grind down the weld and add a plate over the weld to span the site of the original crack.

Adding a reinforcing piece (or Extra Brace) may not be as good as it sounds a number of reasons this is not advisable. Because you could be making an area that needs to flex some to relieve stress is being eliminated; the added weight may change the balance of unit or component.

A good suggestion for future reference is to take photos of cracks (Failures) before the repairs are made; this will aid you in future failures to see what happened in the past ones. This is a good idea because the failed area may not always cause the failure, it may be caused by something else and it is sometimes hard to explain what the failure looked like before it was repaired.

Always repaint any area that has been re-welded to prevent rust as well as cosmetic appearances.

POSSIBLE FAILURE / CAUSE & SOLUTION

SUB - INDEX

Control Valve Spool or Spools Sticking

CAUSE: **Control Valve Bolted to Mounting Plate Incorrectly?**
SOLUTION: Loosen bolts and re-tighten 1 turn at a time using a criss-cross pattern. The Valve Body can be placed in a bind if the mounting bolts are tightened un-evenly. This can cause the Spool to stick in the bore or cause the Valve to leak internaly.

CAUSE: **Contamination in Valve Spool?**
SOLUTION: Find Contamination source and correct it, Clean Valve, Change Filters, Replace Oil (if required to remove contamination), Re-Assemble and Test.

CAUSE: **Faulty Valve Spool or Section?**
SOLUTION: Replace Valve Section, If the valve Section is defective, The Malfunction will most likely occur immediately after being placed in service. If the Unit has been operating for sometime, the problem is most likely to be a failure not a defective part there fore more checking maybe needed to determine why the Valve Spool failed.

Cylinder Excessive Drift:

NOTE: All Cylinder Hydraulic Systems have some amount of drift or leakage in the system. All parts have tolerances and all parts Must have clearance in order to function. Clearance necessary to allow the part to function also results in some internal leakage. Cylinder Drift can also be refered to as "Leak Down" or "Settling", In most cases, the cause of Cylinder Drift will be found in the Cylinder, Valve (s) or Lines. Components have a different leakage rate. Reducing the amount of drift also has its drawbacks. "Tight" components are very sensitive to contamination, Seizure due to high operating temperatures, Seizure due to contamination. Valves have a tight clearance, restrictors have small openings. Leaking External Lines cause Cylinder Drift but this is the easiest problem to correct as it is the easiest type to find. There fore most causes listed below will deal with Internal Leakage. See "Cylinder Drift Rate Chart" in Specification Section of Product Repair Manual to determine if drift rate is excessive. See Cylinders Leak Section for Cylinder leak Problems.

CAUSE: **Cylinder Pistons Seals Bypassing?** Dual Function Cylinders have 2 lines and have pressure both ends, Single Function Cylinders have 1 line and pressure on one end and Vent Plug on other, Piston bypass in Single Action Cylinders it will not require this test, If they leak the Oil will leak out of Vent Plug.

SOLUTION: Raise load and support it safely. Drain Pressure off Line after Load is supported and before removing any lines. Drain Pressure can be done with Tractor "Off" and open valve to lower Load. Remove and solidly plug lines to the Cylinder. Remove Load Support (Hoist will be reqiured), Document the time it takes for the load to drift down. (See Cylinder Drift Chart) If the Piston Seal is cause of excessive Drift down this will tell you. Reseal or Repair Cylinders as required. Note Piston Seal bypass can be caused by damaged Seals, oversized or worn Cylinder Bores. Some Cylinders don't function through out the intire length of their stroke, So the oversize wear could only be in part of the bore, When checking Bore size it is recommended to check entire length of Bore if the length of stroke is not known.

CAUSE: **Work Port Relief Valves Not Seating Properly?**

SOLUTION: Test Cylinders for Bypassing as above. If OK, Leakage must be occurring in the Control Valve Spool or Work Port Reliefs (if Equipped). Suspend the Load with the Cylinders and place Valve Lever in "Hold" (Neutral / Centered) position. Use a "Stethoscope" Tool (or equivelant), Listen to the Valve Body next to the Work Port that is suspect. The Oil will be making a shrill whistling sound as it leaks past the Work Port Poppet. If Leakage is evident, Lower the Load and inspect to Work Port Relief Valve, replace if needed.

Cylinder Excessive Drift: (Continued)

CAUSE: **Leakage Past Control Valve Spool?**

SOLUTION: If excessive Cylinder Drift is confirmed and the Cylinder and Work Port Relief Valves have been eliminated, The possibility is the Control Valve Spool itself. If clearance between the Control valve Spool and Body are causing the drift, the Only Solution is to replace the Valve Section. Keep in mind that the cause for excess clearance must be found and corrected. Frequently the cause is pre-mature wear from abrasive material (Contamination) in the Oil. If this is not corrected failure will re-occur.

CAUSE: **Abrasive Contamination In Oil?**

SOLUTION: Abrasive Contaminants (Dirt, Iron Particles, Clutch Disc Material etc.) in the Oil Sump / System is a major contributor to all of the above internal leakage problems. It is especially likely if the Positioning Hydraulics are using Oil from the Tractor Hydraulic System. If the Tractor Hydraulic System is not properly maintained, Materials from Gears, Clutch Disc and Etc. can enter the Control Valve and Cylinders causing excessive Pre-mature Wear. If Abrasive material Wear is found the complete system Should be flushed and cleaned. On Some Later Models an additional Filter System has been added as additional Filtering of Tractor Hydraulic Oil. But even this add on Filter, if not maintained, will run through the Filter Bypass and contaminate System. KEEP FILTERS CLEAN and/or Replace on a good Maintenance Schedule.

CAUSE: **Electrical Short Circuit?**

SOLUTION: Electrical short causing controls to emit electrical current even though controller is in neutral position. Check all wire connections and try to determine where electrical short is, Repair or replace as needed. Usually this type of problem will allow drift to be rapid unless Short is through Joystick controller, There should be no electrical current when Valve and Joystick are in centered (neutral) position

Cylinder Leaks At Fittings:

CAUSE: **Loose or Wrong Fittings?**
SOLUTION: Make sure correct Fittings are installed and are torque to correct specification. Boss Fittings may have damaged O-Ring, Check and repair as required.

CAUSE: **Port Cracked at Fitting?**
SOLUTION: Repair or Replace Cylinder and/or Fitting. This type failure is more common on Cylinders with Pipe Fittings than the ones with O-Ring Boss Fittings. The reason is because the Pipe Thread is tapered and can be over tightened and the tapered thread acts as a wedge. Don't over tighten any fittings, Don't use Teflon tape at all, if using a Semi Liquid Pipe Thread Sealer Don't put excessive amount on fitting and Never put sealer into ID of Port, It will get into system and contaminate it.

CAUSE: **Deformed or Damaged Fitting?** (JIC)
SOLUTION: Replace damaged Fittings and/or Hose, Over tightening of JIC Fittings can deform the Flares on the Fitting and create leaks. See Torque Specification for proper Torque Values.

Cylinder Leaks Around Rod:

CAUSE: **Faulty Seals On Cylinder Gland?**
SOLUTION: Dis-Assemble and Re-Seal Gland. Seals can be damaged by foreign objects, or worn by abrasive material such as Dirt getting into Seal and/or Rod. Seals can also be damaged during Assembly and this type of damage will almost always show up shortly after being put in service.

CAUSE: **Damage To Cylinder Rod?**
SOLUTION: Determine the cause of the Damage, Dent, Scratch, Rust and/or something stuck to Rod. The Damage and cause should always be identified and corrected before any repairs are made, Repairing the failure and leaving the cause will result in more failure. In Some cases a Cylinder Rod can be cleaned up with CROCUS CLOTH (a very fine abrasive material), DO NOT USE anything more abrasive than crocus cloth. A major problem for cylinders is storage when unit is not being used for a while, The Rods are a chrome alloy but if subjected to moisture long enough they will rust, This is not a problem when being operated as they are be cleaned with every in and out stroke. If Unit is going to be stored for an extended time you can coat Rods (Exposed Part) with Oil or Grease to protect them, But If you do this it must be cleaned off before running to remove the Dust that will have collected on rod from Oil and grease.

CAUSE: **Cylinder Rod Bent?**
SOLUTION: Determine and correct cause of bent Rod, Replace Rod and Re-Seal Cylinder.

Cylinder Moves On Its Own: (Under Power)

CAUSE: **Control Valve Spool Stuck?**
SOLUTION: Locate stuck Spool, repair or replace Spool, Determine why Spool is stuck, Debris, Foreign Objects, Contamination, Broken Spool Components and etc. If just the Spool is replaced and the reason it failed is not corrected, it will fail again.

CAUSE: **Return Spring Broken in Control Valve?**
SOLUTION: Repair or Replace Spring, Determine why it broke.

CAUSE: **Binding of Control Cables or Linkage?** (Remote Cable Control Models)
SOLUTION: Determine cause of Cable Binding or Sticking, repair or replace as required. Sometimes it may be the Linkage sticking or binding and not the Cable, It may be required to disconnect Cables from Linkage to determine which is sticking, If it is the Linkage repair as needed. Cables may stick because of internal abrasion inside calve Housing, Some times this damage is not visible.

CAUSE: **Controller Not Returning to Center?** (Electronic Joystick Control Models)
SOLUTION: Test Joy Stick Controller as shown in Repair Manual, Repair or Replace as needed. Note: Do Not replace Joystick till Test have been performed to eleminate other possible failures, Other Malfunctions can appear like Joystick Failures.

CAUSE: **2 Way Radio RF Interference?** (Models will Electronic Controllers)
SOLUTION: Radio Frequency interference is a common problem with all electronic controllers in all equipment and vehicles. Normally keying the microphone of the radio will result in some unwanted or unexpected operation. In the case of a boom mower on of the boom functions may slowly begin to move.
The resolution of this problem requires that power to the controller be disconnected when operating the radio. To accomplish this, simply switch off the power switch on the controller box prior to using the radio.
This may affect Tractors that are equipped with two way radios and when using radio to send, When Radio Receives there should be no interference.

Cylinder Moves Wrong Way:

(Opposite of direction it should per Control Movement)

CAUSE: **Hoses Routed incorrectly?** (On New or Repaired Units)
SOLUTION: Route hoses per Hose Diagram in Parts Manual.

CAUSE: **Incorrect Valve Operation Plate?** (On New or Repaired Units)
SOLUTION: Replace with correct Plate.

Cylinder Moves Wrong Way: (continued)

CAUSE: **Wire Harness improperly connected?** (On New or Repaired Units with Joystick)
SOLUTION: Change connectors to other solenoid valve on Same Circuit and test. Applies to Old Apitech valve Models (Ten Connector Wiring harness 5 on each side of Valve,)

CAUSE: **Confusion On Direction Travel of Joystick or Switch Application ?**
SOLUTION: The Function of Joystick is specific to type or combinations of movement that is made to perform that function, If the system was not connected correctly when first assembled the the movements may not match what is expected. See Operators Manual, Parts Manual or Repair Manuaul for what action or combination of actions should operate what function.

Cylinder Moves Intermittent: (All Functions)

CAUSE: **Obvious Causes Check First?** (Check These First)
SOLUTION: Perform all Operational checks, Tank Oil Level , Pump Operation, Control Valve Circuit (Electrical Supply & Hyd Supply), All Circuits affected or only some Circuits. If All Circuits will not work the Problem is most likely up-stream of the control Valve or an electrical Problem (Models with Joystick Controller). The Following Causes are based on Only some circuits being affected, Not all Circuits.

CAUSE: **Load Sense Signal Not Reaching The Tractor Pump Control?**
SOLUTION: Remove, Inspect and clean Signal Lines from Control Valve to Priority Valve. Check all orfices to make sure they are clear. Note: it is not unusual for the debris to drain out of system with the Oil when the pressure is released or the lines are removed. Everything can appear clear then be pushed back in when pressure is applied or it may never return, this can be a difficult malfunction to find as well as correct. This means even though it was checked once it does not mean the problem is not there.

CAUSE: **Low Oil Level In Tractor ?**
SOLUTION: Fill to Proper Level with recommended Oil. See Specification Chart for recommended Oil type.

CAUSE: **No Voltage to Joystick Controller?**
SOLUTION: Check for Voltage to Controller. repair or replace as required, Wiring, Fuses, Switches, etc.

CAUSE: **Faulty Joystick Controller ?**
SOLUTION: Check for Voltage output from Controller. With power to Controller and Joystick function actuated, Check for Voltage at Harness end of Solenoid Valve Connector for that function that is actuated. If there is no Output Voltage from Controller, check Controller End of Harness, If still no Voltage Repair or Replace Controller as needed. If Voltage at Controller then check Harness and Repair or Replace as needed. (see pages 56 and 57 trouble Shooting / Testing)

Cylinder Moves Intermittent: (continued)

CAUSE: **Faulty Tractor Hydraulic System ?**
SOLUTION: Perform Hydraulic ? Electrical isolation Test. If Tractor System is at Fault, Trouble Shoot and Repair Tractor per Tractor Manufactures Guidelines.

CAUSE: **No or Low Pilot Pressure?**
SOLUTION: Check Pilot Pressure. Test, Adjust or Replace Pilot Pressure Valve as required

Cylinder Moves Spongy or Jerky:

CAUSE: **Air in Oil?**
SOLUTION: Run the System for a few minutes. Check for Air in the Oil in the Tank. Air entrained Oil will have a foamy appearance. If Air is present, find the Air Leak and correct it. Air Leak can be in the Suction Line and Oil may not leak out because there may only be Oil in that location when the Pump is sucking it in. With the Tractor Engine "Off" you can find a leak by pressurizing the Tank, This will not take but a few pounds of pressure (3 to 5 PSI or less). Look for leakage in the Suction Lines, Because the Oil Pick-Up is lower than the Oil Level this will force Oil out the leak. Leaks in Hoses and at Fittings can draw Air into System as Oil Flows Past. Systems that have had severe or prolonged Air Entry Problems may have Experienced Pump Damage.

CAUSE: **Air in the Cylinders?**
SOLUTION: Remove Air from Cylinders by Bleeding the System. Operate Cylinders and Hold at maximum stroke for several seconds. Repeat several times to purge Air from Cylinder. Repeat for other Cylinders till condition no longer exist.

CAUSE: **Wrong Type of Oil?**
SOLUTION: Fill to Proper Level with recommended Oil. See Specification Chart for recommended Oil type. If changing Oil in Old type Unit always use most recent recommended Oil Type but do not mix types of Oil.

CAUSE: **Cold Oil?**
SOLUTION: Run Unit at low Speed until Oil warms up. If Oil is to cold and flows slowly it can cause Cavitation, this will damage Pump. DO NOT Operate if Oil is so thick that you have this problem, wait till it warms up or move unit To a Building where Oil can warm up before operating.

CAUSE: **Faulty Pump Drive?**
SOLUTION: Inspect Pump Drive Components for wear and damage, or other reason pump May not run smoothly. If Pump is not smooth then Pressure will not be steady causing surges in pressure.

CAUSE: **Work Port Relief Set Too Low for Application?**
SOLUTION: Install proper work Port Relief. If the Pressure needed to operate the function Can exceed the setting of the valve in certain positions, it will cause the Oil to bypass, causing jerky movement of the function.

Cylinder Moves, Some Functions Work, But Not All:

CAUSE: **Faulty Joystick Controller?**

SOLUTION: Check Output voltage at the harness end connector for the affected Function, (Switch ON, Engine OFF, Joystick Function Actuated). If No Voltage is present, Check Harness, If Harness is OK, Repair or Replace Controller as needed. (See Page 56 and 57)

CAUSE: **Obvious Causes Check First?** (Check These First)

SOLUTION: You may have enough Oil to operate one function but not all because Some Cylinders will require more volume than others will. Perform all Operational checks, Tank Oil Level, Pump Operation, Control Valves Circuit (Electrical Supply and Hydraulic Oil Supply), All Circuits affected or only some Circuits. If All Circuits will not work the Problem is most likely up-stream of the control Valve or an electrical Problem? (Models with Joystick Controller). The Following Causes are based on Only some circuits being affected, Not all Circuits.

CAUSE: **Faulty Solenoid Valve?**

SOLUTION: If Pilot Pressure is present with engine running, Voltage is delivered to the Coil and/or Module, the function operates manually but not Electrically, it is likely that the valve is the Problem. Repair or replace as needed.

CAUSE: **Control Valve Bolted to Mount Plate Incorrectly?**

SOLUTION: Loosen Bolts and retighten 1 turn at a time using a criss cross pattern. The Valve Body can be placed in a bind if the mounting bolts are tightened incorrectly. This can cause the Spool to stick in the Bore or results in Internal Valve Leakage.

CAUSE: **Contamination in the Valve Spool?**

SOLUTION: Clean Valve, Check complete System for contamination, Flush and Clean as required. Reassemble and Test.

CAUSE: **Faulty Valve Spool or Section?**

SOLUTION: Determine what caused Valve Spool to be Faulty, is it a failure or a defect, A Defect usually shows up soon, Failure can be any time. If Defect Repair or Replace as needed, If Failure determine cause of Failure, Repair Failure cause and Repair or replace Spool Section.

CAUSE: **Faulty Control Module?** (electric over hydraulic new style (5 wire) valve only.

SOLUTION: Valve control modules may develop one of two modes of failure:

1. Water damage: In this case condensation will develop in the circuit board cavity of the controller and result in a short. With this mode, the controller will stop working in one or both directions and will very seldom regain function.

2. Thermal Fatigue: This failure will be identified as a module which performs adequately when cold but will stop working in one or both directions as the unit warms up. This is caused by fatigue of the wire strip located inside the module. Identify the signal wire from the joystick attached to the faulty segment of the valve (swing, lift, dipper, etc). Use a phillips screw driver to remove the wire. Remove the wire attached to the module next to the faulty segment and swap the two wires. If the problem moves to the new location, the problem is in the Joystick or harness. If the problem continues in the affected valve segment, replace the module.

Cylinder Won't Move At All: (No Power)

CAUSE: **Obvious Causes Check First?** (Check These First)
SOLUTION: Perform all Operational checks, Tank Oil Level, Pump Operation, Control Valve Circuit (Electrical Supply & Hydraulic Supply), All Circuits affected or only some Circuits. If All Circuits will not work the Problem is most likely up-stream of the control Valve or an electrical Problem (Models with Joystick Controller). The Following Causes are based on only some circuits being affected, Not all circuits.

CAUSE: **Incorrect Hose Routing?** (Unit has never worked or been repaired)
SOLUTION: Check Hose Routing with Parts Manual and Assembly Guide to make sure Hoses are routed correctly. Move and reconnect Hoses as required.

CAUSE: **Work Port Relief Installed Improperly?** (Unit has never worked or been repaired)
SOLUTION: Determine correct positioning of Work Port Relief's. If relief's are incorrectly installed, Install correctly and Test.

CAUSE: **Work Port Relief Malfunction?**
SOLUTION: Determine if one or both sides are affected. Make sure Work Port Relief's are in proper position, Swap Hoses with another circuit or swap Work Port relief's with another circuit to determine where problem lies. Repair or replace faulty Parts as required.

CAUSE: **Control valve or Remote Control Malfunction?**
SOLUTION: Observe actuation of Valve Spool in relation to Control Lever. Repair any faults.

CAUSE: **Restrictions in System?**
SOLUTION: Look for Kinked, Plugged, Pinched Hoses or Lines. Observe as Cutting Head is moved throughout its range of movement. Do not forget the possibility of foreign objects being lodged in Restrictors, Hoses, Tubes, Fittings and/or Lines

CAUSE: **Piston has come off of Rod?**
SOLUTION: This can be difficult to diagnose, if the Piston comes completely off of Rod it can be pushed to bottom of Barrel below Port, Then Oil just circulates around through Piston with little or no resistance, This makes it appear there is no Pressure or valve is not working. The best way to check would be with a Flowmeter in Cylinder Line. Check, Repair or Replace as required.

CAUSE: **Vent Plug Block or Not Installed?** (Power One Way Cylinders)
SOLUTION: This applies to Cylinders that only Stroke in or Out under pressure, The return Stroke under gravity. Remove Plug, Clean or Replace as needed. If No Vent Plug is there determine if one is needed and install as required. (See Parts / Operators Manual for Vent Plug requirements).

Cylinder Won't Move Under Load: (Moves Slowly)

CAUSE: **Obvious Causes Check First?** (Check These First)
SOLUTION: Perform all Operational checks, Tank Oil Level, Pump Operation, Control Valve Circuit (Electrical Supply & Hydraulic Supply), All Circuits affected or only some Circuits. If All Circuits will not work the Problem is most likely up-stream of the control Valve or an electrical Problem (Models with Joystick Controller). The Following Causes are based on only some circuits being affected, Not all Circuits.

CAUSE: **Incorrect Hose Routing?** (Unit has never worked or been repaired)
SOLUTION: Check Hose Routing with Parts Manual and Assembly Guide to make sure Hoses Are routed correctly. Move and reconnect Hoses as required.

CAUSE: **Work Port Relief Installed Improperly?** (Unit has never worked or has been repaired or worked on)
SOLUTION: Determine correct positioning of Work Port Relief's. If reliefs are incorrectly installed, Install correctly and Test.

CAUSE: **Work Port Relief Malfunction?**
SOLUTION: Determine if one or both sides are affected. Make sure Work Port Relief's are in proper position, Swap Hoses with another circuit or swap Work Port relief's with another circuit to determine where problem lies. Repair or replace faulty Parts as required.

CAUSE: **Control valve or Remote Control Malfunction?**
SOLUTION: Observe actuation of Valve Spool in relation to Control Lever. Repair any faults.

CAUSE: **Restrictions in System?**
SOLUTION: Check Hoses and Lines for Kinks / Obstructions. Hoses have an inner lining that can turn loose and block a hose. If Assembly or Repair work has been performed, recheck all connections for correct location. Some may not be visible without some dis-assembly. Unplanned restrictions cause increased backpressure, loss of usable power, excess Heating of Oil and failure of Shaft Seals.
Restrictions can sometimes be found by measuring the temperature of the Oil (or fittings) at various points in circuit as heat will usually be higher at the restriction. The restriction should be located at or upstream of the increased temperature point.
Restrictions are sometimes caused by foreign objects that get into the system, This can happen during servicing, maintenance or repairs. It is not uncommon to find bolts, nuts, plastic plugs, paper or rags stuck into system when it was being repaired or assembled then forgotten about.
Restrictions sometimes can be a piece off of a failed component up stream or a Component such as a Hose built wrong.

Cylinder Won't Move Under Load: (Continued)

CAUSE: **Piston has come off of Rod?**
SOLUTION: This can be difficult to find, If the Piston comes completely off of Rod it can be pushed to bottom of Barrel below Port, Then Oil just circulates through Cylinder with little or no resistance, This makes it appear there is no Pressure or valve isn't working. The best way to check would be with a Flowmeter in Cylinder Line. Check, Repair or Replace as required.

CAUSE: **Restrictor Valve Installed in Wrong Line, Backwards or Plugged?**
SOLUTION: Determine the correct location of installation for Restrictor and make sure it is in correct location. Inspect for being Plugged, Clean or Replace as needed.

CAUSE: **Excessive Internal Leakage in Pump / Motor?**
SOLUTION: Perform Flow and Pressure Test. If results aren't within Specifications, determine the cause of the internal leakage, correct the cause. Replace worn or damaged parts. It is good to replace the Filter any time the Pump and/or Motor are repaired or replaced. Pump and/or Motor wear usually occurs over a long period and are gradual loses of power and excess heating of Oil. This may go un-noticed until it is severe making the operator think it just started, this can make this type of failure hard to determine. Pre-Mature Pump and/or Motor Failure wear occurs quickly, The problem for these failures must be found and repaired or the failure will be repetitive. The Most common cause of Pre-Mature Failure is Cavitation, Oil Contamination, Oil Aeration and/or Defects in Pump and/or Motor. MACHETE SPECIFIC, When performing the Flow Test on the Machete, The flow going to Motor and either the return from the Motor or the Case drain must be determined. These figures will indicate internal leakage in the Motor.

CAUSE: **Air in Oil?**
SOLUTION: Run the System for a few minutes. Check for Air in the Oil in the Tank. Air entrained Oil will have a foamy appearance. If Air is present, find the Air Leak and correct it. Air Leak can be in the Suction Line and Oil may not leak out because there may only be Oil in that location when the Pump is sucking it in. With the Tractor Engine "Off" you can find a leak by pressurizing the Tank; This will not take but a few pounds of pressure (3 to 5 PSI or Less) look for leakage in the Suction Lines, Because the Oil Pick-Up is lower than the Oil Level this will force Oil out the leak. Leaks in Hoses and at Fittings can draw Air into System as Oil Flows Past. Systems that have had severe or prolonged Air Entry Problems may have Experienced Pump Damage.

CAUSE: **Engine RPM Too Slow?**
SOLUTION: Run Tractor Engine at required Speed to achieve GPM through Pump, See Specification Section in Repair Manual.

CAUSE: **Vent Plug Block or Not Installed?** (Power One Way Cylinders)
SOLUTION: This applies to Cylinders that only Stroke in or Out under pressure, The return Stroke under gravity. Remove Plug, Clean or Replace as needed. If No Vent Plug is there determine if one is needed and install as required. (See Parts / Operators Manual for Vent Plug requirements).

Cylinder Rod Bent:

CAUSE: **Excessive Load Applied to Cylinder?**
SOLUTION: This is an Operational Problem or Operational Accident. The Mode of failure would be that an excessive load was applied while the Control Valve Spool was in “Hold” and there was no Work Port Relief in circuit (or it was malfunctioning). Corrective action is to counsel the operator to avoid conditions that resulted in bending. repair or replace Cylinder and any other damaged component. A good example would be using Tractor Wheel Power to put pressure against boom and Valve closed so Cylinder can not give (Exceeding Break-A-Way).

CAUSE: **Misalignment of Cylinder Lugs?**
SOLUTION: make sure something has not been bent, Frame, Lugs and etc. Align Cylinder Lugs (may require cutting and Welding) or replace faulty Parts as needed. Mis-Alignment of Lugs place a side load on Rods that can cause them to bend. Usually this alignment is noticeable.

CAUSE: **Work Port Relief Malfunction?**
SOLUTION: Check relief Pressure of Valves that are in the affected circuit. Adjust or replace them as needed to bring them to specification (See Repair Manual). Do not operate with Relief Setting incorrect, this will cause damage. Also check to make sure that Port Relief’s are installed correctly and in the proper places.

CAUSE: **Interference with Another Part of Component?**
SOLUTION: Repair or Replace the damaged cylinder. Slowly actuate the Implement throughout its full range of motion, utilizing all possible Cylinders. Observe for interference with any other Part. Correct cause of interference as needed.

Cylinder Rod Came Out of Cylinder:

CAUSE: **Piston Nut Backed Off of Rod?**
SOLUTION: Replace damaged Parts and Assemble. Make sure Piston Nut is Correct and Properly Torqued. This problem is usually caused by improper assembly (Nut Not Torqued) but can also be caused by a faulty Nut and/or Rod threads, This failure would show Rod Threads that are damaged most likely. Some times Threads will show damage from Piston working on Rod because it has been operated while Nut was loose.

CAUSE: **Wrong Nut On Rod?**
SOLUTION: Replace with correct Piston Nut, Check Piston Nut that it is not too Thin, Wrong Threads or Insufficient Thread engagement on Rod.

Cylinder Rod Came Out of Cylinder: (Continued)

CAUSE: **Relief Valve Setting Too High?**

SOLUTION: After Replacing the damaged Parts, test the Settings of the Relief Valve, Test this by slowly pressurizing the Cylinder to determine the Relief Pressure, a Pressure Gauge installed inline for testing will show this Relief Pressure. If Pressure exceeds what Relief Should be stop. Repair or replace Relief Valve and retest. IF RELIEF IS TO HIGH DO NOT CONTINUE WITH PRESSURE UNTILL RELIEF IS REPAIRED OR DAMAGE WILL RESULT. Note: Usually Rods that have Nuts pulled off due to Pressure to high will have Threads pulled off of Rod.

Deck Cracks:

CAUSE: **Severe Usage?**

SOLUTION: Prepare and Repair, Weld, Grind Down, Add Scab Plate and Re-Paint Repaired Area.

CAUSE: **Vibration?**

SOLUTION: Locate and correct cause of Vibration problem. Prepare and Repair, Weld, Grind Down, Add Scab Plate and Re-Paint Repair Area.

CAUSE: **Poor or Missing Welds, Missing Bracing?**

SOLUTION: Prepare and Repair, Weld, Grind Down, Add Scab Plate and Re-Paint Repaired Area. As this will usually be found rather quickly from delivery date it should be covered under warranty, always take photos of this before any repairs as they may be requested by factory.

CAUSE: **Inadequate Bracing?**

SOLUTION: This is a difficult subject, It is recommended that you consult with the factory before making modifications of this type, Adding additional pieces may change many components functions, the weight added could affect balance weight ratio and the Hydraulic Functions ability to lift.

Deck Worn on Underside:

CAUSE: **Mowing Over Sand or Other Abrasive Material?** Under side of deck has Sand Blasted appearance. This Sand Blasted appearance will also be visible on Blades and Carrier, most severe on Fan Blades (Up-Lift Blades).

SOLUTION: 1. Run Mower with as low a Tractor RPM as Possible (Decreased PTO Speed) and still get a satisfactory Mowing job done. Use Flat non Up Lift Blades is available. Try to do the mowing at a time when the ground is still damp (earlier in day).

2. Check to make sure mower is operating at correct RPM (540 or 1000 as required by mower components). If a 540 RPM mower was connected to a 1000 RPM Tractor the Blade Tip Speed would be way to high and this would create severe amount of Sand and Dust under deck.

Deck Worn on Underside: (Continued)

CAUSE: **Deck being Worn and Ripped away by Heavy Debris?**
SOLUTION: Make sure material being cut is not to heavy, large or thick for unit being used, This type wear will be accompanied by dents and large scratches. The best solution for this is to make sure that Unit is suited for job. Make sure job is not over tasking Unit.

CAUSE: **Deck Worn from Continuous Use?**
SOLUTION: The Deck will wear over time, If Deck had severe wear by sand or other debris at one time causing excess (premature) wear, then this will make it wear that much faster and the only solution would be to replace Deck.

Hydraulic System Noise: (Squeal)

CAUSE: **Restrictions in System?** A Squeal may be normal in some Valves when the lowering function is actuated as Oil is going over restrictors.
SOLUTION: Check Hoses and Lines for Kinks / Obstructions. Hoses have an inner lining that can turn loose and block a hose. If Assembly or Repair work has been performed, recheck all connections for correct location. Some may not be visible without some disassembly. Unplanned restrictions cause increased backpressure, loss of usable power and excess heating of Oil. Restrictions can sometimes be found by measuring the temperature of the Oil (or fittings) at various points in circuit as heat will usually be higher at the restriction. The restriction should be located at or upstream of the increased temperature point. Foreign objects that get into the system sometimes cause restrictions, This can happen during servicing, maintenance or repairs. It is not uncommon to find bolts, nuts, plastic plugs, paper or rags stuck into system when it was being repaired or assembled then forgotten about. Restrictions sometimes can be a piece off of a failed component up stream or a Component such as a Hose built wrong

CAUSE: **Relief Valve Malfunction?**
SOLUTION: Perform Flow Pressure Test. If Flow is correct and Pressure is Low, remove Relief Valve and inspect for damaged Seals, Contamination or other abnormalities. Re-Seal, Adjust or replace the Valve as needed. Leakage through the Valve (from Low Pressure setting) or leakage around the Valve from damaged Seals will cause heating of the Oil and Low Power complaints. NOTE: There may be situations when Pump Flow is insufficient to reach Relief Pressure. Therefore it is important to test for proper Flow before condemning the Relief Valve.

Hydraulic System Noise: (Continued)

CAUSE: **Cavitation?** Cavitation is caused by inadequate amount of fluid reaching the Pump, Cavitation will damage Pump, so do not run with a Cavitation problem any more than necessary to check system. If Suction side is pulling Air in the Oil will usually cause Oil to Foam after running some.

SOLUTION: Cavitation is usually caused by a restriction of some sort in the suction lines, but can also be caused by an un-vented tank which creates a vacuum when the pump has a demand for Oil. Other problems such as plugged Suction Screens or very thick Oil can cause cavitation. The cause must be found and corrected before a new Pump is installed as cavitation will damage a Pump. Repair or Replace components a required.

CAUSE: **Wrong Oil?** (Oil to Thick or Viscous)

SOLUTION: Make sure correct Oil is used, Recommended Hydraulic Oil only should be used. Do not mix grades and types of Oil, if wrong oil has been used it must be completely remove before adding different types Oil. See Specification Chart for recommended Oil type

Hydraulic System Overheating:

Note:

1. Overheating of the Hydraulic System can have many individual causes. Before going too far into trouble shooting an overheating complaint it would be well to understand exactly the difference between HOT and TO HOT.

2. Heat is produced anytime a Hydraulic System is working. Heat is generated when the Oil moves from an area of High Pressure to an area of Low Pressure. These “Pressure drops” occur when work is performed by the System and normally occurs in Pumps, Motors, Hoses and Valves. They are expected and allowed for in the design of the System.

3. Alamo Industrial’s Systems are designed to operate at approximately 100 Degrees F. above ambient temperature (Ambient Temperature measured close to Tank) with the proper Oil Level in tank and System. Small variances can be expected due to normal wear in the System and other environmental conditions. A System is not considered to be overheating unless it significantly exceeds 100 degree F. over ambient temperature. This is not to be measured by touching, use a temperature measuring device to measure temperature to avoid being burnt.

4. When Discussing the Problem with a Customer, it is important to determine the condition under which the Symptoms occur. For example, Ask if the Symptom has existed for the life of the machine, has been gradually getting worse, or if it has occurred suddenly. A sudden occurrence might indicate that foreign material entered the system when work was being performed. Gradual worsening would indicate internal leakage (Wear or Breakage). Symptoms that occur with specific operators would indicate a possible operational problem. Symptoms that have been present for some time could be any of the above problems.

Hydraulic System Overheating: (Continued)

CAUSE: **Restrictions?** Just as indicated, an unintentional obstruction to normal Oil Flow through the circuit.

SOLUTION: Check for an unwanted increase in pressure, The obstruction would be down stream from the Pressure increase, so you would want to check pressure going back toward pressure inlet. As Oil passes through the obstruction it causes Heat increase, a check of temperatures will generally be near restriction, a heat sensing gun works well for this. Some Examples of Restrictions are:

- Kinked, Mashed or Internally Broken Hoses.
- Obstruction by foreign materials in lines.
- Plugged Filter or Wrong Filters installed
- Open (Stuck) By Pass Valve
- Wrong Size Hoses or fittings installed.
- Repair work done and parts assembled wrong.

The number of possibilities is numerous, Do not forget when checking especially for kinks in hoses it may be required to run the cylinders through their complete range of movement to check them. Know what repair work or modifications were performed.

CAUSE: **Wrong Type Valve being Used For Tractor?** (Tractor Hydraulics Only)

SOLUTION: Determine type of Control Valve for Tractor, Is tractor a Fixed Displacement (Open Center) System or a Load Sense (Closed Center) System. Make Sure the Valve that is installed is the correct one for the Type Tractor Hydraulics be used. If the Wrong System is Used it will cause a Heating problem.

CAUSE: **Spool Valve Stuck In Open or Partially Open Position?**

SOLUTION: Repair or Replace Valve components as needed.

CAUSE: **Relief Valve Set to Low?** (Load Sense / Closed Center Only)

SOLUTION: Relief Valve for Mower Positioning Control Valve must be set higher than Tractor Relief Valve, Otherwise the Oil will bypass continuously and overheat rapidly.

CAUSE: **Leakage?**

SOLUTION: This type Leakage is Internal, an External Leak will not cause Heating unless it causes enough Oil loss to effect the Oils cooling. Another type leakage would be Air entering the system on the suction side, This may not leak externally when system is engaged because it would be a suction. Some internal leakage is always present because of tolerance in the components, Valve, Pump, Motor and other components. But usually this is compensated for in the design of the system and components. Internal leakage will normally increase with wear and age on the system components. Heating from normal internal leakage is usually not severe or noticeable until it reaches advanced stages. It usually occurs gradually and is accompanied by a gradual loss of power. Test System for leakage by running Pressure and flow Test, Rebuild or Replace as required.

Hydraulic System Overheating: (Continued)

CAUSE: **Excessive Pump or Motor Wear?** These will be accompanied by a Power Loss when Mower Head is Cutting. Rapid Pump and/or Motor wear can be from damage caused by Cavitation (restricted Oil Supply), Contamination, Aeration, or defects in the Pump and Motor. Air Leaks (Air being sucked into system) causes Air Bubbles to be entrained into the Oil. These Air Bubbles will reduce the lubricating ability of the Oil causing adhesive wear to the Pump and Motor and a rapid increase in internal leakage, Air entrained Oil will have a foamy look after the system has run for a while.

SOLUTION: Test System for excessive Pump and Motor Wear or Cavitaion by running Pressure and flow Test, Repair or Replace as required.

CAUSE: **Engine RPM Too High?**

SOLUTION: Run Tractor Engine at required Speed to achieve GPM through Pump, See Specification Section in Repair Manual.

CAUSE: **Malfunctioning Valves?** (Main Relief, Priority Valves and Logic Valves)

SOLUTION: Test the above Valves, they are on the High Pressure Side of the system, these act on a pressure differential and are spring loaded. The Typical failure is a Leaking Seal between the Valve Cartridge and the Valve Block. An improper Low setting of Relief Valve to Low a Pressure can cause rapid Heating as the Oil passes from the High Pressure to the Low-Pressure area. The same is true for the other Spring Type Valves such as the Priority Valve (Governors).

CAUSE: **Operational Problems?** (Cutting Excessively Heavy Material, Traveling to Fast for Conditions, Improper Cutting Height)

SOLUTION: Make sure Cutting Height is not so low Blades are hitting Ground. Make sure that Travel Speed while cutting does not exceed cutting capacity of Model Design. Make sure something too heavy for this model is not being cut. Make Sure the Tractor Engine is running at the correct RPM to run Hydraulics at the correct Speed. All of these can cause Over Heating by forcing the system pressure over relief (causing Relief Valves to Open and heating the Oil as it passes across the Valve). If the system pressure is going over relief too frequently or for too long at a time, The Oil capacity will not be sufficient to maintain the desired operating temperature. Travel Speed is always dependent on the material being cut.

Motor Flange Breaking:

CAUSE: **Insufficient Support on Upper End of Motor?**

SOLUTION: 1. Make sure that the Motor Plate is installed on top of Motor and that it is installed correctly, These Plates must be installed with clearance dimensions and Torque settings, See the Spindle repair instruction in the Operators / Product Service Manual.
2. Some Units built prior to 1996 did not have this Motor Plate on it, There was a kit made to add to these early units. Kit P/N 02970754 can be used to add Motor Plate to Units made prior to 1996.

CAUSE: **Motor to Spindle retaining Bolts not Tight?**

SOLUTION: Check and Tighten Motor to Spindle Mounting Bolts.

Motor Inoperative: (Won't Run)

CAUSE: **Low Oil Level or No Oil?**
SOLUTION: Check and Correct Oil Level, If oil level was extremely Low or Empty, Pump Damage most likely has occurred, This will also have to be checked. Repair any cause of Oil loss before continuing.

CAUSE: **No Oil Flow to Motor?** Front Pump Inoperative, No Pump Pressure reaching Motor.
SOLUTION: Oil Level is correct but no Oil Flow to Motor. Check Pump connection to Tractor, Shafts, Couplers and Adapters, make sure they are not stripped or broken. Check to make sure Pump is "ON" if equipped with Pump "Shut Off". Check to make sure Motor is "ON" when equipped with "Shut Off". Check for any malfunctions in Drive System and Shut Off Components.

CAUSE: **No Voltage to Solenoid Valve?** (If Equipped)
SOLUTION: Check Fuse (if used), replace if required and try again. With Tractor Ignition Switch "ON", and Mower Switch "ON" Test for voltage at the Solenoid Valve. A quick test is to turn switches on (With Tractor Engine "Off") and see if a small metal object such as a paper clip or washer will stick to the end of the Valve when the mower is turned "ON". If it does not, The Coil is not magnetizing the Valve. Test for Voltage at the Wire using a test Light or Voltmeter. If no Voltage is present, trace the circuit back through the wiring, the Mower Switch, The Fuse and the Tractor Wiring to locate the faulty part. If Current is available to the Solenoid but Solenoid won't turn on motor replace Solenoid.

CAUSE: **Spindle Locked Up?**
SOLUTION: The Spindle can be locked up causing Motor not to Start, This can usually be felt or seen in the System trying to run but having to bypass. Sometimes the Spindle is not seized but only tight, this can prevent motor from starting right away from a dead Stop or slowly start, The tightness is not enough to prevent motor from running once it is started, See the Spindle Section for more information.

Motor Over Heating: (Motor Over Heating is considered when the Operating temperature exceeds 100 degrees F. over ambient Temperature).

CAUSE: **Oil Level Too Low?**
SOLUTION: Make sure it is filled to proper level with recommended Oil. Determine reason for low Oil Level (leaks, etc.) and correct problem, Run Mower and check temperature, it should not exceed 100 degree F. above ambient Temperature.

CAUSE: **Incorrect Oil Used?**
SOLUTION: Use recommended Hydraulic Oil, DO NOT mix Oils that are not compatible, in some cases it may be required to drain and replace all the oil. See Specification Chart for recommended Oil Type. When repairing unit it is recommended that Oil be update to recommended Oil.

Motor Over Heating: (Continued)

CAUSE: **Air in Oil?**

SOLUTION: Run the System for a few minutes. Check for Air in the Oil in the Tank. Air entrained Oil will have a foamy appearance. If Air is present, find the Air Leak and correct it. Air Leak can be in the Suction Line and Oil may not leak out because there may only be Oil in that location when the Pump is sucking it in. With the Tractor Engine Off you can find a leak by pressurizing the Tank, This will not take but a few pounds of pressure (10 PSI or Less) look for leakage in the Suction Lines, Because the Oil Pick-Up is lower than the Oil Level this will force Oil out the leak. Leaks in Hoses and at Fittings can draw Air into System as Oil Flows Past. Systems that have had severe or prolonged Air Entry Problems may have Experienced Pump Damage.

CAUSE: **Engine RPM Too High?**

SOLUTION: Run Tractor Engine at required Speed to achieve GPM through Pump, See Specification Section in Repair Manual.

CAUSE: **Excessive Ground Speed for Mowing Conditions?** (Operational Problem)

SOLUTION: This will usually also have a Heating Problem if continuing to mow. Observe (or Ask Operator) mowing conditions, Material being Cut etc. Correct Ground Speed is always relative to Material and conditions of mowing. One indication of Excessive Ground Speed is considerable wear on tips of blades but this is not exclusive of Excessive Ground Speed as the Wear can be caused by other factors. So Blade Wear alone is not definite Travel Speed problem. The Cut is Choppy and uneven, the material is coming from under deck in Lumps instead of being distributed across width of Deck. These conditions can force the Oil to go over relief because of excessive Load on Motor. A Change of Ground Speed and/or material being cut by unit will cure this problem.

CAUSE: **Excessive Ground Contact with Blades?** (Operational Problem)

SOLUTION: Inspect Blades, Blade Carrier and Blade Bolts for wear, Excessive wear could indicate frequent contact with the ground, Check cutting Height of Blades above Skid Shoes, Check for proper Blades and Skid Shoe condition, Repair or Replace as required.

CAUSE: **Incorrect Oil Installed?**

SOLUTION: Incorrect Oil installed may produce internal wear, which will overheat the motor. Use only the recommended Oil for the model being used. See Specification Chart for correct Oil type. Do not mix Oil Types as the may not be compatible, if types of Oil are being changed over, completely change the Oil, Drain and flush the system before installing the new Oil.

Motor Over Heating: (Continued)

CAUSE: **Excessive Internal Leakage in Pump / Motor?**

SOLUTION: Perform Flow and Pressure Test. If results are not within Specifications, determine the cause of the internal leakage, correct the cause. Replace worn or damaged parts. It is good to replace the Filter any time the Pump and/or Motor are repaired or replaced. Pump and/or Motor wear usually occurs over a long period and are gradual loss of power and excess heating of Oil. This may go un-noticed until it is severe, making the operator think it just started, this can make this type of failure hard to determine. Pre-Mature Pump and/or Motor Failure wear occurs quickly, The problem for these failures must be found and repaired or the failure will be repetitive. The Most common cause of Pre-Mature Failure is Cavitation, Oil Contamination, Oil Aeration and/or Defects in Pump and/or Motor. MACHETE SPECIFIC, When performing the Flow Test on the Machete, The flow going to the Motor and either the return from the Motor or the Case drain must be determined. These figures will indicate internal leakage in the Motor.

CAUSE: **Relief Valve Malfunction?**

SOLUTION: Perform Flow Pressure Test. If Flow is correct and Pressure is Low, remove Relief Valve and inspect for damaged Seals, Contamination or other abnormalities. Re-Seal, Adjust or replace the Valve as needed. Leakage through the Valve (from Low Pressure setting) or leakage around the Valve from damaged Seals will cause heating of the Oil and Low Power complaints.
NOTE: There may be situations when Pump Flow is insufficient to reach Relief Pressure. Therefore it is important the proper Flow be present before condemning the Relief Valve.

CAUSE: **Restrictions in System?**

SOLUTION: Check Hoses / Lines for Kinks/Obstructions. Hoses have inner linings that can turn loose to block it. If assembly or Repair work has been performed, recheck all connections for correct location. Some may not be visible without some disassembly. Unplanned restrictions cause increased backpressure, loss of usable power and excess Heating of Oil. Restrictions can sometimes be found by measuring the temp of the Oil (or fittings) at various points in circuit for higher heat. The restriction should be located at or upstream of the increased temp. point. Foreign objects sometimes cause restrictions in the system,
This can happen during servicing, maintenance or repairs. It is not uncommon to find bolts, nuts, plastic plugs, paper or rags stuck into system when it was used as being repaired or assembled then forgotten about. Restrictions sometimes can be a piece off of a failed component up stream, a Component such as a Hose built wrong.

CAUSE: **Insufficient Flow From Charge Pump?** (MACHETE SPECIFIC)

SOLUTION: Measure Flow from charge Pump (Install Flowmeter in series upstream of Charge Filter). If Flow is significantly less than 6 GPM at rated RPM. Replace the Pump Assembly and retest for proper Flow.

Motor Shaft Seal Leaking:

CAUSE: **Excessive Back Pressure on return side of Motor?** (Constant or Intermittent)
SOLUTION: Check for restrictions on the return side of Motor (See Overheating in General). Check all return Plumbing for kinked hoses or hoses that can Kink in various positions of the Cutting Head or Boom. Look for plugged Lines or a Plugged Filter. Check also for other Valves or add-on components downstream of the motor that can stop or restrict the Flow of Oil. Do not just replace the Seal without curing the problem, if you do it will likely happen again.

CAUSE: **Incorrect Oil Used?**
SOLUTION: Use recommended Hydraulic Oil, DO NOT mix Oils that are not compatible, in some cases it may be required to drain and replace all the oil. See Specification Chart for recommended Oil Type. When repairing unit it is recommended that Oil is updated to recommended Oil.

CAUSE: **Shaft Seal Worn?**
SOLUTION: This is usually visible damage. Replace Seal if Shaft is NOT also worn, If Shaft is worn (Groove or scratches in Shaft) it is advisable to replace the Motor. Seal and Shaft wear are normally caused by abrasive material (dirt) getting around the Seal, Damage can also occur from damaged Spindle Assembly. What ever the cause it must be corrected before new Motor is installed.

CAUSE: **Shaft Seal Coming Out of Bore?**
SOLUTION: Check Seal retainer if equipped to make sure that retainer is of proper size and installed properly. Install New Seal and proper retainer, But always try to find the cause of Seal blowing out to correct the problem.

CAUSE: **Faulty Motor?**
SOLUTION: Motors can leak at the Shaft Seal due to internal wear, Damaged Internal Seals or Improper Assembly. Repair or Replace as required.

Motor Runs Too Slow: (Or Slows Down under Load)

Note: The Motor on the Cutting Head running too slow can be a result of many causes and not all caused by the Motor itself. It needs to be determined whether the Symptom occurs by itself or if it is accompanied by other symptoms such as overheating, unusual noise, etc. The question should be asked whether the symptom occurs when the mower is freewheeling or only when the Mower is cutting under a load (light or heavy grass). If the Motor only slows when under a load see Motor Stop Section. If Mower Loads and not under a Load see the following Section Motor runs to Slow.

Motor Runs Too Slow: (Continued)

CAUSE: **Engine RPM Too Slow?**
SOLUTION: Run Tractor Engine at required Speed to achieve GPM through Pump, See Specification Section in Repair Manual.

CAUSE: **Pump Drive Damaged?**
SOLUTION: Inspect Pump Drive components for wear or damage, If Pump is not being driven properly, repair or replaced parts as required.

CAUSE: **Faulty Logic Valve in Motor Control Circuit?** (If Equipped)
SOLUTION: Remove and inspect Logic Cartridge for damaged seals or contamination, Repair, Reseal or Replace as needed. If the Seals on the Logic Valve repeatedly fail, it will likely be required to replace the Valve Block due to damage or erosion in the Valve Bore.

CAUSE: **Air in Oil?**
SOLUTION: Run the System for a few minutes. Check for Air in the Oil in the Tank. Air entrained Oil will have a foamy appearance. If Air is present, find the Air Leak and correct it. Air Leak can be in the Suction Line and Oil may not leak out because there may only be Oil in that location when the Pump is sucking it in. With the Tractor Engine Off you can find a leak by pressurizing the Tank, This will not take but a few pounds of pressure (10 PSI or less) look for leakage in the Suction Lines, Because the Oil Pick-Up is lower than the Oil Level this will force Oil out the leak. Leaks in Hoses and at Fittings can draw Air into System as Oil Flows Past. Systems that have had severe or prolonged Air Entry Problems may have Experienced Pump Damage.

CAUSE: **Restrictions in System?**
SOLUTION: Check Hoses / Lines for Kinks/Obstructions. Hoses have inner linings that can turn loose to block it. If Assembly or Repair work has been performed, recheck all connections for correct location. Some may not be visible without some dis-assembly. Unplanned restrictions cause increased backpressure, loss of usable power and excess Heating of Oil. Restrictions can sometimes be found by measuring the temperature of the Oil (or fittings) at various points in circuit for higher heat. The restriction should be located at or upstream of the increased temperature point. Foreign objects sometimes cause restrictions in the system, This can happen during servicing, maintenance or repairs. It is not uncommon to find bolts, nuts, plastic plugs, paper or rags stuck into system when it was used as being repaired or assembled then forgotten about. Restrictions sometimes can be a piece off of a failed component up stream, Component such as a Hose built wrong.

CAUSE: **Damaged O-Ring on Solenoid Valve?** (If Equipped)
SOLUTION: Remove Valve and inspect Seals, replace if damaged.

CAUSE: **Insufficient Flow From Charge Pump?** (MACHETE SPECIFIC)
SOLUTION: Measure Flow from charge Pump (Install Flowmeter in series upstream of Charge Filter). If Flow is significantly less than 6 GPM at rated RPM. Replace the Pump Assembly and retest for proper Flow.

Motor Runs Too Slow: Continued

CAUSE: **Excessive Internal Leakage in Pump / Motor?**

SOLUTION: Perform Flow and Pressure Test. If results are not within Specifications, determine the cause of the internal leakage, correct the cause. Replace worn or damaged parts. It is good to replace the Filter any time the Pump and/or Motor are repaired or replaced. Pump and/or Motor wear usually occurs over a long period and are gradual loss of power and excess heating of Oil. This may go unnoticed till it is severe making the operator think it just started, this can make this type of failure hard to determine. Pre-Mature Pump and/or Motor Failure wear occurs quickly, The problem for these failures must be found and repair or the failure will be repetitive. The Most common cause of Pre-Mature Failure is Cavitation, Oil Contamination, Oil Aeration and/or Defects in Pump and/or Motor.

NOTES:

Motor Stops: (Mower Quits Under Load)

CAUSE: **Incorrect Oil Used?**
SOLUTION: Use recommended Hydraulic Oil, DO NOT mix Oils that are not compatible, in some cases it may be required to drain and replace all the oil. See Specification Chart for recommended Oil Type. When repairing unit it is recommended that Oil is updated to recommended Oil.

CAUSE: **Air In Oil?**
SOLUTION: Run the System for a few minutes. Check for Air in the Oil in the Tank. Air entrained Oil will have a foamy appearance. If Air is present, find the Air Leak and correct it. Air Leak can be in the Suction Line and Oil may not leak out because there may only be Oil in that location when the Pump is sucking it in. With the Tractor Engine Off you can find a leak by pressurizing the Tank, This will not take but a few pounds of pressure (10 PSI or Less) look for leakage in the Suction Lines, Because the Oil Pick-Up is lower than the Oil Level this will force Oil out the leak. Leaks in Hoses and at Fittings can draw Air into System as Oil Flows Past. Systems that have had severe or prolonged Air Entry Problems may have Experienced Pump Damage.

CAUSE: **Engine RPM Too Slow?**
SOLUTION: Run Tractor Engine at required Speed to achieve GPM through Pump, See Specification Section in Repair Manual.

CAUSE: **Excessive Ground Speed For Mowing Conditions?** (Operational Problem)
SOLUTION: This will usually also have a Heating Problem if continuing to mow. Observe (or Ask Operator) mowing conditions, Material being Cut etc. Correct Ground Speed is always relative to Material and conditions of mowing. One indication of Excessive Ground Speed is considerable wear on tips of blades but this is not exclusive of Excessive Ground Speed as the Wear can be caused by other factors. So Blade Wear alone is not definite Travel Speed problem. The Cut is Choppy and uneven, the material is coming from under deck in Lumps instead of distributed across width of Deck. These conditions can force the Oil to go over relief because of excessive Load on Motor. A Change of Ground Speed and/or application will cure this problem.

CAUSE: **Excessive Internal Leakage in Pump / Motor?**
SOLUTION: Perform Flow / Pressure Test. If results are not within Specifications, determine cause of the internal leakage, correct the cause. Replace worn / damaged parts. It is good to replace the Filter anytime the Pump and/or Motor are repaired or replaced. Pump and/or Motor wear usually occurs over a long period and are gradual loss of power and excess heating of Oil. This may go unnoticed till it is severe making the operator think it just started, this can make this type of failure hard to determine. Pre-Mature Pump and/or Motor Failure wear occurs quickly, The problem for these failures must be found and repaired or the failure will be repetitive. The Most common cause of Pre-Mature Failure is Cavitation, Oil Contamination, Oil Aeration and/or Defects in Pump and/or Motor.

Motor Stops: (Mower Quits) Continued

CAUSE: **Low Relief Valve Setting?**
SOLUTION: Best Tested with Pressure / Flowmeter, Some Relief Valve can be Repaired, Some Only Replaced, See Assembly set up instruction on Relief Valves, See Specification Section on Relief valve Settings. DON'T exceed recommended Relief Settings. Before condemning Relief Valve do a Flow and Pressure Test, The Pump under some conditions can't build enough pressure to make the relief open and this would appear Relief Valve is stuck, A Flowmeter will show when Pressure Relief opens.

CAUSE: **Restrictions in System?**
SOLUTION: Check Hoses / lines for Kinks / Obstructions. May not be visible without disassembly. Unplanned restrictions cause increased back pressure, loss of usable power and excessive heating of Oil (Usually at the restriction). Restrictions can sometimes be found by checking different locations for the temperature, The restriction will generally be upstream of heated spot. There are a number of things that can cause this heating problem, Most common Problem, Contamination, Kinked or Damaged Hose,

Pump Seizure: (Pump Locking Up)

CAUSE: **Lack of Oil?** (Lubrication)
SOLUTION: This is normally caused by failure to Pre-Lube the Pump before starting or cavitation (Air or Lack of Oil) during operation. A Lack of Pre-Lube failure will occur soon after start up if Pre-Lube is not done when unit is assembled. Obstruction or damage to Intake (Suction) Side of Pump or Lines can cause this problem. The solution would be to determine what is damaged and why was Oil Low, Repair or Replace as required

CAUSE: **Improper Assembly?**
SOLUTION: Damage can be caused by over torquing the Pump components, incorrect alignment or location of components. Improper Torquing or Assembly will normally show up very soon after start up. The solution would be to determine what is damaged and why, Repair or Replace as required

CAUSE: **Faulty - Defective Pump?**
SOLUTION: Sometimes Oil passages are not open inside the Pump during Manufacturing. These problems will show up as early Bearing failures or Pump not working when installed and very seldom occur after being run for awhile unless there is debris or other contamination blocking something. The solution would be to determine damage, why, and Repair or Replace as required

CAUSE: **Foreign Material?** (Contamination)
SOLUTION: Objects left in Tank or fall in during service. This can include, Dirt, Pieces of Hose, Plugs, Rags or any other object can be left or get into system. Keep everything clean and account for every thing used when serviced. The solution is to determine what is damaged and why, Repair/ Replace as required.

Pump Wear: (Rapid Excessive Wear)

CAUSE: **Contamination In System?**

SOLUTION: Locate and correct source of contaminants, This could include the complete system, Pump, Motor, Valves, Hoses, Tank, Oil, Filter System or any other component including your source of replacement Oil Supply. The Contaminants must be found and completly removed and stopped. The Solution is to repair or replace worn parts, Completly Flush and Clean all Hydraulic Components, Install New Clean Recommended Oil.

CAUSE: **Cavitation?**

SOLUTION: Cavitation is caused by inadequate amount of Fluid (Hydraulic Oil) reaching Pump, Usually a restriction of some sort in the suction lines but can also be caused by an unvented Tank. This will cause a vacuum when the Pump starts demanding Oil, The Pump cannot pull Oil out of this vacuum. Other Problems such as plugged Suction Screens or very Thick Oil can cuase cavitation. This must be found and corrected before repairing old Pump ot installing new one.

CAUSE: **Air In The Oil?**

SOLUTION: Run System for a few minutes. Check for Air in the Oil in the Tank. Air entrained Oil has a foamy appearance. If Air is present, find the Air Leak and correct it. Air Leak can be in the Suction Line and Oil may not leak out because there may only be Oil in that location when the Pump is sucking it in. With the Tractor Engine Off you can find a leak by pressurizing the Tank, This will not take but a few pounds of pressure (10 PSI or Less) look for leakage in the Suction Lines, Because the Oil Pick-Up is lower than the Oil Level this will force Oil out the leak. Leaks in Hoses and at Fittings can draw Air into System as Oil Flows Past. Systems that have severe or prolonged Air Entry Problems may have Experienced Pump Damage.

CAUSE: **Pump Not Pre-Lubed before Starting?**

SOLUTION: Repair or Replace Pump, Fill Pump with Oil during Assembly and or before Starting, This can be done by pouring Oil into the Suction Hose and letting it run into Pump as you are connecting Suction Hose, The Pump should have been Assembled using lubricant as it was assembled. The Machete and Brahma this is not required as the Pump is lower than the tank. This will make the suction line full of Oil to Pump

CAUSE: **Incorrect Oil Used?**

SOLUTION: Use recommended Hydraulic Oil, DO NOT mix Oils that are not compatible, in some cases it may be required to drain and replace all the oil. See Specification Chart for recommended Oil Type. When repairing unit it is recommended that Oil is updated to recommended Oil.

CAUSE: **Water In Oil?**

SOLUTION: Moisture in Oil adversely affects the lubricating ability of the Oil. The Source of the Moisture entry must be found and corrected, The System cleaned and flushed, All damaged components replaced. DO NOT operate system with moisture in it because the moisture will turn to Steam when heated, Steam will pit and damage components of Pump, Valves and Motors. As well as the Lubricating ability of the Oil will be diminished.

Spindle Leaking at Motor:

CAUSE: **Filling Spindle with Hydraulic Oil?** Motor Seal Leaks.
SOLUTION: Determine and correct cause of Motor Shaft Seal Leaking, Re-Seal Motor, Clean Repack or rebuild Spindle as required. Note: Be sure to determine what caused Seal to Blow out and repair that problem before considering the repair to be done. If you just put in New Motor Seal you have not cured the cause of the Problem. See Motor Seal Leaking for possible cause of Seal problems.

CAUSE: **Motor Loose or Bolts Missing?**
SOLUTION: Tighten Motor to Spindle retaining bolts, If they will not tighten? check and repair threads. Notice this problem will let Spindle Oil Leak but will not let Hydraulic Oil from Motor Leak.

CAUSE: **Gasket Torn or Damaged?**
SOLUTION: Remove Motor, Check surface of Spindle Housing and surface of Motor, Clean Surfaces of both, Check for Burrs or deep Scratches. Burrs can be removed by carefully filing surface, If you file surface caution must be taken to keep filings out of Spindle. If Scratches they can be filled with a sealer. Make Sure Sealer is Oil compatible?

CAUSE: **Pressure in Spindle Housing? Excess Backpressure.**
SOLUTION: Make sure Relief Plug installed or Relief Plug is not clogged, Check Spindle Oil level so it is not overfull, Notice this will be Spindle Oil leaking out not Hydraulic Oil.

Spindle Leaking around Bottom Seal:

CAUSE: **Seal Damaged?** Could be damaged by foreign material.
SOLUTION: It will be required to replace Seal and refill Spindle with Lubricant. Before replacing Seal always check to make sure Shaft Bearings have not lost Pre-load (Shaft will be loose in Housing) as this will make Seal Leak and will damage Seal. If Shaft is Loose see next cause / Solution. Always Check condition of Shaft surface at Seal Area that it is not damaged, Always coat ID of Seal with light coat of grease before installing.

CAUSE: **Bearings Loose?**
SOLUTION: If Bearings are Loose the Bearing Pre-Load is lost and Bearings are most likely damaged, Remove Motor, Dis-assemble Spindle, clean and Inspect, Rebuild and Fill with Lubricant. (See Spindle Repair / Product Service manual).

Spindle Leaking at Relief Plug:

CAUSE: **Relief Fitting Installed in Wrong Hole?**

SOLUTION: 1. First Determine what is leaking, Spindle Oil or Hydraulic Oil, If it is Spindle Oil continue, If it is Hydraulic Oil See Motor Seal Leaking.
2. Sometimes the Fill Plug (Grease Fitting on Spindles that are filled with Grease) and the Relief Fitting are installed in the wrong Holes. The relief Fitting should be in the Upper Hole (Hole closest to the Motor) if there are 2 holes. Note: There were changes made to Spindle in 1996 to add another Hole near the top of the Housing (above Oil Level) for the Relief Fitting to be installed, a Plug was installed into the lower hole where the relief/fill plug was installed as the early spindle only had the one hole. Spindle should always be installed with Pressure and Fill Plugs pointing away from Tractor.

CAUSE: **Spindle Overfilled?**

SOLUTION: Continue running (Only continue to Run if sure Leak is because Spindle is Over Filled) and clean up the mess until the leakage stops or remove some of the lubricant with possibly a suction gun,

Spindle Over Heating:

Spindle will operate up to 200 F. which is considered within tolerance range and is not considered over heating, DON'T Check for over heating with the touch of your Hand, The Temperature is to high and will burn you.

CAUSE: **Low Oil Level in Spindle?**

SOLUTION: Find causes of Low Oil Level and correct it. If Spindle was run Low Lubricant it is likely to be Bearing Damage from lack of Lubricant. The Spindle should be dis-assembled, Inspected and reassembled replacing any damaged parts. Always use New Seals.

CAUSE: **Excessive Bearing Pre-load?** (Bearings to Tight)

SOLUTION: Bearing need to be removed and inspected for damage from running too tight. Rebuild Spindle replacing Parts as required, Always replace with new Seal. Set Bearing Pre-Load and Lock Adjusting and Locking Nut down as instructed in Spindle repair section to correct Specifications, always double check to make sure Nuts are Locked in place.

CAUSE: **Bolts Holding Blade Bar to Spindle replaced and New Bolts to Long?**

SOLUTION: Check that Blade Bar Retaining Bolts are not to Long to cause them to bottom out and jam through Spindle damaging Shaft. Always make sure same Length Bolts are installed that came Out. If to long of Bolts have been installed in Spindle, it will have to be rebuilt.

Spindle Shaft Loose or Falls Out:

Note: When Spindles are properly assembled and lubricated, The Shaft should not loosen up in service. Shaft loosening up is an indication of a serious internal problem. Merely tightening up the adjusting Nut will not correct the cause of the problem.

CAUSE: **Bearing Adjusting Nut Backed Off?** (Not Properly Locked)
SOLUTION: Dis-Assemble Spindle and inspect Parts for damage, All components have a possibility of being damaged if ran with Bearings Loose. Install required replacement parts and re-assemble. See Spindle repair section for assembly and settings.

CAUSE: **Bearing Cups or Bearing Cones Not Seated Properly?**
SOLUTION: 1. IF MOWER HAS NOT BEEN RUN since Spindle was assembled, Find out why Bearings are not seated and correct problem, readjust Bearing Pre-load and make sure Bearings are seated properly, Fill with Lubricant and Test.
2. IF MOWER HAS BEEN RUN since Spindle was assembled. Dis-Assemble Spindle and inspect Parts for damage, All components have a possibility of being damaged if ran with Bearings Loose. Install required replacement parts and re-assemble. See Spindle repair section for assembly instructions and settings.

CAUSE: **Shaft Falls Out of Spindle Housing?** (Lost Bearing Pre-Load))
SOLUTION: Remove Motor from Spindle Housing and Remove Spindle from Deck. Clean and inspect all Parts, try to determine what part failed and why. Replace Parts as required and re-assemble spindle assembly. Note: Pay close attention to the threads on top of the Shaft where Bearing Adjusting Nuts screw on if using old shaft, make sure that Shaft and Nut Threads are in good shape and compatible. DO NOT use old parts if the fit of them is not correct.

Spindle Locks Up: (Seizes and will not turn)

CAUSE: **Low Oil Level in Spindle?** (Causing it to Over Heat)
SOLUTION: This will damage almost all parts in Spindle Assembly, the only way to find out is to completely dis-assemble the spindle. Repair and / or Replace as required.

CAUSE: **Excessive Bearing Pre-load?** (Bearings to Tight)
SOLUTION: Bearing needs to be removed and inspected for damage from running too tight. Rebuild Spindle replacing Parts as required, Always replace with new Seal. Set Bearing Pre-Load and Lock Adjusting and Locking Nut down as instructed in Spindle repair section to correct Specifications, always double check to make sure Nuts are locked in place.

CAUSE: **Bolts Holding Blade Bar to Spindle replaced and New Bolts to Long?**
SOLUTION: Check that Blade Bar Retaining Bolts are not too long to cause them to bottom out and jam through Spindle damaging Shaft. Always make sure same Length Bolts are installed that came out. If to long of Bolts have been installed in Spindle, it will have to be rebuilt.

CAUSE: **Seal Protector Damaged?** (Component Bent), The Seal Protector, there has been two types, Old Type was a Cup type that slid up on to bottom of Shaft. This type usually would not stop the Spindle from spinning while running if it got bent, but it could prevent the spindle from starting. The New Type is a Steel Wing that is welded to Blade Bar, it is thicker than old type but it can get bent.
SOLUTION: Check Seal protector type and if damaged repair or replace as required Seal protector can be straighten if damage will allow, as long as it does not hit Housing and protect Seal it will be OK.

Starter on Tractor Will Not Crank:

Note: Most of the problems that will cause the Tractor not to fail to crank will be found in the Tractor, However there are some causes that involve the Mower. Only those problems that are caused by the Mower are covered here, and only mower models that have electrical systems that are tied in with Tractor Electrical system could affect Tractor Starting Circuit.

CAUSE: **Mower "ON" / "OFF" Switch Engaged?**
SOLUTION: Move Mower Switch to the "Off" Position and retry Tractor Starter System. Tractor is not supposed to start when Mower Switch is on, This is a safety feature and is not to be bypassed. When Mower Switch is "Off" the System is internally bypassed to allow the Tractor to Start. Therefore if Switch is "Off" and Starter circuit is not complete through switch, Check Wiring and Switch. Repair or Replace as needed.

Starter on Tractor Will Not Crank: (Continued)

CAUSE: **Mower "ON" / "OFF" Switch or Wiring Malfunction?**

SOLUTION: CAUTION, MAKE SURE TRACTOR IS IN NUETRAL WITH PARKING BRAKE SET! MAKE SURE ENGINE IS DISABLED TO SO THAT IT WILL NOT SUDDENLY START SHOULD IT START CRANKING, ALSO MAKE SURE EVERYONE AROUND YOU KNOWS THAT THE TRACTOR ENGINE MAY SUDDENLY START CRANKING! THIS BECAUSE WHEN DEALING WITH A SHORT OR LOOSE CONNECTION YOU MAY MOVE IT AND MAKE IT START TO OPERATE!

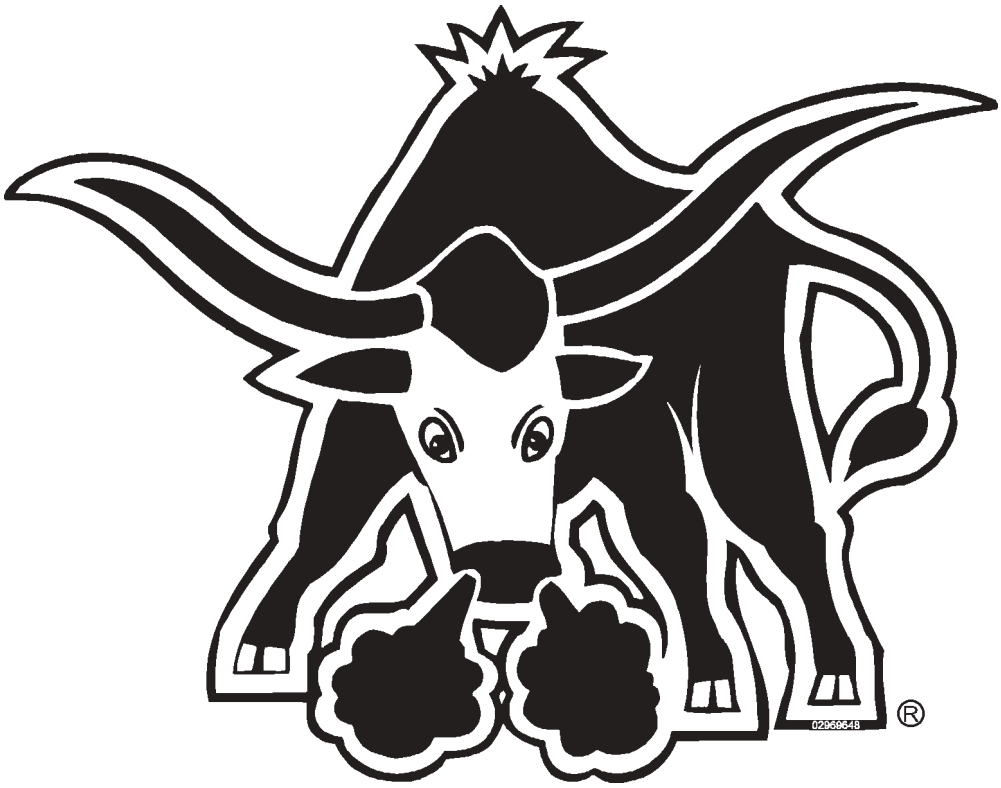
Check for Voltage at Starter Solenoid when Starter Switch is engaged. If Voltage is not present make Sure Mower Switch is "Off" and recheck for Voltage at Starter Solenoid. If still no Voltage check through circuit till voltage is found (checking must be done with Starter Switch engaged). The faulty component is most likely immediately down stream of the point of voltage. Repair or Replace as needed and retest system. DO NOT BYPASS MOWER SWITCH SAFETY FEATURE!

Tractor Battery Dead or Low:

Note: Most of the problems that will cause the Tractor Battery to fail drain power will be found in the Tractor, However there is a cause that involves the Mower. Only the problem that could be caused by the Mower is covered here, and only mower models that have electrical systems that are tied in with Tractor Electrical system could affect Tractor Battery Circuit.

CAUSE: **"ON" / "OFF" Switch or Joystick Wired Incorrectly?**

SOLUTION: Power Wire from Tractor to Mower control system must be wired through the Tractor Ignition (Key) Switch to where it only has current when Tractor (Key) Ignition Switch is "ON". If the Mower Power Source is connected where it has Power (Constant Power) when Tractor Ignition (Key) Switch is "OFF" it will put a constant Drain on Battery. This is the only one problem that should be able to affect Tractor Battery from Mower Electrical System. Check where Wiring is connected, Correct as required, See Operators, Parts or Repair Manuals for Wiring Schematics.



BRAHMA

ALAMO INDUSTRIAL

Brahma (Service Manual) 05/05

Manual P/N 02982817

Printed U.S.A.