



# SERVICE MANUAL

## MODELS

30 JET • 40 (4 CYL)

### With Serial Numbers

|                         |                    |
|-------------------------|--------------------|
| United States . . . . . | 0C159200 and Above |
| Belgium . . . . .       | 9570305 and Above  |
| Canada . . . . .        | 0A748269 and Above |



## Notice

Throughout this publication, “Dangers”, “Warnings” and “Cautions” (accompanied by the International HAZARD Symbol ) are used to alert the mechanic to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly. **OBSERVE THEM CAREFULLY!**

These “Safety Alerts” alone cannot eliminate the hazards that they signal. Strict compliance to these special instructions when performing the service, plus “Common Sense” operation, are major accident prevention measures.

### **DANGER**

**DANGER - Immediate hazards which WILL result in severe personal injury or death.**

### **WARNING**

**WARNING - Hazards or unsafe practices which COULD result in severe personal injury or death.**

### **CAUTION**

**Hazards or unsafe practices which could result in minor personal injury or product or property damage.**

## Notice to Users of This Manual

This service manual has been written and published by the Service Department of Mercury Marine to aid our dealers’ mechanics and company service personnel when servicing the products described herein.

It is assumed that these personnel are familiar with the servicing procedures of these products, or like or similar products manufactured and marketed by Mercury Marine, that they have been trained in the recommended servicing procedures of these products which includes the use of mechanics’ common hand tools and the special Mercury Marine or recommended tools from other suppliers.

We could not possibly know of and advise the service trade of all conceivable procedures by which a service might be performed and of the possible hazards and/or results of each method. We have not undertaken any such wide evaluation. Therefore, anyone who uses a service procedure and/or tool, which is not recommended by the manufacturer, first must completely satisfy himself that neither his nor the products safety will be endangered by the service procedure selected.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication. As required, revisions to this manual will be sent to all dealers contracted by us to sell and/or service these products.

It should be kept in mind, while working on the product, that the electrical system and ignition system are capable of violent and damaging short circuits or severe electrical shocks. When performing any work where electrical terminals could possibly be grounded or touched by the mechanic, the battery cables should be disconnected at the battery.

Any time the intake or exhaust openings are exposed during service they should be covered to protect against accidental entrance of foreign material which could enter the cylinders and cause extensive internal damage when the engine is started.

It is important to note, during any maintenance procedure replacement fasteners must have the same measurements and strength as those removed. Numbers on the heads of the metric bolts and on the surfaces of metric nuts indicate their strength. American bolts use radial lines for this purpose, while most American nuts do not have strength markings. Mismatched or incorrect fasteners can result in damage or malfunction, or possibly personal injury. Therefore, fasteners removed should be saved for reuse in the same locations whenever possible. Where the fasteners are not satisfactory for re-use, care should be taken to select a replacement that matches the original.



# Cleanliness and Care of Outboard Motor

A marine power product is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the ten thousands of an inch./mm. When any product component is serviced, care and cleanliness are important. Throughout this manual, it should be understood that proper cleaning, and protection of machined surfaces and friction areas is a part of the repair procedure. This is considered standard shop practice even if not specifically stated.

Whenever components are removed for service, they should be retained in order. At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.

Personnel should not work on or under an outboard which is suspended. Outboards should be attached to work stands, or lowered to ground as soon as possible.

We reserve the right to make changes to this manual without prior notification.

Refer to dealer service bulletins for other pertinent information concerning the products described in this manual.



# Service Manual Outline

## Section 1 - Important Information

## Section 2 - Electrical & Ignition

- A - Ignition System
- B - Battery, Charging System & Starting System
- C - Timing, Synchronizing & Adjustment
- D - Wiring Diagrams

## Section 3 - Fuel System & Carburetion

## Section 4 - Powerhead

## Section 5 - Mid-Section

- A - Clamp/Swivel Bracket & Drive Shaft Housing
- B - Power Trim (Design I)
- C - Power Trim (Design II)
- D - Power Trim (Design III)
- E - Power Trim (Design IV)
- F - Manual Tilt System (Design I, II, III)
- G - Manual Tilt System (Design IV)

## Section 6 - Lower Unit

- A - Lower Unit
- B - Jet Drive

## Section 7 - Outboard Motor Installation/Attachments

- A - Outboard Motor Installation/Attachments
- B - Tiller Handle and Co-Pilot
- C - Rewind Starter

## Section 8 - Oil Injection System

Important  
Information

1

Electrical & Ignition

2

Fuel System &  
Carburetion

3

Powerhead

4

Mid-Section

5

Lower Unit

6

Outboard Motor  
Installation/  
Attachments

7

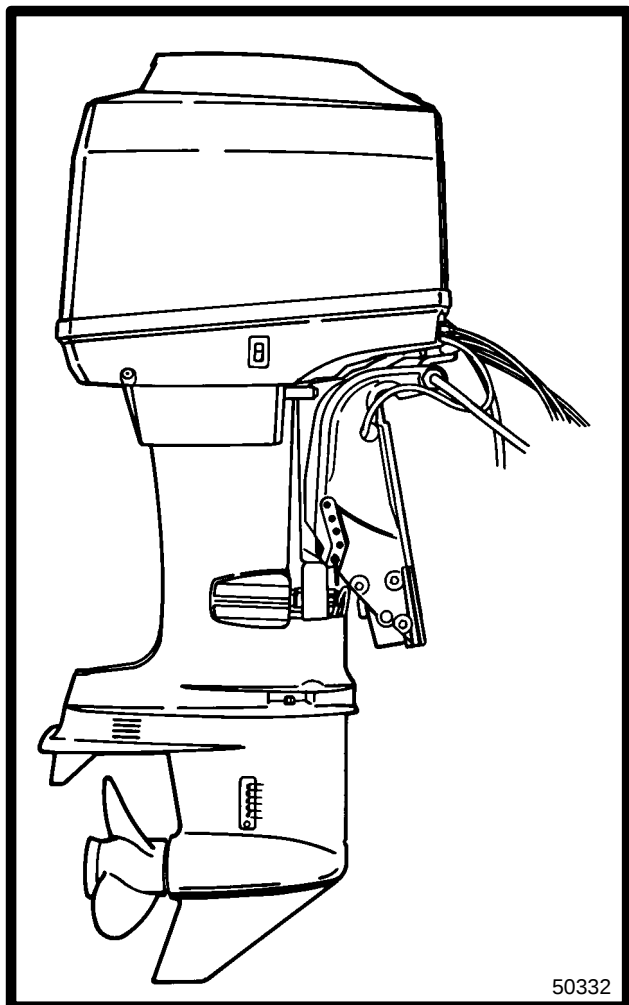
Oil Injection System

8



# IMPORTANT INFORMATION

1



## GENERAL INFORMATION and SPECIFICATIONS



# Table of Contents

|                                                                  | Page |
|------------------------------------------------------------------|------|
| Propeller Information .....                                      | 1-1  |
| How to Use this Manual .....                                     | 1-1  |
| General Specifications .....                                     | 1-2  |
| Propeller Selection .....                                        | 1-3  |
| Propeller Installation .....                                     | 1-3  |
| Trim "In" Angle Adjustment .....                                 | 1-4  |
| Power Trim System (Models with Power Trim)                       |      |
| General Information .....                                        | 1-4  |
| Checking Trim System Fluid Level .....                           | 1-5  |
| Trimming (Models with Power Trim) .....                          | 1-5  |
| Trimming Outboard "Out" ("Up")                                   |      |
| Characteristics .....                                            | 1-5  |
| Trimming Outboard "In" ("Down")                                  |      |
| Characteristics .....                                            | 1-5  |
| Trim Tab Adjustment .....                                        | 1-6  |
| Boat Performance .....                                           | 1-6  |
| Test Instructions .....                                          | 1-6  |
| Boat Test Chart (Example) .....                                  | 1-7  |
| Lubrication Points .....                                         | 1-8  |
| Ride-Guide Steering Cable and Pivot                              |      |
| Points Lubrication .....                                         | 1-9  |
| Gear Housing Lubrication .....                                   | 1-10 |
| Salt Water Corrosion - Gear Housing                              |      |
| Bearing Carrier and Cover Nut .....                              | 1-10 |
| Periodic Inspection .....                                        | 1-11 |
| Flushing Outboard Cooling System .....                           | 1-11 |
| Following Complete Submersion .....                              | 1-12 |
| Salt Water Submersion (Special Instructions) .....               | 1-12 |
| Submerged While Running (Special Instructions) .....             | 1-12 |
| Submerged Engine (Fresh Water) (Plus Special Instructions) ..... | 1-12 |
| Out-of-Season Outboard Storage .....                             | 1-13 |
| Out-of-Season Battery Storage .....                              | 1-13 |
| How Weather Affects Engine                                       |      |
| Performance .....                                                | 1-14 |
| Conditions Affecting Operation .....                             | 1-15 |
| Detonation: Causes and Prevention .....                          | 1-15 |
| Compression Check .....                                          | 1-16 |
| Painting Procedure .....                                         | 1-17 |
| Decal Application .....                                          | 1-18 |



## Propeller Information

For in-depth information on marine propellers and boat performance - written by marine engineers - see your Authorized Dealer for the illustrated "What You Should Know About Quicksilver Propellers and Boat Performance Information" (Part No. 90-86144).

## How to Use this Manual

The manual is divided into SECTIONS (shown, right) which represents major components and systems.

Some SECTIONS are further divided into PARTS. Each PART has a title page. A "Table of Contents" for the particular PART is printed on the back of the title page.

SECTIONS and PARTS are listed on the "Service Manual Outline" sheet which immediately follows the cover of this book.

| Section | Section Heading                   |
|---------|-----------------------------------|
| 1       | Important Information             |
| 2       | Electrical and Ignition           |
| 3       | Fuel System and Carburetion       |
| 4       | Powerhead                         |
| 5       | Mid-Section                       |
| 6       | Lower Unit                        |
| 7       | Outboard Installation/Attachments |
| 8       | Oil Injection System              |



# General Specifications

|                                                                                |                                                                                                                    |
|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| <b>Model</b>                                                                   | <b>40</b>                                                                                                          |
| Horsepower                                                                     | 40                                                                                                                 |
| Engine Type                                                                    | 4 Cylinder, In-Line, Two-Stroke                                                                                    |
| Full Throttle RPM Range                                                        | 5000-5500                                                                                                          |
| Idle RPM Range (in Forward Gear)                                               | 600-700                                                                                                            |
| Piston Displacement                                                            | 44 cu. in. (721cc)                                                                                                 |
| Cylinder Bore Standard                                                         | 2.565 in. (65.151mm)                                                                                               |
| Stroke                                                                         | 2.125 in. (53.975mm)                                                                                               |
| Ignition Type                                                                  | Thunderbolt Capacitor Discharge                                                                                    |
| Firing Order                                                                   | 1-3-2-4                                                                                                            |
| Recommended Spark Plug                                                         | NGK BUHW-2                                                                                                         |
| Gear Selection                                                                 | Forward - Neutral - Reverse                                                                                        |
| Gear Ratio                                                                     | 2:1                                                                                                                |
| Gear Housing Lubricant Capacity                                                | 12.5 fl. oz. (370ml)                                                                                               |
| Outboard Weight (ELPTO)                                                        | 192 lbs. (87kg)                                                                                                    |
| Carburetion                                                                    | 2 Carburetors, Center Bowl                                                                                         |
| Recommended Gasoline                                                           | Any leaded or unleaded (lead-free) gasoline, with a minimum posted octane rating of 86 (research octane number 90) |
| Remote Fuel Tank Capacity:<br>- U.S. Gallons<br>- Imperial Gallons<br>- Liters | 6.6<br>5.5<br>25                                                                                                   |
| Recommended Oil                                                                | Quicksilver 2-Cycle Outboard Oil                                                                                   |
| Gasoline/Oil Ratio                                                             | 50:1                                                                                                               |
| Oil Tank Capacity*                                                             | 0.935 gal. (3.54 Liters)                                                                                           |
| Maximum Operation at Full Throttle*                                            | 7 Hours                                                                                                            |
| Oil Remaining when Warning Buzzer Sounds*                                      | 7.5 fl. oz.                                                                                                        |
| Approximate Running Time Remaining at Wide Open Throttle when Buzzer Sounds*   | 30 Minutes                                                                                                         |
| Recommended Battery Rating                                                     | Minimum Reserve Capacity rating of 100 Minutes and Cold Cranking Amperage of 350 Amperes                           |

\*Specification for Oil Injected Model



## Propeller Selection

1. Select a propeller that will allow the engine to operate at or near the top of the recommended full throttle RPM range (listed in "Specifications," preceding) with a normal load. Maximum engine speed (RPM) for propeller selection exists when boat speed is maximum and trim is minimum for that speed. (High RPM, caused by an excessive trim angle, should not be used in determining correct propeller.) Normally, there is a 150-350 RPM change between propeller pitches.
2. If full throttle operation is below the recommended range, the propeller **MUST BE** changed to a lower pitch to prevent loss of performance and possible engine damage.
3. For better acceleration, such as is needed in water skiing, propping up to 500 RPM above the recommended range is advised. Continuous operation above the recommended maximum RPM, however, is not permissible.
4. After initial propeller installation, the following common conditions may require that the propeller be changed to a lower pitch:
  - a. Warmer weather and great humidity will cause an RPM loss.
  - b. Operating in a higher elevation causes an RPM loss.
  - c. Operating with a damaged propeller or a dirty boat bottom or gear housing will cause an RPM loss.
  - d. Operation with an increased load (additional passengers, equipment, pulling skiers, etc.).

## Propeller Installation

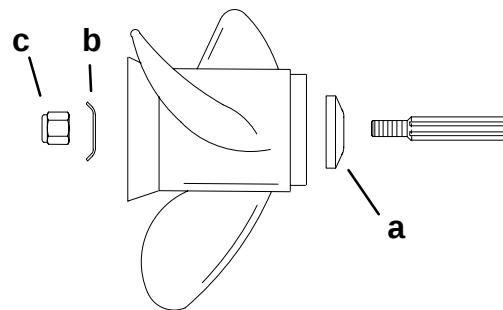
### WARNING

If the propeller shaft is rotated while the engine is in gear, there is the possibility that the engine will crank over and start. To prevent this type of accidental engine starting and possible serious injury caused from being struck by a rotating propeller, always shift outboard to neutral position and remove spark plug leads when you are servicing the propeller.

Coat the propeller shaft with Quicksilver Anti-Corrosion Grease or 2-4-C Marine Lubricant with Teflon.

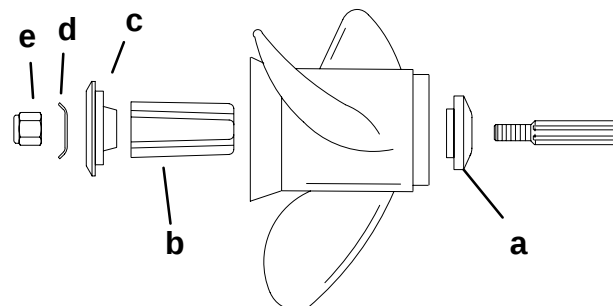
**IMPORTANT:** To prevent the propeller hub from corroding and seizing to the propeller shaft, especially in salt water, always apply a coat of the recommended lubricant to the entire propeller shaft at the recommended maintenance intervals and also each time the propeller is removed.

### Flo-Torq I Drive Hub Propellers



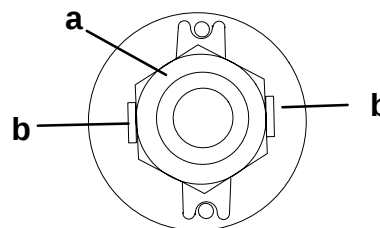
- a - Forward Thrust Hub
- b - Propeller Nut Retainer
- c - Propeller Nut

### Flo-Torq II Drive Hub Propellers



- a - Forward Thrust Hub
- b - Replaceable Drive Sleeve
- c - Rear Thrust Hub
- d - Propeller Nut Retainer
- e - Propeller Nut

1. Tighten propeller nut to 55 lb.ft. (75 N·m). Bend tabs against nut.



- a - Propeller Nut - Torque To 55 lb. ft. (75 N·m)
- b - Bend Tabs Against Nut



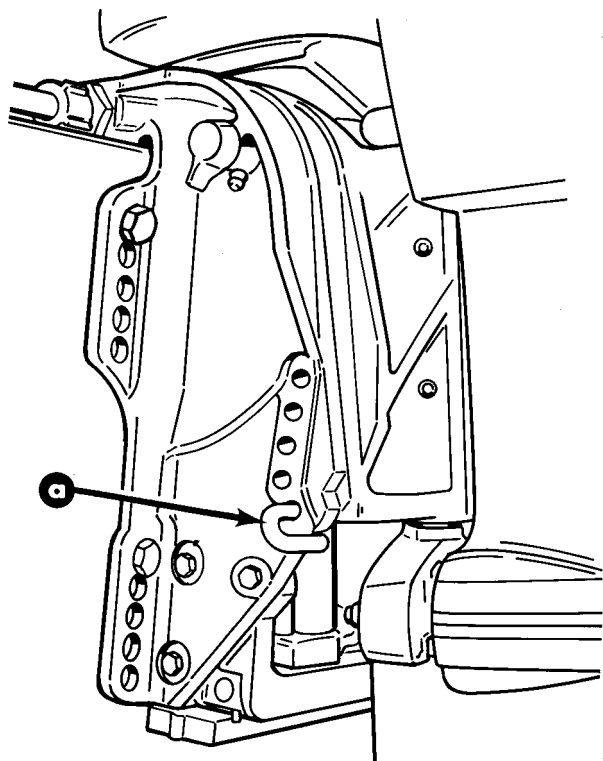
## Trim “In” Angle Adjustment

### ⚠ WARNING

Operating some boats with outboard trimmed to the full “in” trim angle [not using trim adjustment bolt (a)] at planing speed will cause undesirable and/or unsafe steering conditions. Each boat must be water tested for handling characteristics after outboard installation and after any trim adjustments.

**IMPORTANT:** Some boat/outboard combinations, that do not use the trim adjustment pin (a) and are trimmed to the full “in” trim angle, will not experience any undesirable and/or unsafe steering conditions during planing speed. Thus, not using trim adjustment pin may be desired. However, some boats with outboard trimmed to the full “in” trim angle at planing speeds will cause undesirable and/or unsafe steering conditions. If these steering conditions are experienced, under no circumstances should the outboard be operated without the trim adjustment pin and without the pin adjusted in the proper holes to prevent unsafe handling characteristics.

Water test the boat not using the trim adjustment pin. If undesirable and/or unsafe steering conditions are experienced (boat runs with nose down), install trim adjustment pin in proper hole to prevent unsafe handling characteristics.



50157

## Power Trim System (Models with Power Trim)

### General Information

The power trim system is filled at the manufacturer and is ready for use.

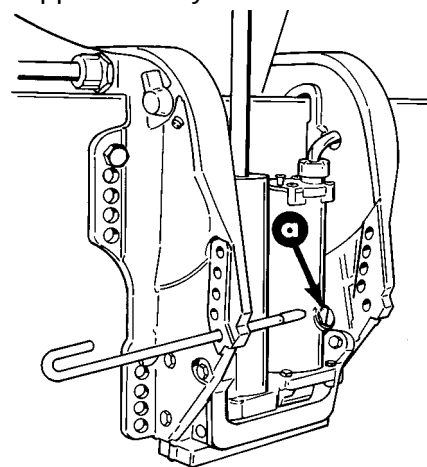
Trim outboard through entire trailering range several times to remove any air from the system.

The trim system is pressurized and is not externally vented.

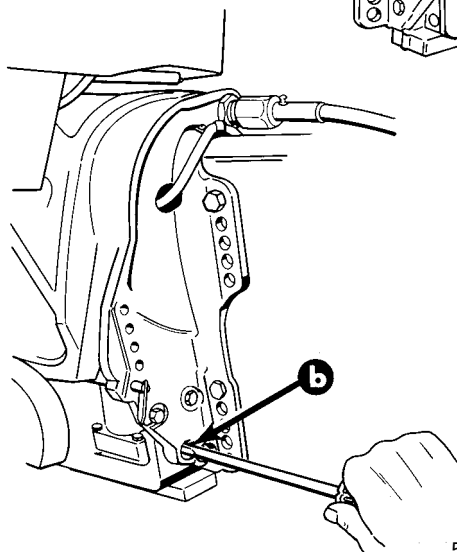
The outboard can be raised or lowered manually by loosening the manual release valve 2 to 3 turns counterclockwise.

The trim “out” angle of this outboard is not adjustable. The trim system has an internal valve which will automatically stop the outward trim travel at 200° when engine RPM is approximately 2000 RPM or higher; outboard also has to be in water and in gear.

The outboard can be operated beyond the 200° trim limit for operating outboard in shallow water if engine RPM is kept below approximately 2000 RPM.



50158



50146

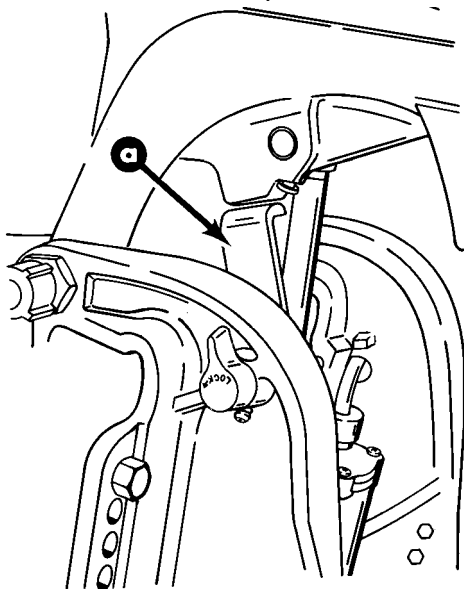
- a - Fill Screw (System is Pressurized, DO NOT Open Unless Outboard is Tilted to Full Up Position)
- b - Manual Tilt Release Valve Location



## Checking Trim System Fluid Level

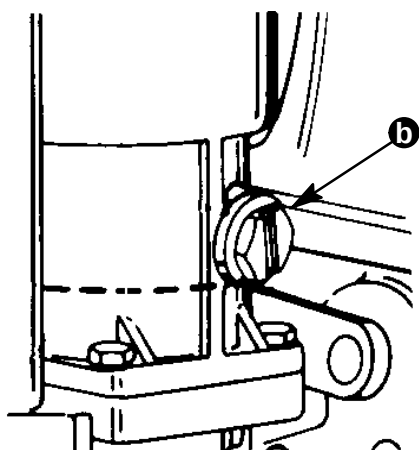
**IMPORTANT:** This trim system is pressurized. Remove fill screw when outboard is trimmed to the full “up” position. Retighten fill screw securely.

1. Trim outboard to full “up” position. Engage tilt lock level (a). Trim system fluid can only be checked when outboard is in this position.



50157

2. Remove fill screw and check fluid level. Fluid level should be to bottom of threads in fill hole (b).
3. If necessary, add Quicksilver Power Trim & Steering Fluid or; Automatic Transmission Fluid (ATF) Type F, FA or Dexron 11 fluid to trim system.
4. Reinstall fill screw.



## Trimming (Models with Power Trim)

**NOTE:** Because varying hull designs react differently in various degrees of rough water, it is recommended to experiment with trim positions to determine whether trimming up or down will improve the ride in rough water.

When trimming your outboard from a mid-trim position (trim tab in neutral straight fore-and-aft position), you can expect the following results:

### Trimming Outboard “Out” (“Up”) Characteristics

#### ⚠ WARNING

Excessive trim “out” also may reduce the stability of some high speed hulls. To correct instability at high speed, reduce the power **GRADUALLY** and trim the outboard “In” slightly before resuming high speed operation. (Rapid reduction in power will cause a sudden change of steering torque and may cause additional momentary boat instability.)

1. Will lift bow of boat, generally increasing top speed.
2. Transfers steering torque harder to left on standard or slightly elevated transom installation (single outboard).
3. Increases clearance over submerged objects.
4. In excess, can cause porpoising and/or ventilation.
5. If trimmed out beyond the water pickup, reduced water supply can cause serious overheating.

### Trimming Outboard “In” (“Down”) Characteristics

#### ⚠ WARNING

Excessive speed at minimum trim “in” may cause undesirable and/or unsafe steering conditions. Each boat should be tested for handling characteristics after any adjustment is made to the trim angle (trim adjustment pin relocation).

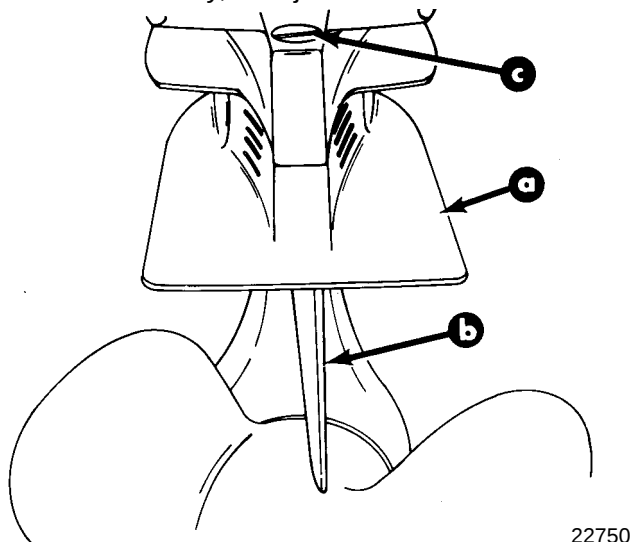
1. Will help planing off, particularly with a heavy load.
2. Usually improves ride in choppy water.



3. In excess, can cause boat to veer to the left or right (bow steer).
4. Transfers steering torque harder to right (or less to the left) on single outboard installations.
5. Improves planing speed acceleration.

## Trim Tab Adjustment

1. Check trim tab position as follows:
  - a. Operate boat at the speed at which it would normally be operated.
  - b. If the boat pulls to the right (starboard), the trailing edge of trim tab must be moved to the right. If the boat pulls to the left (port), the trailing edge of trim tab must be moved to the left.
2. If necessary, adjust trim tab as follows:
  - a. Shift outboard control into neutral and turn ignition key to "Off" position.
  - b. Remove plug from rear of drive shaft housing and loosen bolt and trim tab.
  - c. If boat pulls to the left, adjust trailing edge of trim tab to the left. If boat pulls to the right, adjust trailing edge of trim tab to the right.
  - d. Tighten trim tab bolt securely and replace plug.
  - e. Operate boat per "Check trim tab position as follows," preceding, to check trim tab setting. If necessary, readjust trim tab.



- a - Anti-Ventilation Plate  
b - Adjustable Trim Tab  
c - Plug

## Boat Performance

### Test Instructions

#### ⚠ WARNING

A tight grip on the steering wheel/tiller handle is always advisable and is required when accelerating, decelerating or when trimming the boat. On models with Power Trim, upon reaching cruising speed, the outboard should be trimmed to obtain a balanced steering condition. While trimming, steering loads will vary and will pull in one direction until a balanced condition has been attained. If the outboard is trimmed past the balanced steering condition, the steering wheel/tiller handle then will have a tendency to pull in the opposite direction. Excessive trimming past the balanced steering position will result in increased steering loads and, in most boat applications, a decrease in performance.

#### ⚠ CAUTION

When trimming boat with dual outboards, both outboards should be at approximately the same tilt angle and be tilted out (up) simultaneously (to prevent boat from pitching side-to-side) until desired boat attitude is achieved. Outboards can then be trimmed individually to precisely adjust boat trim angle and pitch.

1. With boat in water, trim the outboard(s) (trim button in remote control handle) so that the decal on the side of cowl is horizontal. This is a typical average setting that should give reasonable acceleration and top speed.
2. Go for a short familiarization ride at various throttle and trim settings BEFORE starting testing.

**NOTE:** Instruments should be read with eye directly in front to eliminate any error in reading the instruments.

3. When making either top speed or acceleration runs, best accuracy will be obtained by running with or against any wind. Side winds require driving in a constant turn to keep the boat moving straight ahead. If winds are 10 MPH (16 km/hr) or greater, it is suggested that all acceleration runs be made downwind.



4. The top speed WOT (wide-open-throttle) test should be done with the boat normally loaded (to duplicate actual running conditions). Operate boat in gear at WOT and check RPM. Engine RPM must be within the recommended full throttle RPM range (listed in the Operation and Maintenance Manual).

**NOTE:** When performing an acceleration test, it is recommended that a stop watch be used to improve testing accuracy. A wrist watch with a second hand may also be substituted.

5. An acceleration test can also be performed if desired. Start the test with boat motionless in the water and outboard in neutral. A stop watch should be started as the throttle is quickly pushed to WOT (wide-open-throttle). Stop the watch as the speedometer needle sweeps past 20 MPH (32 km/hr). Several runs should be made to assure a good average.

6. Prop "break loose" (sudden higher RPM), if not excessive, in some cases can be beneficial during acceleration. If undesirable "break loose" occurs, it can be decreased by trimming the outboard further under. If it remains excessive with all similar propellers, the outboard must be lowered.

7. It is suggested that all applicable data be recorded on a chart (such as that illustrated, following) and retained for future reference.

8. After several propellers of different pitch and/or design have been tried, select one that best serves the general purpose of the boat. The selected propeller should enable the engine to operate within its recommended full throttle RPM range, without excessive propeller "break loose" during acceleration or turns. A second propeller that would make both a suitable spare or a special purpose alternate might also be desirable.

**NOTE:** A higher pitch often gives best top speed, but the next lower pitch gives adequate top speed with much better acceleration.

**Boat Test Chart (Example)**

| Propeller Diameter and Pitch | WOT RPM | WOT MPH | Acceleration Time in Seconds @ | Propeller Break Loose |              | Wind during Run                                                                     |     | Water Condition | Air Temperature (°F) | Comments |
|------------------------------|---------|---------|--------------------------------|-----------------------|--------------|-------------------------------------------------------------------------------------|-----|-----------------|----------------------|----------|
|                              |         |         |                                | During Acceleration   | During Turns | Direction                                                                           | MPH |                 |                      |          |
| 10 1/8" x 15                 | 5450    | 35      | 7                              | slight                | no           |  | 5   | 3" chop         | 73                   |          |
| 10 1/4" x 14                 | 5700    | 34      | 6                              | no                    | no           |                                                                                     | 5   | 3" chop         | 73                   |          |

\* WOT is wide-open-throttle



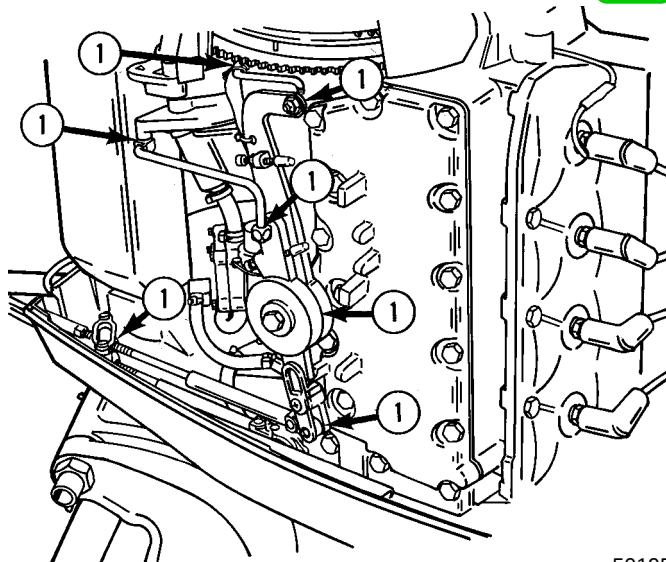
# Lubrication Points

| Item No. | Description                                      | Type of Lubricant                                                                             | Fresh Water Frequency                                                                          | Salt Water Frequency                                                                           |
|----------|--------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| 1        | Throttle/Shift Linkage Pivot Points              | Quicksilver 2-4-C Marine Lubricant                                                            | Every 60 Days                                                                                  | Every 30 Days                                                                                  |
| 2        | Upper Shift Shaft                                |                                                                                               |                                                                                                |                                                                                                |
| 3        | Tilt Lock Lever                                  |                                                                                               |                                                                                                |                                                                                                |
| 4        | Swivel Pin                                       |                                                                                               |                                                                                                |                                                                                                |
| 5        | Ride Guide Steering Cable                        |                                                                                               |                                                                                                |                                                                                                |
| 6        | Tilt Tube                                        |                                                                                               |                                                                                                |                                                                                                |
| 7        | Steering Link Rod Pivot Points                   | SAE 30W Motor Oil                                                                             | Every 60 Days                                                                                  | Every 30 Days                                                                                  |
| 8        | Propeller Shaft                                  | Quicksilver<br>- Special Lubricant 101<br>- Anti-Corrosion Grease<br>- 2-4-C Marine Lubricant | Once in Season                                                                                 | Every 60 Days                                                                                  |
| 9        | Starter Motor Pinion Gear                        | SAE 10W Motor Oil                                                                             | Once in Season                                                                                 | Every 60 Days                                                                                  |
| ★        | Gear Housing Bearing Carrier and Cover Nut       | Quicksilver<br>- Special Lubricant 101<br>- 2-4-C Marine Lubricant                            |                                                                                                | After first 20 hours, then once in season                                                      |
| □        | Gear Housing                                     | Quicksilver Gear Lube                                                                         | Check and fill after first 10 days, then every 30 days                                         | Check and fill after first 10 days, then every 30 days                                         |
|          |                                                  |                                                                                               | Drain and refill after 1st 25 hours, then after every 100 hours, or once a year before storing | Drain and refill after 1st 25 hours, then after every 100 hours, or once a year before storing |
| ◇        | Engine Crankshaft Splines to Drive Shaft Splines | Quicksilver 2-4-C Marine Lubricant                                                            | Once in Season                                                                                 | Once in Season                                                                                 |

★ Refer to lubrication instructions outlined in "Salt Water Corrosion - Gear Housing Bearing Carrier and Cover Nut" of this section (see "Table of Contents").

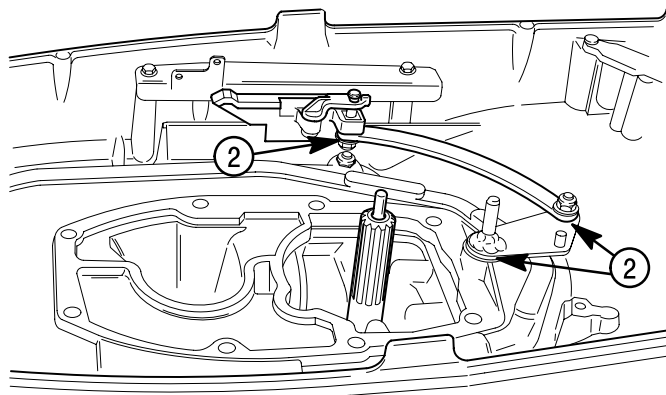
□ Refer to "Gear Housing Lubrication" of this section (see "Table of Contents").

◇ Refer to "Gear Housing Removal and Installation" (Section 5).



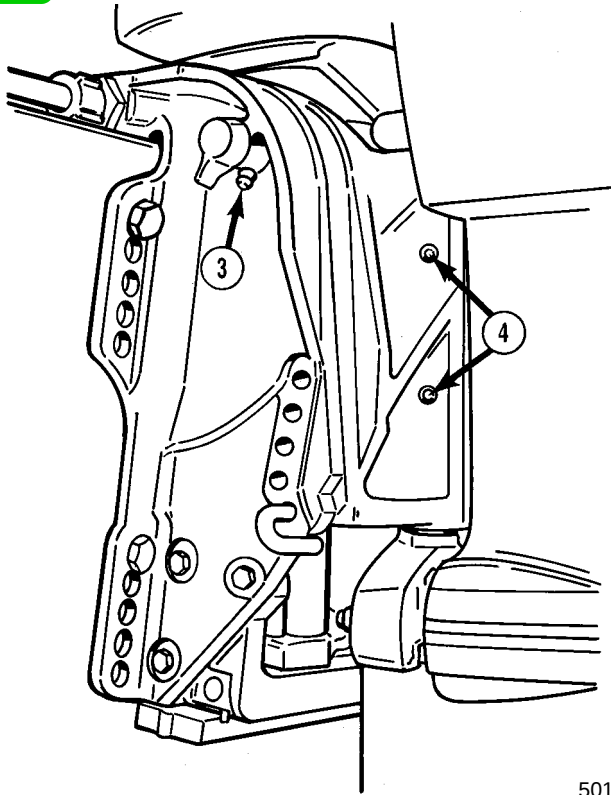
50195

1 - Throttle/Shift Linage Pivot Pint Lubrication



54634

2 - Upper Shift Shaft Lubrication



50157

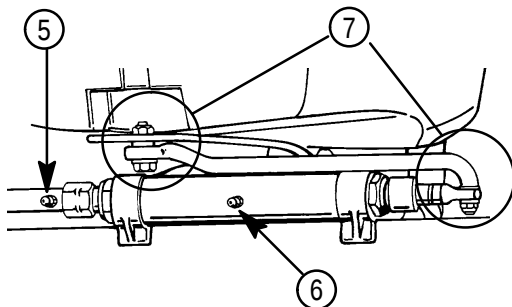
- 3 - Tilt Lock Lever Grease Fitting
- 4 - Swivel Pin Grease Fittings

## Ride-Guide Steering Cable and Pivot Points Lubrication

### ⚠ WARNING

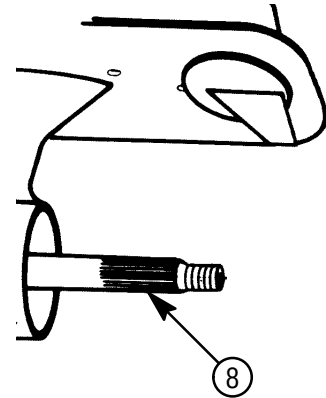
**Core of steering cable (transom end) must be fully retracted into cable housing before lubricating cable. If cable is lubricated while extended, hydraulic lock of cable could occur.**

With core of Ride-Guide Steering cable (transom end) fully retracted, lubricate transom end of steering cable thru grease fitting and exposed portion of cable end with Quicksilver 2-4-C Marine Lubricant. Lubricate all pivot points with SAE 30W engine oil.



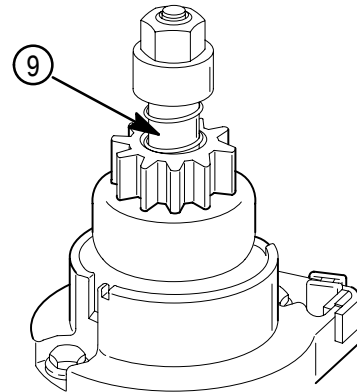
50334

- 5 - Ride-Guide Steering Grease Fitting
- 6 - Tilt Tube Grease Fitting
- 7 - Steering Link Rod Pivot Point Lubrication



26474

### 8 - Propeller Shaft Lubrication



12579

### 9 - Starter Motor Pinion Gear Lubrication



## Gear Housing Lubrication

**NOTE:** Refer to "Specifications," for gear housing lubricant capacity.

### ⚠ WARNING

If gear housing is installed on outboard, to avoid accidental starting, disconnect (and isolate) spark plug leads from spark plugs before working near the propeller.

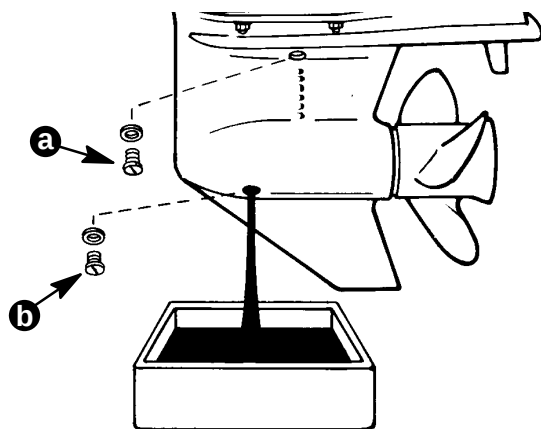
### ⚠ CAUTION

Do not use automotive grease in the gear housing. Use only Quicksilver Gear Lube or Quicksilver Super-Duty Lower Unit Lubricant.

1. Tilt outboard so that lubricant in gear housing will drain toward front of housing, out fill hole and into clean container.

**IMPORTANT:** Inspect fill and VENT plug washers for damage. Use new washer as needed.

2. Remove lubricant fill plug and washer. Note amount of metal particles on magnetic fill plug.
3. Remove VENT plug with washer and allow sufficient time for all lubricant to drain.



- a - Lubricant VENT Plug  
b - Lubricant Fill Plug/Washer

4. Inspect gear lubricant for metal particles (lubricant will have a "metal flake" appearance). Presence of fine metal particles (resembling powder) on the drain plug bar magnet indicates normal wear. The presence of metal chips on the drain plug bar magnet indicates the need for gear housing disassembly and components inspection.

5. Note color of gear lubricant. White or cream color indicates presence of water in lubricant. Gear lubricant which has been drained from a gearcase recently in operation will have a yellowish color due to lubricant agitation/aeration. This is normal and should not be confused with the presence of water.

6. Presence of water in gear lubricant indicates the need for disassembly and inspection of oil seals, seal surfaces, O-rings, water pump gaskets as well as gear housing components for damage.

**IMPORTANT:** Never add lubricant to gear housing without first removing VENT plug, as trapped air will prevent housing from being filled. Fill gear housing only when outboard is in operating position.

7. With outboard in operating position, insert lubricant tube into fill hole.
8. Fill gear housing with lubricant, until excess starts to flow from VENT hole.
9. At this point, drain approximately one fluid ounce (30ml) from gear housing to permit expansion of lubricant.
10. Install VENT plug and washer.
11. Remove lubricant tube and install cleaned magnetic fill plug with washer.

## Salt Water Corrosion - Gear Housing Bearing Carrier and Cover Nut

Salt water corrosion buildup can be sufficient to split a gear housing and destroy an entire lower unit. To protect against such damage, therefore, it is recommended that the gear housing bearing carrier and gear housing cover nut be lubricated on a regular basis, as follows:

Service first at the 20-hour inspection, then on an annual basis. Remove the cover nut and entire bearing carrier to adequately clean corrosive deposits and dried-up lubricant from both ends of the bearing carrier, as well as the gear housing internal threads and cover nut external threads. Apply a liberal amount of Quicksilver Special Lubricant 101; or 2-4-C Marine Lubricant to the 2 ends of the bearing carrier and to the gear housing and cover nut threads, then reassemble and retorque. Refer to gear housing disassembly and reassembly (Section 5).



## Periodic Inspection

Conduct a periodic, systematic inspection to uncover and correct a failure before it can cause inconvenience or mechanical damage. Inspection interval is based on average operating conditions in utility service. Under severe conditions, the inspection interval should be shortened. Inspection includes:

1. Clean entire unit thoroughly, including all accessible powerhead parts.
2. Check entire unit for loose, damaged or missing parts. Tighten or replace as required.
3. Lubricate gear housing as instructed previously.
4. Lubricate other points as indicated, previously.
5. Lubricate starter motor shaft with light film of SAE 10W motor oil. Do not over-lubricate.
6. Service spark plugs. Inspect spark plug leads and electrical leads for damage or deterioration, as explained in Section 2 "Electrical and Ignition" section.
7. Inspect fuel lines for damage or deterioration and service fuel filters as indicated in Section 3 "Fuel System and Carburetion."
8. Remove propeller and inspect. Trim nicks and burrs with a file, being careful not to remove more metal than absolutely necessary. Inspect for cracks, damage or bent condition. If condition is doubtful, refer to authorized Quicksilver Propeller Repair Station facilities. Before reinstalling propeller, coat propeller shaft with Quicksilver Special Lubricant 101, Anti-Corrosion Grease or 2-4-C Marine Lubricant.
9. Inspect the outboard surface finish for damage or corrosion. Thoroughly clean damaged or corroded areas and apply matching paint (Quicksilver Spray Paints).
10. Check trim tab and galvanic corrosion inhibitor for damage or for deterioration from salt water operation.
11. Check remote controls and steering. Be sure that all connections and fittings are in good condition, properly secured and correctly adjusted.

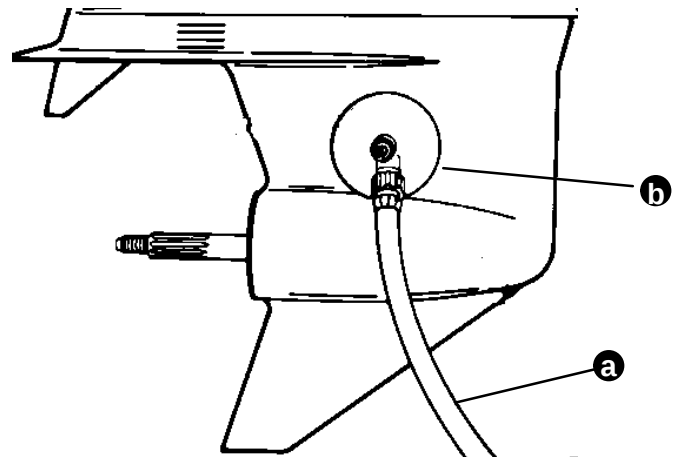
## Flushing Outboard Cooling System

### **⚠ WARNING**

**When flushing, be certain that area in vicinity of propeller is clear and that no person is standing nearby - to avoid possible injury. It is recommended to remove propeller as a precautionary measure.**

1. Install Quicksilver Flushing Attachment (44357A2) [or equivalent tool] on the gear housing from the FRONT side, positioning the rubber cups over the water intake openings.

### Typical Gear Housing



- a - Water Hose (1/2 in. [13mm] I.D. or Larger)  
b - Flushing Attachment (44357A2)

2. Connect hose (1/2 in. [13mm] I.D. or larger) between flushing attachment and water tap.

**IMPORTANT: To prevent water pump damage, do not start or run engine unless cooling water is flowing.**

3. With the outboard in normal operating position (vertical), partially open water tap (IT IS NOT NECESSARY to use full water pressure) and adjust water flow so that there is a significant water loss around the rubber cups.
4. Start engine and idle in neutral. Then increase engine speed, not to exceed 2500 RPM.



5. Flush or service engine as required. Be sure adequate cooling water is provided.

a. Water must be discharged thru "tell-tale."

**IMPORTANT: Prevent engine overheating. If water flow is insufficient, stop engine and determine cause before continuing.**

b. Flush until discharged water is clear. In salt-water areas, run outboard 3 to 5 minutes.

c. Stop engine before turning off water.

6. Stop engine, turn water off and remove flushing attachment from gear housing.

**IMPORTANT: While and after flushing, keep outboard in upright position until all water has drained from drive shaft housing to prevent water from entering the powerhead via drive shaft housing and exhaust ports.**

## Following Complete Submersion

Submerged engine treatment is divided into 3 distinct problem areas. The most critical is submersion in salt water; the second is submersion while running.

### Salt Water Submersion (Special Instructions)

Due to the corrosive effect of salt water on internal engine components, complete disassembly is necessary before any attempt is made to start the engine.

### Submerged While Running (Special Instructions)

When an engine is submerged while running, the possibility of internal engine damage is greatly increased. If, after engine is recovered and with spark plugs removed, engine fails to turn over freely when turning flywheel, the possibility of internal damage (bent connecting rod and/or bent crankshaft) exists. If this is the case, the powerhead must be disassembled.

## Submerged Engine (Fresh Water) (Plus Special Instructions)

1. Recover engine as quickly as possible.
2. Remove cowling.
3. Flush exterior of outboard with fresh water to remove mud, weeds, etc. DO NOT attempt to start engine if sand has entered powerhead, as power head will be severely damaged. Disassemble powerhead if necessary to clean components.
4. Remove spark plugs and get as much water as possible out of powerhead. Most water can be eliminated by placing engine in a horizontal position (with spark plug holes down) and rotating flywheel.
5. Pour alcohol into carburetor throat (alcohol will absorb water). Again rotate flywheel.
6. Turn engine over and pour alcohol into spark plug openings and again rotate flywheel.
7. Turn engine over (place spark plug opening down) and pour engine oil into throat of carburetors while rotating flywheel to distribute oil throughout crankcase.
8. Again turn engine over and pour approximately one teaspoon of engine oil into each spark plug opening. Again rotate flywheel to distribute oil in cylinders.
9. Remove and clean carburetors and fuel pump assembly.
10. Reinstall spark plugs, carburetors and fuel pump.
11. Attempt to start engine, using a fresh fuel source. If engine starts, it should be run for at least one hour to eliminate any water in engine.
12. If engine fails to start, determine cause (fuel, electrical or mechanical). Engine should be run within 2 hours after recovery of outboard from water, as serious internal damage may occur. If unable to start engine in this period, disassemble engine and clean all parts and apply oil as soon as possible.



## Out-of-Season Outboard Storage

### WARNING

**As a safety precaution, when boat is in storage, remove positive (+) battery cable. This will eliminate possibility of accidental starting of engine and resultant overheating and damage to engine from lack of water.**

In preparing an outboard for out-of-season storage, 2 precautions must be considered: 1) The engine must be protected from physical damage and 2) the engine must be protected from rust, corrosion and dirt.

1. Remove cowling from engine.
2. Place outboard in water or install Quicksilver Flushing Attachment over water intake by following instructions outlined in "Flushing Outboard" (see "Table of Contents").
3. Start engine and allow to warm up. Disconnect fuel line and allow engine to run at low RPM while inducing approximately 2 oz. (57 g) of Quicksilver Storage Seal into each carburetor throat. Allow engine to stall out, indicating that carburetors have run dry.
4. Remove spark plugs from engine and spray approximately one ounce (30ml) of Quicksilver Storage Seal into each spark plug hole. Manually turn engine over several times to distribute Storage Seal throughout cylinders. Reinstall spark plugs.
5. If engine fuel filter appears to be contaminated, remove and replace. Refer to Section 3 "Fuel System and Carburetion."
6. Drain and refill lower unit with Quicksilver Gear Lube, as explained in "Gear Housing Lubrication" (see "Table of Contents").
7. Clean outboard thoroughly, including all accessible powerhead parts, and spray with Corrosion and Rust Preventive.
8. Refer to lubrication chart in this section (see "Table of Contents") and lubricate all lubrication points.
9. Remove propeller. Apply Special Lubricant 101, Anti-Corrosion Grease or 2-4-C Marine Lubricant to propeller shaft and reinstall propeller. Refer to "Propeller Installation" (see "Table of Contents").

10. If the water pickup is clogged, the speedometer will be inoperative. Clean the pickup with a piece of wire or blow out with compressed air. Before blowing out with air, disconnect the tubing from the speedometer.
11. To prevent freeze damage, drain the speedometer system of water completely before storage. Remove tubing from speedometer fitting and blow thru the tubing to remove water.
12. Store battery as outlined in "Out-of-Season Battery Storage," following.
13. For out-of-season storage information on Auto-Blend units, refer to Section 8 in this service manual.

**IMPORTANT: When storing outboard for the winter, be sure that all water drain holes in gear housing are open and free so that all water will drain out. If a speedometer is installed in the boat, disconnect the pickup tube and allow it to drain. Reconnect the tube after draining. Trapped water may freeze and expand, thus cracking gear housing and/or water pump housing. Check and refill gear housing with Quicksilver Gear Lube before storage to protect against possible water leakage into gear housing which is caused by loose lubricant vent plug or loose grease fill plug. Inspect gaskets under lubricant vent and fill plugs, replacing any damaged gaskets, before reinstalling plugs.**

## Out-of-Season Battery Storage

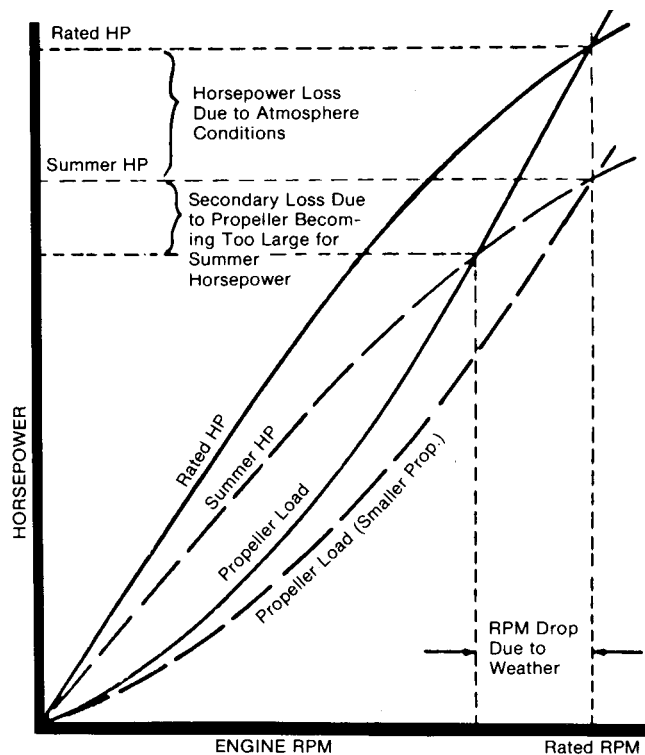
1. Remove battery as soon as possible and remove all grease, sulfate and dirt from top surface.
2. Cover plates with distilled water, but not over 3/16in. (5mm) above perforated baffles.
3. Cover terminal bolts well with grease.
4. Store battery in a COOL, DRY place in a dry carton or box.
5. Remove battery from storage every 60 days. Check water level and place on charge for 5 to 6 hours at 6 amperes. DO NOT fast charge.

### CAUTION

**A discharged battery can be damaged by freezing.**



# How Weather Affects Engine Performance



It is a known fact that weather conditions exert a profound effect on power output of internal combustion engines. Therefore, established horsepower ratings refer to the power that the engine will produce at its rated RPM under a specific combination of weather conditions.

Corporations internationally have settled on adoption of I.S.O. (International Standards Organization) engine test standards, as set forth in I.S.O. 3046 standardizing the computation of horsepower from data obtained on the dynamometer, correcting all values to the power that the engine will produce at sea level, at 30% relative humidity at 77° F (25° C) temperature and a barometric pressure of 29.61 inches of mercury.

Summer Conditions of high temperature, low barometric pressure and high humidity all combine to reduce the engine power. This, in turn, is reflected in decreased boat speeds--as much as 2 or 3 miles-per-hour in some cases. (Refer to previous chart.) Nothing will regain this speed for the boater, but the coming of cool, dry weather.

In pointing out the practical consequences of weather effects, an engine--running on a hot, humid summer day--may encounter a loss of as much as 14% of the horsepower it would produce on a dry, brisk spring or fall day. The horsepower, that any internal combustion engine produces, depends upon the density of the air that it consumes and, in turn, this density is dependent upon the temperature of the air, its barometric pressure and water vapor (or humidity) content.

Accompanying this weather-inspired loss of power is a second but more subtle loss. At rigging time in early spring, the engine was equipped with a propeller that allowed the engine to turn within its recommended RPM range at full throttle. With the coming of the summer weather and the consequent drop in available horsepower, this propeller will, in effect, become too large. Consequently, the engine operates at less than its recommended RPM.

Due to the horsepower/RPM characteristics of an engine, this will result in further loss of horsepower at the propeller with another decrease in boat speed. This secondary loss, however, can be regained by switching to a smaller pitch propeller that allows the engine to again run at recommended RPM.

For boaters to realize optimum engine performance under changing weather conditions, it is essential that the engine be propped to allow it to operate at or near the top end of the recommended maximum RPM range at wide-open-throttle with a normal boat load.

Not only does this allow the engine to develop full power, but equally important is the fact that the engine also will be operating in an RPM range that discourages damaging detonation. This, of course, enhances overall reliability and durability of the engine.



## Conditions Affecting Operation

1. Proper positioning of the weight inside the boat (persons and gear) has a significant effect on the boat's performance, for example:
  - a. Shifting weight to the rear (stern)
    - (1.) Generally increases top speed.
    - (2.) If in excess, can cause the boat to porpoise.
    - (3.) Can make the bow bounce excessively in choppy water.
    - (4.) Will increase the danger of the following-wave splashing into the boat when coming off plane.
  - b. Shifting weight to the front (bow)
    - (1.) Improves ease of planing off.
    - (2.) Generally improves rough water ride.
    - (3.) If excessive, can make the boat veer back-and-forth (bow steer).
2. **Boat Bottom:** For maximum speed, a boat bottom should be nearly a flat plane where it contacts the water and particularly straight and smooth in fore-and-aft direction.
  - a. **Hook:** Exists when bottom is concave in fore-and-aft direction when viewed from the side. When boat is planing, "hook" causes more lift on bottom near transom and allows bow to drop, thus greatly increasing wetted surface and reducing boat speed. "Hook" frequently is caused by supporting boat too far ahead of transom while hauling on a trailer or during storage.
  - b. **Rocker:** The reverse of hook and much less common. "Rocker" exists if bottom is convex in fore-and-aft direction when viewed from the side, and boat has strong tendency to porpoise.
  - c. **Surface Roughness:** Moss, barnacles, etc., on boat or corrosion of outboard's gear housing increase skin friction and cause speed loss. Clean surfaces when necessary.
3. **Gear Housing:** If unit is left in the water, marine vegetation may accumulate over a period of time in certain types of water. This growth must be removed from unit before operation, as it may clog the water inlet holes in the gear housing and cause the engine to overheat.

## Detonation: Causes and Prevention

Detonation in a 2-cycle engine somewhat resembles the "pinging" heard in an automobile engine. It can be otherwise described as a tin-like "rattling" or "planking" sound.

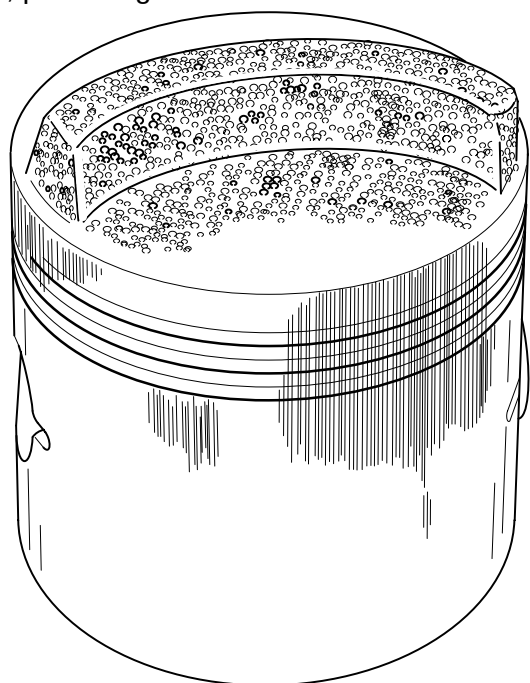
Detonation generally is thought of as spontaneous ignition, but it is best described as a noisy explosion in an unburned portion of the fuel/air charge after the spark plug has fired. Detonation creates severe, untimely shock waves in the engine, and these shock waves often find or create a weakness: The dome of a piston, piston rings or piston ring lands, piston pin and roller bearings.

While there are many causes for detonation in a 2-cycle engine, emphasis is placed on those causes which are most common in marine 2-cycle application. A few, which are not commonly understood, are:

1. Over-advanced ignition timing.
2. Use of low octane gasoline.
3. Propeller pitch too high (engine RPM below recommended maximum range).
4. Lean fuel mixture at or near wide-open-throttle.
5. Spark plugs (heat range too hot - incorrect reach - cross-firing).
6. Inadequate engine cooling (deteriorated cooling system).
7. Combustion chamber/piston deposits (result in higher compression ratio).



Detonation usually can be prevented, provided that 1) the engine is correctly set up and 2) diligent maintenance is applied to combat the detonation causes, listed, preceding.



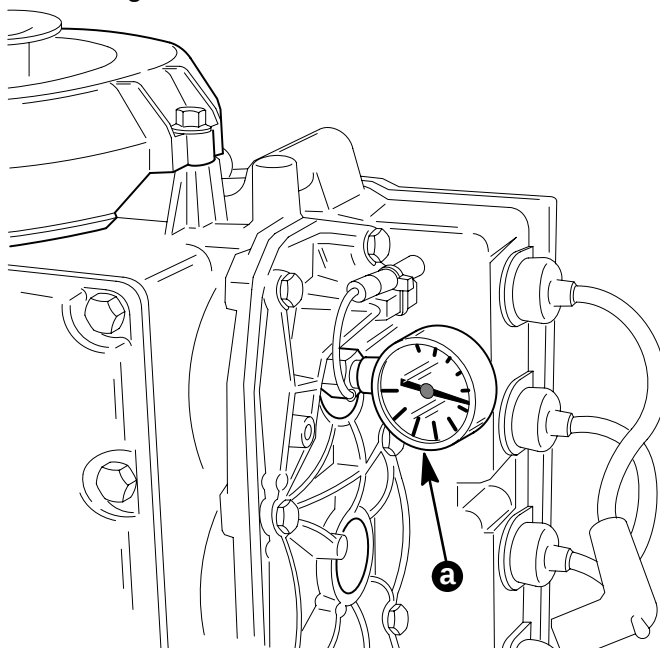
54635

**Damaged Piston Resulting From Detonation**

## Compression Check

1. Remove spark plugs.
2. Install compression gauge in spark plug hole.
3. Hold throttle plates at W.O.T.
4. Crank engine thru at least 4 compression strokes to obtain highest possible reading.
5. Check and record compression of each cylinder. Variation of more than 15 lbs. per sq. in. (103.5 kPa) between cylinders indicates that lower compression cylinder is in some way defective, such as worn or sticking piston rings and/or scored piston and cylinder.

6. Compression check is important because an engine with low or uneven compression cannot be tuned successfully to give peak performance. It is essential, therefore, that improper compression be corrected before proceeding with an engine tuneup.
7. Cylinder scoring: If powerhead shows any indication of overheating, such as discolored or scorched paint, remove transfer port cover and visually inspect cylinders for scoring or other damage as outlined in Section 4 "Power Head."



54636

a - Compression Gauge (P/N 91-29287)



# Painting Procedures

## Cleaning & Painting Aluminum Propellers & Gear Housings

### WARNING

Avoid serious injury from flying debris. Avoid serious injury from airborne particles. Use eye and breathing protection with proper ventilation.

### PROPELLERS

1. Sand the entire area to be painted with 3M 120 Regalite Polycut or coarse Scotch-Brite, disc or belts.
2. Feather edges of all broken paint edges. Try not to sand through the primer.
3. Clean the surface to be painted using PPG Industries DX330 Wax and Grease Remover or equivalent (Xylene or M.E.K.).
4. If bare metal has been exposed, use Quicksilver's Light Gray Primer.
5. Allow a minimum of 1 hour dry time and no more than 1 week before applying the finish coat.
6. Apply the finish coat using Quicksilver's EDP Propeller Black.

### GEAR HOUSINGS

The following procedures should be used in refinishing gear housings. This procedure will provide the most durable paint system available in the field. The materials recommended are of high quality and approximate marine requirements. The following procedure will provide a repaint job that compares with a properly applied factory paint finish. It is recommended that the listed materials be purchased from a local Ditzler Automotive Finish Supply Outlet. The minimum package quantity of each material shown following is sufficient to refinish several gear housings.

#### Procedure:

1. Wash gear housing with a muriatic acid base cleaner to remove any type of marine growth, and rinse with water, if necessary.
2. Wash gear housing with soap and water, then rinse.

3. Sand blistered area with 3M 180 grit sandpaper or P180 Gold Film Disc to remove paint blisters only. Feather edge all broken paint edges.
4. Clean gear housing thoroughly with (DX-330) wax and grease remover.
5. Spot repair surfaces where bare metal is exposed with (DX-503) alodine treatment.

**IMPORTANT: Do not use any type of aerosol spray paints as the paint will not properly adhere to the surface nor will the coating be sufficiently thick to resist future paint blistering.**

6. Mix epoxy chromate primer (DP-40) with equal part catalyst (DP-401) per manufacturers instructions, allowing proper induction period for permeation of the epoxy primer and catalyst.
7. Allow a minimum of one hour drying time and no more than one week before top coating assemblies.
8. Use Ditzler Urethane DU9000 for Mercury Black, DU34334 for Mariner Grey, and DU35466 for Force Charcoal, and DU33414M for Sea Ray White. Catalyze all three colors with Ditzler DU5 catalyst mixed 1:1 ratio. Reduce with solvents per Ditzler label.

### CAUTION

**Be sure to comply with instructions on the label for ventilation and respirators. Using a spray gun, apply one half to one mil even film thickness. Let dry, flash off for five minutes and apply another even coat of one half to one mil film thickness. This urethane paint will dry to the touch in a matter of hours, but will remain sensitive to scratches and abrasions for a few days.**

9. The type of spray gun used will determine the proper reduction ratio of the paint.

**IMPORTANT: Do not paint sacrificial zinc trim tab or zinc anode.**

10. Cut out a cardboard "plug" for trim tab pocket to keep paint off of mating surface to maintain good continuity circuitry between trim tab and gear housing.



# Decal Application

## Decal Removal

1. Mark decal location before removal to assure proper alignment of new decal.
2. Carefully soften decal and decal adhesive with a heat gun or heat blower while removing old decal.
3. Clean decal contact area with a 1:1 mixture of isopropyl alcohol and water.
4. Thoroughly dry decal contact area and check for a completely cleaned surface.

## Instructions for “Wet” Application

**NOTE:** The following decal installation instructions are provided for a “Wet” installation. **All** decals should be applied wet.

### TOOLS REQUIRED

1. Plastic Squeegee\*
2. Stick Pin
3. Dish Washing **Liquid/Detergent without ammonia**\*\* “Joy” and “Drift” are known to be compatible for this process.

\* Automotive Body Filler Squeegee

\*\* Do not use a soap that contains petroleum based solvents.

**SERVICE TIP:** Placement of decals using the “Wet” application will allow time to position decal. Read entire installation instructions on this technique before proceeding.

### TEMPERATURE

**IMPORTANT:** Installation of vinyl decals should not be attempted while in direct sunlight. Air and surface temperature should be between 60°F (15°C) and 100°F (38°C) for best application.

### SURFACE PREPARATION

**IMPORTANT:** Do not use a soap or any petroleum based solvents to clean application surface.

Clean entire application surface with mild dish washing liquid and water. Rinse surface thoroughly with clean water.

## DECAL APPLICATION

1. Mix  $\frac{1}{2}$  ounce (16 ml) of dish washing liquid in one gallon (4 l) of cool water to use as wetting solution.

**NOTE:** Leave protective masking, if present, on the face of decal until final steps of decal installation. This will ensure that the vinyl decal keeps it's shape during installation.

2. Place the decal face down on a clean work surface and remove the paper backing from “adhesive side” of decal.
3. Using a spray bottle, flood the entire “adhesive side” of the decal with the pre-mixed wetting solution.
4. Flood area where the decal will be positioned with wetting solution.
5. Position pre-wetted decal on wetted surface and slide into position.
6. Starting at the center of the decal, “lightly” squeegee out the air bubbles and wetting solution with overlapping strokes to the outer edge of the decal. Continue going over the decal surface until all wrinkles are gone and adhesive bonds to the cowl surface.
7. Wipe decal surface with soft paper towel or cloth.
8. **Wait 10 - 15 minutes.**
9. Starting at one corner, “carefully and slowly” pull the masking off the decal surface at a 180° angle.

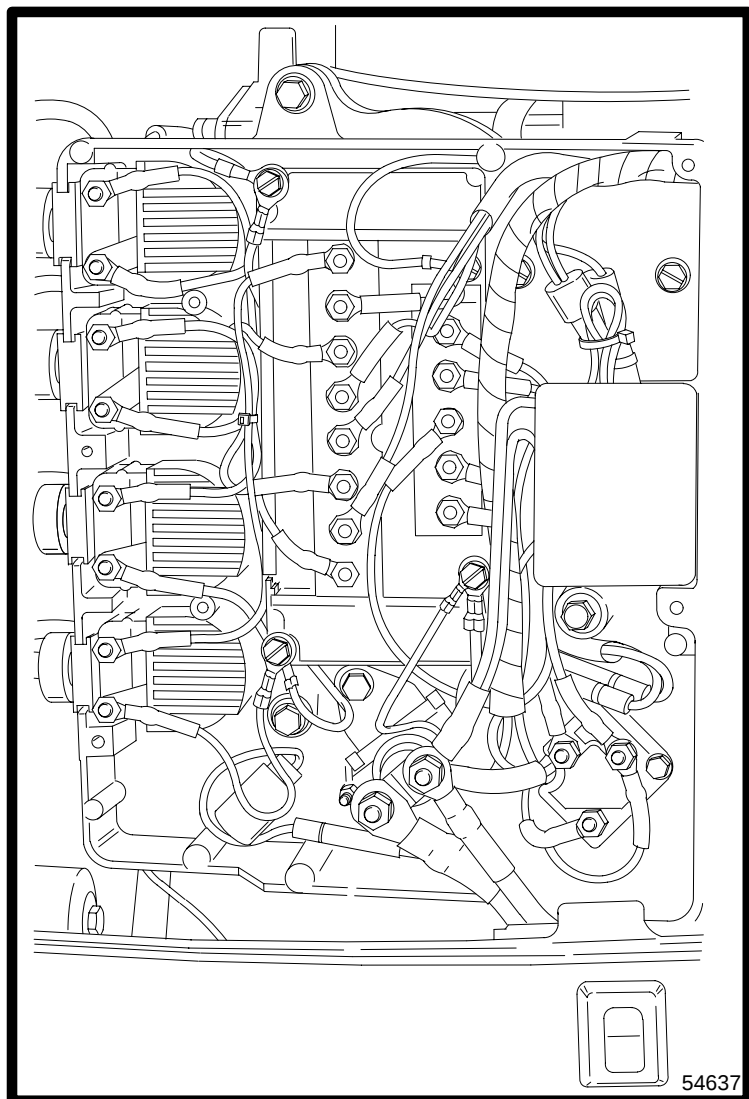
**NOTE:** To remove any remaining bubbles, pierce the decal at one end of the bubble with stick pin and press out the entrapped air or wetting solution with your thumb (moving toward the puncture).



# ELECTRICAL AND IGNITION

2

A



## IGNITION SYSTEM



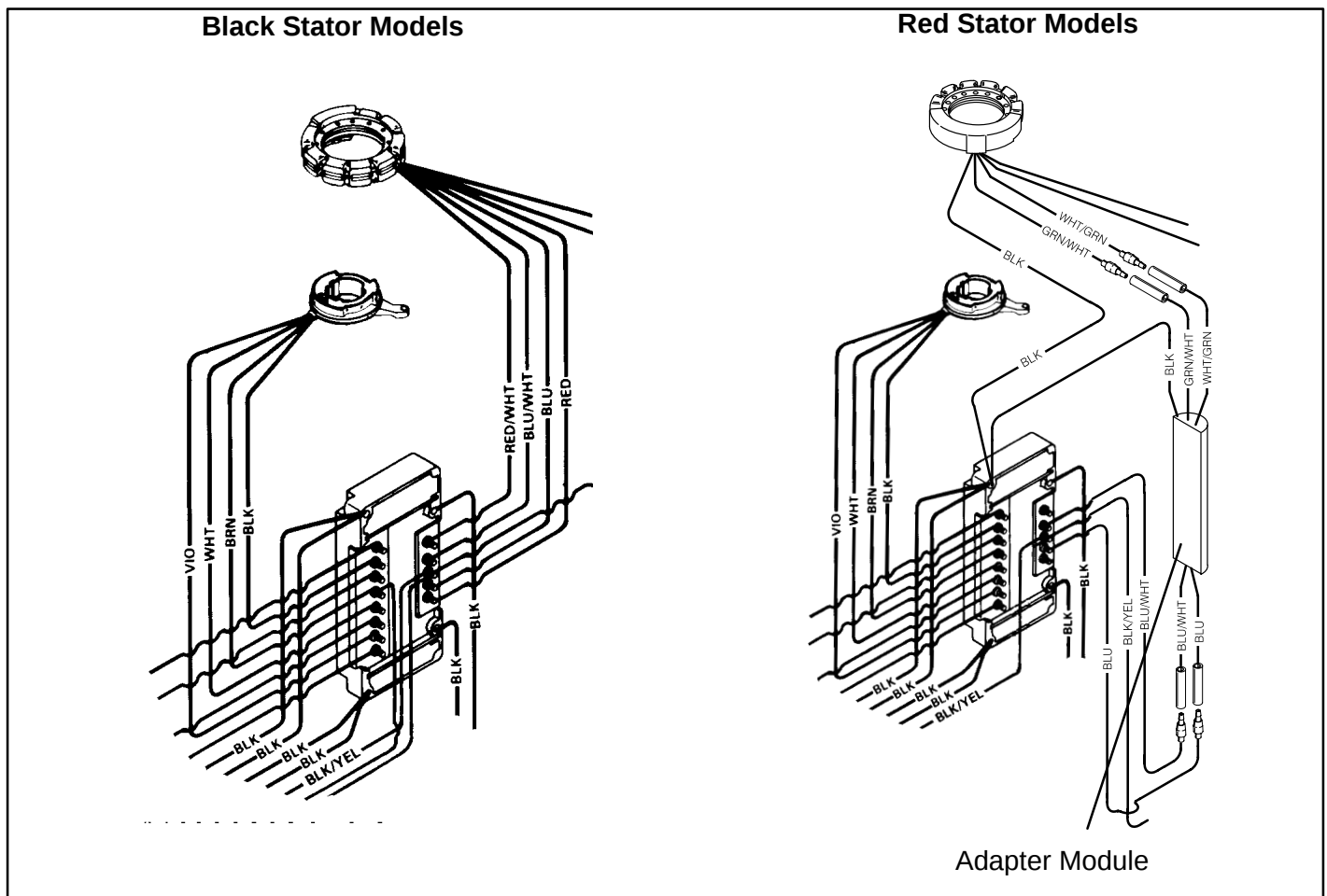
# Table of Contents

## Page

|                                                               |       |
|---------------------------------------------------------------|-------|
| Ignition System .....                                         | 2A-1  |
| Description .....                                             | 2A-1  |
| Ignition Troubleshooting .....                                | 2A-2  |
| Checking For Loss Spark .....                                 | 2A-2  |
| Troubleshooting Test Equipment .....                          | 2A-2  |
| Ignition Troubleshooting (Engines With<br>Black Stator) ..... | 2A-3  |
| Ignition Troubleshooting (Engines With<br>Red Stator) .....   | 2A-7  |
| Ignition Component Testing .....                              | 2A-10 |
| Trigger Test .....                                            | 2A-10 |
| Ignition Coil Test .....                                      | 2A-10 |
| Test For Spark .....                                          | 2A-12 |
| Running Voltage Output Test .....                             | 2A-12 |
| Ignition (Key) Switch Test .....                              | 2A-13 |
| Mercury (Tilt) Stop Switch Test .....                         | 2A-13 |
| Flywheel Removal and Installation .....                       | 2A-14 |
| Flywheel Removal .....                                        | 2A-14 |
| Manual Start Model .....                                      | 2A-14 |
| Electric Start Model .....                                    | 2A-14 |
| Flywheel Installation .....                                   | 2A-15 |
| Ignition Components .....                                     | 2A-15 |
| Stator Assembly Removal .....                                 | 2A-15 |
| Black Stator Assembly Installation .....                      | 2A-17 |
| Red Stator Assembly Installation .....                        | 2A-18 |
| Trigger Plate Assembly Removal .....                          | 2A-21 |
| Trigger Plate Assembly Installation .....                     | 2A-22 |
| Ignition Coil Removal .....                                   | 2A-23 |
| Ignition Coil Installation .....                              | 2A-23 |
| Switch Box Removal .....                                      | 2A-23 |
| Switch Box Installation .....                                 | 2A-24 |



# Ignition System



## Description

The ignition system is alternator-driven with distributor-less capacitor discharge. Major components of the ignition system are the flywheel, stator assembly, trigger assembly, switch box, ignition coils and spark plugs.

The stator assembly is mounted below the flywheel and has 2 coils. The flywheel is fitted with permanent magnets inside the outer rim. As the flywheel rotates, the permanent magnets pass the stationary stator ignition coils. This causes the ignition coils to produce AC voltage. The AC voltage then is conducted to the switch boxes where it is rectified and stored in a capacitor.

The trigger assembly (also mounted under the flywheel) has 2 coils. The flywheel likewise has a second set of magnets (located around the hub). As the flywheel rotates, the second set of permanent magnets passes the trigger coils. This causes the trigger coils, in turn, to produce an AC voltage that is conducted to an electronic switch (SCR) in the switch box.

The switch discharges the capacitor voltage into the ignition coil at the correct time and in firing order sequence.

Capacitor voltage is conducted to the ignition coil primary. The ignition coil multiplies this voltage to a value high enough to jump the gap at the spark plug.

The preceding sequence occurs once-per-engine-revolution for each cylinder.

Spark timing is changed (advanced/retarded) by rotating the trigger coil position in relation to the permanent magnets on the flywheel hub.

## Red Stator Models

Red stators require an adapter module that gets connected between the stator and switch box. Without the adapter module, the voltage supplied by the stator would exceed the voltage capability of the switch box.



# Ignition Troubleshooting

## ⚠ WARNING

**DANGER - HIGH VOLTAGE/SHOCK HAZARD! Do not touch ignition components and/or metal test probes while engine is running and/or being "cranked". STAY CLEAR OF SPARK PLUG LEADS. To assure personal safety, each individual spark plug lead should be grounded to engine.**

Before troubleshooting the ignition system, check the following:

- Make sure that electrical harness, lanyard switch, ignition switch, and mercury switch are not the source of the problem.
- Check that plug-in connectors are fully engaged and terminals are free of corrosion.
- Make sure that wire connections are tight and free of corrosion.
- Check all electrical components, that are grounded directly to engine, and all ground wires to see that they are grounded to engine.
- Check for disconnected wires and short and open circuits.

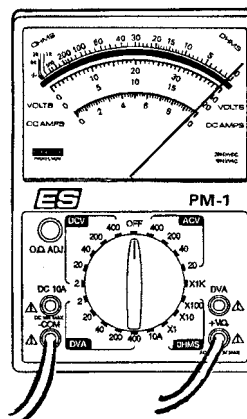
## Checking for Loss of Spark

The use of an inductive timing light while cranking or running the engine will show whether there is spark present or not. The timing light will not show the strength of the spark. Incorrect spark strength may not allow the spark plug to fire under compression

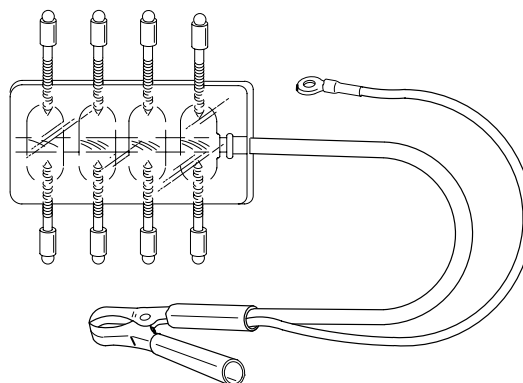
The use of a spark gap or spark gap board will give a visual indication of the strength of the spark. Normal ignition spark is BLUE in color. A YELLOW or RED spark indicates a weak ignition.

## Troubleshooting Test Equipment

Multimeter / DVA Tester 91-99750



Spark Tester 91-850439

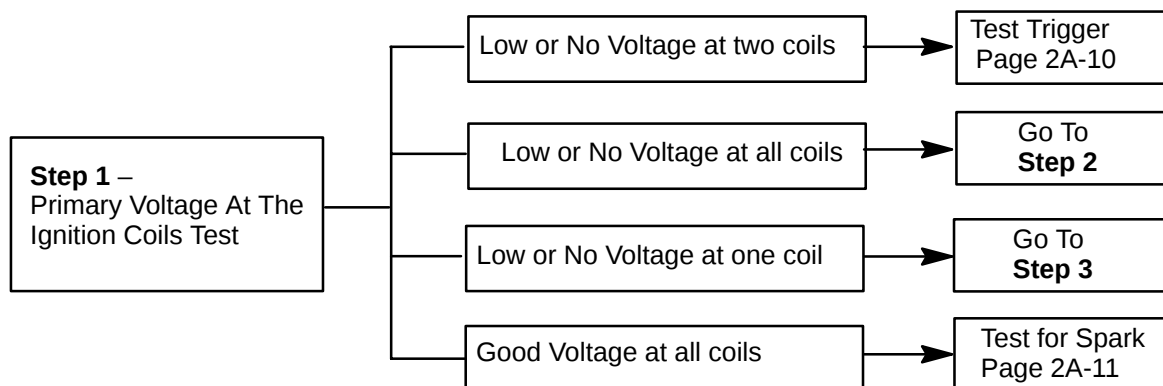




# Ignition Troubleshooting (Engines With Black Stator)

## Troubleshooting Sequence Chart – (Engines with Black Stator)

Start the ignition troubleshooting by first performing Step 1, then continue the series of steps to locate the problem. Refer to the troubleshooting steps on the following pages.



## DVA TESTS – 9 AMP BLACK STATOR

| Tested Part       | Selector Position | Red                   | Black             | Reading At 300 - 1000 RPM | Reading At 1000 - 4000 RPM |
|-------------------|-------------------|-----------------------|-------------------|---------------------------|----------------------------|
| Coil Primary      | 400 VDC*          | Coil (+) Terminal     | Coil (-) Terminal | 160 - 250                 | 180 - 275                  |
| Stop Circuit      | 400 VDC*          | Black/Yellow Terminal | Ground            | 200 - 360                 | 200 - 360                  |
| Stator Low Speed  | 400 VDC*          | Blue Sw. Box Term.    | Ground            | 210 - 310                 | 190 - 310                  |
| Stator High Speed | 400 VDC*          | Red Sw. Box Term.     | Ground            | 25 - 90                   | 140 - 310                  |

## DVA TESTS – 16 AMP BLACK STATOR (398-9710A33 & 398-9710A42)

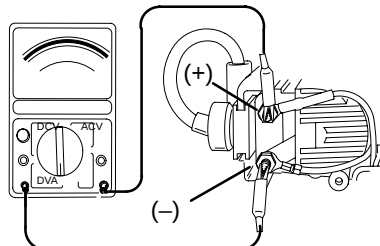
| Tested Part       | Selector Position | Red                   | Black                           | Voltage @ 300 RPM | Voltage @ 1000 RPM | Voltage @ 4000 RPM |
|-------------------|-------------------|-----------------------|---------------------------------|-------------------|--------------------|--------------------|
| Coil Primary      | 400 VDC*          | Coil (+) Terminal     | Coil (-) Terminal               | 110 - 140         | 250 - 300          | 215 - 265          |
| Stop Circuit      | 400 VDC*          | Black/Yellow Terminal | Ground                          | 160 - 200         | 315 - 385          | 270 - 330          |
| Stator Low Speed  | 400 VDC*          | Blue Sw. Box Term.    | Ground                          | 160 - 200         | 315 - 385          | 270 - 330          |
| Stator High Speed | 400 VDC*          | Red Sw. Box Term.     | Ground                          | 8 - 10            | 27 - 33            | 165 - 205          |
| Switch Box Bias   | 20 VDC or 40 VDC  | Ground                | White/Black Switch Box Terminal | 2 - 10            | 10 - 30            | 10 - 30            |

\* If using a meter with a built-in DVA, place selector switch in the DVA/400 VDC position.



# Ignition Troubleshooting (Engines With Black Stator)

## STEP 1 – Primary Voltage At The Ignition Coils Test



### TEST RESULTS

- No voltage output or low voltage output on all coils. Go to STEP 2 – Stop Circuit Test.
- Good voltage on two coils. Go to Trigger Test.
- Good voltage on all coils. Go to Testing For Spark.

1. Use Multimeter / DVA Tester 91-99750.
2. Crank engine and observe meter reading.

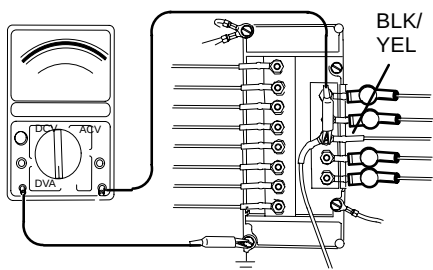
### IGNITION VOLTAGE – 9 AMP STATOR

| Tested Part  | Selector Position | Red               | Black             | Reading At 300 - 1000 RPM | Reading At 1000 - 4000 RPM |
|--------------|-------------------|-------------------|-------------------|---------------------------|----------------------------|
| Coil Primary | 400 VDC           | Coil (+) Terminal | Coil (-) Terminal | 160 - 250                 | 180 - 275                  |

### IGNITION VOLTAGE – 16 AMP STATOR (398-9710A33 & 398-9710A42)

| Tested Part  | Selector Position | Red               | Black             | Voltage @ 300 RPM | Voltage @ 1000 RPM | Voltage @ 4000 RPM |
|--------------|-------------------|-------------------|-------------------|-------------------|--------------------|--------------------|
| Coil Primary | 400 VDC           | Coil (+) Terminal | Coil (-) Terminal | 110 - 140         | 250 - 300          | 215 - 265          |

## STEP 2 – Stop Circuit Test



### TEST RESULTS

- Good voltage output. Go to STEP 3 – Stator Low Speed and High Speed Test
- High voltage output. The trigger or switch box is defective. Go to Trigger Test and test trigger. If trigger tests OK, replace switch box and repeat step.
- No voltage output or low voltage output. Remove BLK/YEL wires from switch box terminal and repeat test. If voltage output is now OK, either the ignition switch, stop switch or wiring is defective. If no voltage or low voltage remains, go to STEP 5 – Stator, Low and High Speed Test.

1. Use Multimeter / DVA Tester 91-99750.
2. Crank engine and observe meter reading.

### IGNITION VOLTAGE – 9 AMP STATOR

| Tested Part  | Selector Position | Red                   | Black  | Reading At 300 - 1000 RPM | Reading At 1000 - 4000 RPM |
|--------------|-------------------|-----------------------|--------|---------------------------|----------------------------|
| Stop Circuit | 400 VDC           | Black/Yellow Terminal | Ground | 200 - 360                 | 200 - 360                  |

### IGNITION VOLTAGE – 16 AMP STATOR (398-9710A33 & 398-9710A42)

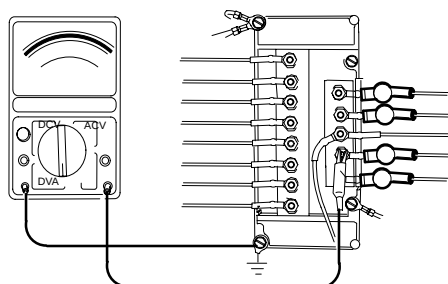
| Tested Part  | Selector Position | Red                   | Black  | Voltage @ 300 RPM | Voltage @ 1000 RPM | Voltage @ 4000 RPM |
|--------------|-------------------|-----------------------|--------|-------------------|--------------------|--------------------|
| Stop Circuit | 400 VDC           | Black/Yellow Terminal | Ground | 160 - 200         | 315 - 385          | 270 - 330          |



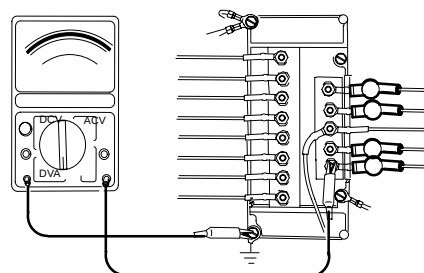
# Ignition Troubleshooting (Engines With Black Stator)

## STEP 3 – Stator Low Speed and High Speed Test

Stator Low Speed Test



Stator High Speed Test



1. Use Multimeter / DVA Tester 91-99750.
2. Crank engine and observe meter reading.

### IGNITION VOLTAGE – 9 AMP STATOR

| Tested Part       | Selector Position | Red                | Black  | Reading At 300 - 1000 RPM | Reading At 1000 - 4000 RPM |
|-------------------|-------------------|--------------------|--------|---------------------------|----------------------------|
| Stator Low Speed  | 400 VDC           | Blue Sw. Box Term. | Ground | 210 - 310                 | 190 - 310                  |
| Stator High Speed | 400 VDC           | Red Sw. Box Term.  | Ground | 25 - 90                   | 140 - 310                  |

### IGNITION VOLTAGE – 16 AMP STATOR (398-9710A33 & 398-9710A42)

| Tested Part       | Selector Position | Red                | Black  | Voltage @ 300 RPM | Voltage @ 1000 RPM | Voltage @ 4000 RPM |
|-------------------|-------------------|--------------------|--------|-------------------|--------------------|--------------------|
| Stator Low Speed  | 400 VDC           | Blue Sw. Box Term. | Ground | 160 - 200         | 315 - 385          | 270 - 330          |
| Stator High Speed | 400 VDC           | Red Sw. Box Term.  | Ground | 8 - 10            | 27 - 33            | 165 - 205          |

### TEST RESULTS

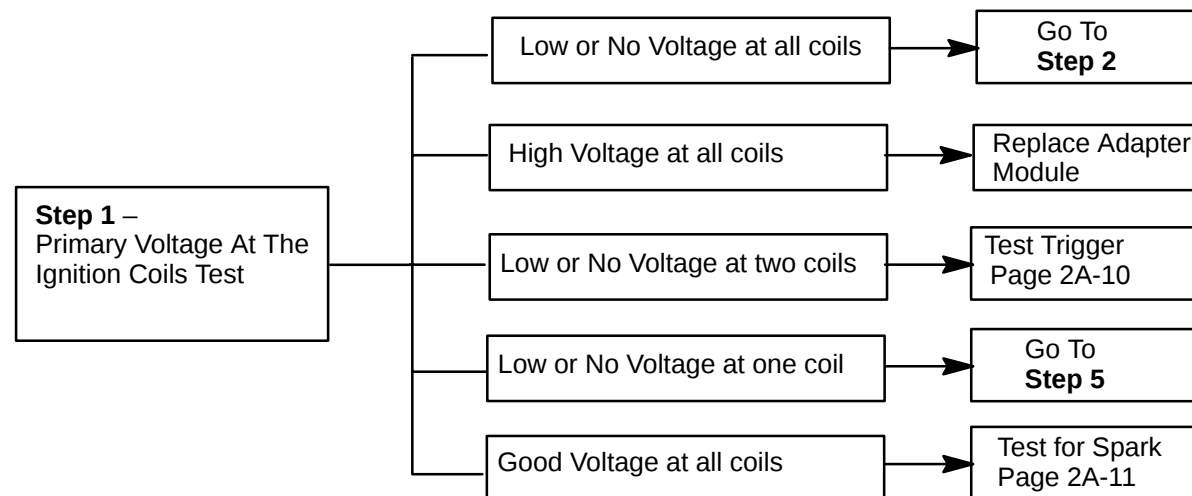
- If voltage output is low to either the stator low speed or stator high speed, the stator or switch box is defective. Go to stator test and test stator. If stator tests OK, replace switch box and repeat step.
- If voltage output is good to either the stator low speed or stator high speed, replace the switch box and repeat step



# Ignition Troubleshooting (Engines With Red Stator)

## Troubleshooting Sequence Chart – (Engine with Red Stator)

Start the ignition troubleshooting by first performing Step 1, then continue the series of steps to locate the problem. Refer to the troubleshooting steps on the following pages.



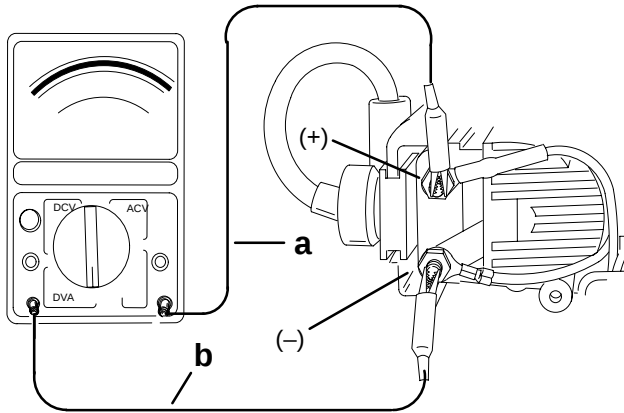
## RED Stator DVA Test

| Test                        | Selector Switch Position | RED DVA Lead                  | BLACK DVA Lead    | Voltage @ 300 RPM | Voltage @ 1000 RPM | Voltage @ 4000 RPM |
|-----------------------------|--------------------------|-------------------------------|-------------------|-------------------|--------------------|--------------------|
| Coil Primary                | 400 VDC                  | Coil (+) Terminal             | Coil (–) Terminal | 130 Volts Minimum | 195 to 275         | 195 to 275         |
| Stop Circuit                | 400 VDC                  | Black/Yellow Sw. Box Terminal | Ground            | 190 Volts Minimum | 275 to 320         | 260 to 320         |
| Blue Sw. Box Terminal       | 400 VDC                  | Blue Sw. Box Terminal         | Ground            | 190 Volts Minimum | 275 to 320         | 260 to 320         |
| Blue/White Sw. Box Terminal | 400 VDC                  | Blue/White Sw. Box Terminal   | Ground            | 190 Volts Minimum | 275 to 320         | 260 to 320         |



# Ignition Troubleshooting (Engines With Red Stator)

## STEP 1 – Primary Voltage At The Ignition Coils Test



- a - Connect (+) Test Lead To (+) Coil Terminal  
b - Connect (-) Test Lead To (-) Coil Terminal

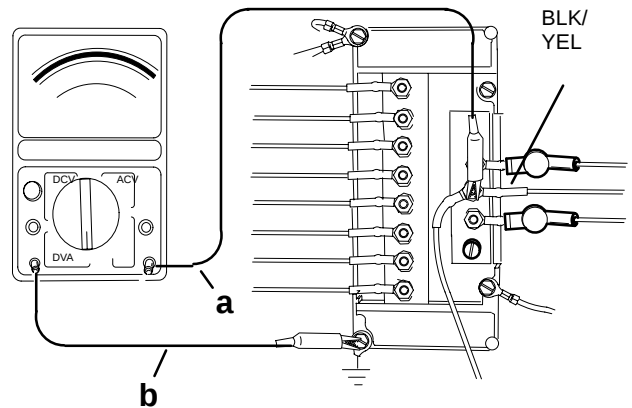
1. Use Multimeter / DVA Tester 91-99750. Set switch position to – 400 DVA.
2. Crank engine and observe meter reading.

| Voltage at 300 RPM (cranking) | Voltage at 1000 – 4000 RPM (Running) |
|-------------------------------|--------------------------------------|
| 130 Volts                     | 195 to 275 Volts                     |

### TEST RESULTS

- Voltage output is high on all coils. The adapter module is defective. Replace adapter module.
- No voltage output or low voltage output on all coils. Go to STEP 5 – Stator, Adapter Module, and Switch Box Test.
- Good voltage on two coils. Go to Trigger Test.
- Good voltage on all coils. Go to Testing For Spark.

## STEP 2 – Stop Circuit Test



- a - Connect (+) Test Lead To BLK/YEL Wire Terminal On Switch Box  
b - Connect (-) Test Lead To Engine Ground

1. Use Multimeter / DVA Tester 91-99750. Set switch position to – 400 DVA.
2. Crank engine and observe meter reading.

| Voltage at 300 RPM (cranking) | Voltage at 1000 – 4000 RPM (Running) |
|-------------------------------|--------------------------------------|
| 190 Volts                     | 275 to 320 Volts                     |

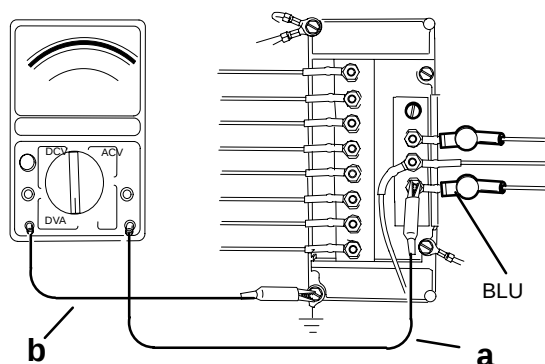
### TEST RESULTS

- Voltage output is high. The adapter module is defective. Replace adapter module.
- Good voltage output. Go to STEP 3 – Switch Box (BLU Wire) Circuit Test.
- No voltage output or low voltage output. Remove BLK/YEL wires from switch box terminal and repeat test. If voltage output is now OK, either the ignition switch, stop switch or wiring is defective. If no voltage or low voltage remains, go to STEP 5 – Stator, Adapter Module, and Switch Box Test.



# Ignition Troubleshooting (Engines With Red Stator)

## STEP 3 – Switch Box (BLU Wire) Circuit Test



- a - Connect (+) Test Lead To BLU Wire Terminal On Switch Box  
b - Connect (-) Test Lead To Engine Ground

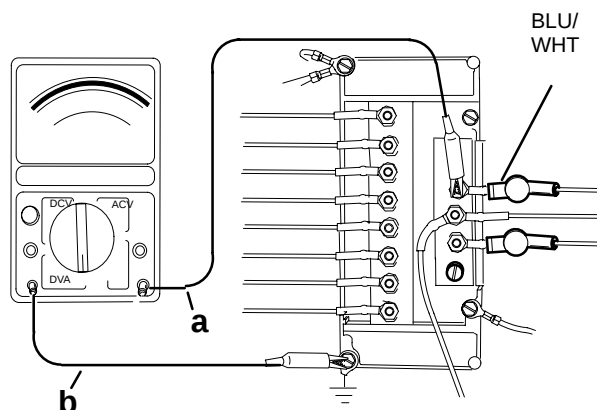
1. Use Multimeter / DVA Tester 91-99750. Set switch position to – 400 DVA.
2. Crank engine and observe meter reading.

| Voltage at 300 RPM (cranking) | Voltage at 1000 – 4000 RPM (Running) |
|-------------------------------|--------------------------------------|
| 190 Volts                     | 275 to 320 Volts                     |

### TEST RESULTS

- Voltage output is high. The adapter module is defective. Replace adapter module.
- Good voltage output. Go to STEP 3 – Switch Box (BLU/WHT Wire) Circuit Test.
- No voltage output or low voltage output. Go to STEP 5 – Stator, Adapter Module and Switch Box Test.

## STEP 4 – Switch Box (BLU/WHT Wire) Circuit Test



- a - Connect (+) Test Lead To BLU/WHT Wire Terminal On Switch Box  
b - Connect (-) Test Lead To Engine Ground

1. Use Multimeter / DVA Tester 91-99750. Set switch position to – 400 DVA.
2. Crank engine and observe meter reading.

| Voltage at 300 RPM (cranking) | Voltage at 1000 – 4000 RPM (Running) |
|-------------------------------|--------------------------------------|
| 190 Volts                     | 275 to 320 Volts                     |

### TEST RESULTS

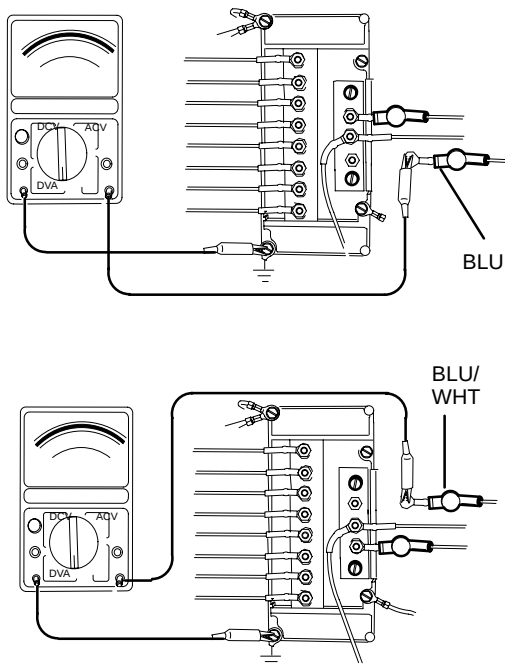
- Voltage output is high. The adapter module is defective. Replace adapter module.
- Good voltage output..
- No voltage output or low voltage output. Go to STEP 5 – Stator, Adapter Module and Switch Box Test.



# Ignition Troubleshooting (Engines With Red Stator)

## STEP 5 – Stator, Adapter Module, and Switch Box Test

### Elimination Test



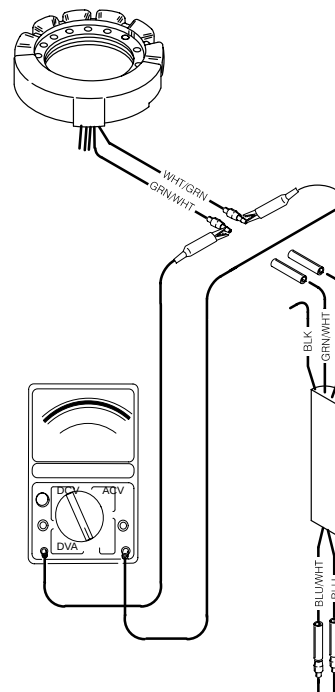
1. Set multipurpose switch position to – 400 DVA.
2. Disconnect only the BLU wire from the switch box. Connect test leads between BLU wire and engine ground.
3. Crank engine and observe meter reading.
4. Reconnect BLU wire.
5. Disconnect only the BLU/WHT wire from the switch box. Connect test leads between BLU/WHT wire and engine ground.
6. Crank engine and observe meter reading.

| Voltage at 300 RPM (cranking) |
|-------------------------------|
| 190 to 260 Volts              |

### TEST RESULTS

- If voltage output is good on both wires, the switch box is defective.
- Voltage output is low on either wire, continue with test.

7. Disconnect the GRN/WHT and WHT/GRN (stator) leads from the adapter module.



8. Measure the resistance between the GRN/WHT and WHT/GRN (stator) leads.

| Test Leads To –                            | Ohm Scale | Meter Reading |
|--------------------------------------------|-----------|---------------|
| Between GRN/WHT and WHT/GRN (Stator) leads | R x 100   | 660-710 Ohms  |

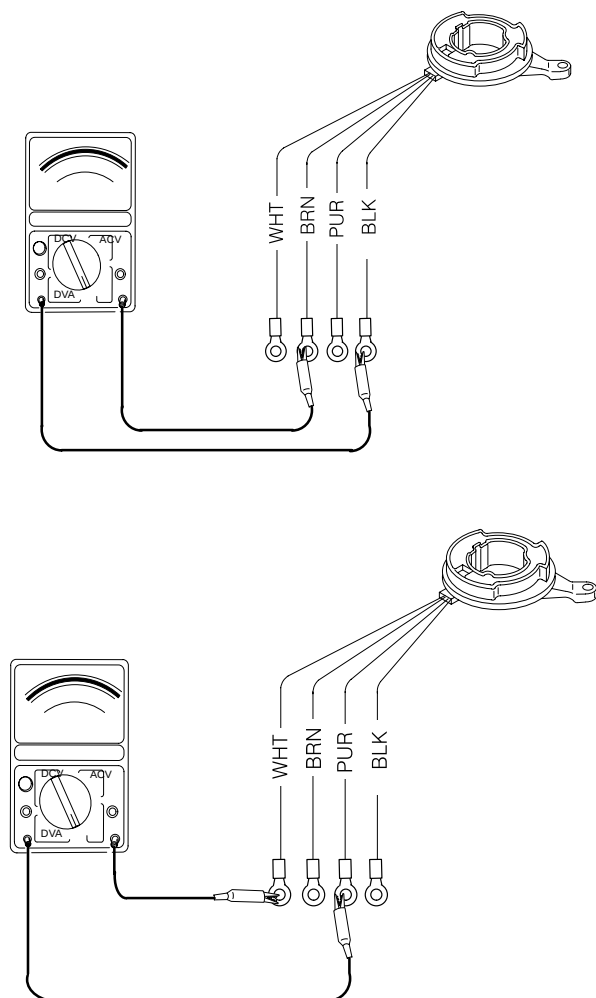
### TEST RESULTS

- If the resistance is OK (660 to 710 ohms), the adapter module is defective. Replace adapter module.
- If the resistance is incorrect, the stator is defective. Replace stator.



# Ignition Component Testing

## Trigger Test



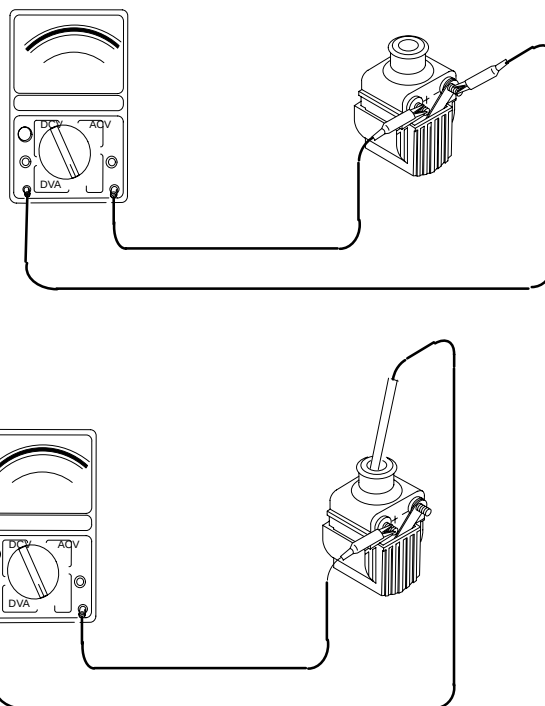
1. Disconnect all trigger leads from switch box.
2. Use a VOA meter and perform the following checks.

| Test Leads To –                       | Ohm Scale | Meter Reading |
|---------------------------------------|-----------|---------------|
| Between BRN lead and BLK lead         | R x 100   | 700-1000 Ohms |
| Between WHT lead and PUR trigger lead | R x 100   | 700-1000 Ohms |

**NOTE:** Above resistance readings are for a cold engine (room temperature). Resistance will increase if engine is warm.

3. If meter readings are not as specified, replace trigger.

## Ignition Coil Test



1. Disconnect wires from coil terminals.
2. Pull spark plug lead out of coil tower.
3. Use a VOA meter and perform the following checks.

| Test Leads To –                          | Ohm Scale | Meter Reading   |
|------------------------------------------|-----------|-----------------|
| Between (+) and (-) Coil Terminals       | R x 1     | .02-.04* Ohms   |
| Between Coil Tower and (-) Coil Terminal | R x 100   | 800-1100** Ohms |

\* The primary DC resistance of these coils generally is less than one (1) OHM. If a reading resembling a short is obtained, this would be acceptable.

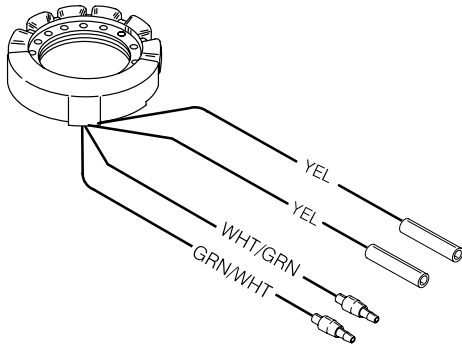
\*\* Copper wire is an excellent conductor, but it will have a noticeable difference in resistance from cold to hot temperatures. Reasonable variations from these readings are acceptable.

4. If meter readings are not as specified, replace ignition coil.

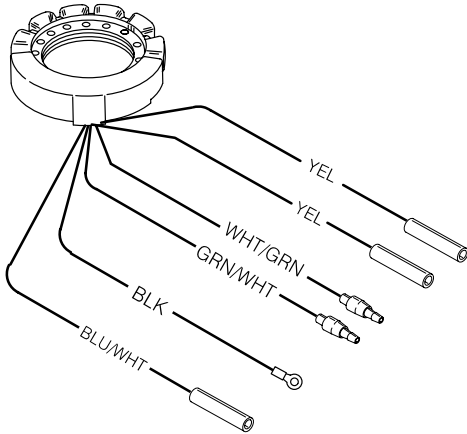


# Stator Test (Red Stator)

## Electric Start Engines



## Manual Start Engines



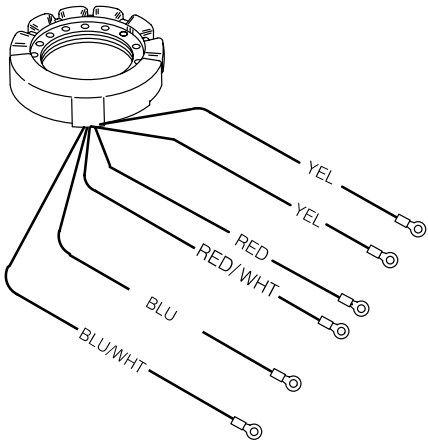
1. Disconnect all stator leads.
2. Use a VOA meter and perform the following checks.

| Electric Start Engines |           |             |
|------------------------|-----------|-------------|
| Test Leads To –        | Ohm Scale | Ohm Reading |
| GRN/WHT and WHT/GRN    | R x 100   | 660-710     |
| YEL and YEL            | R x 1     | 0.165–0.181 |
| Manual Start Engines   |           |             |
| Test Leads To –        | Ohm Scale | Ohm Reading |
| GRN/WHT and WHT/GRN    | R x 100   | 660-710     |
| BLK/WHT and BLK        | R x 100   | 130-145     |
| YEL and YEL            | R x 1     | 0.17–0.19   |

**NOTE:** Above resistance readings are for a cold engine (room temperature). Resistance will increase if engine is warm.

If meter readings are other than specified, replace stator.

# Stator Test (Black Stator)



1. Disconnect all stator leads.
2. Use a VOA meter and perform the following checks.

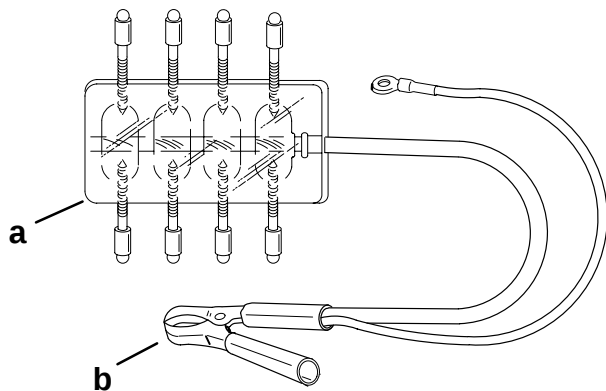
| 9 AMP Stator                              |           |             |
|-------------------------------------------|-----------|-------------|
| Test Leads To –                           | Ohm Scale | Ohm Reading |
| Blue and Blue/White                       | R x 1000  | 5.7-8.0     |
| Red and Red/White                         | R x 1     | 56-76       |
| Blue and Engine Ground                    | R X 1000  | No Reading  |
| Red and Engine Ground                     | R X 1000  | No Reading  |
| YEL and YEL                               | R x 1     | .5-1.0      |
| 16 AMP Stator (398-9710A33 & 398-9710A42) |           |             |
| Test Leads To –                           | Ohm Scale | Ohm Reading |
| Blue and Blue/White                       | R x 1000  | 1000-1400   |
| Red and Red/White                         | R x 1     | 15-30       |
| Blue and Engine Ground                    | R X 1000  | No Reading  |
| Red and Engine Ground                     | R X 1000  | No Reading  |
| YEL and YEL                               | R x 1     | .10-.50     |

**NOTE:** Above resistance readings are for a cold engine (room temperature). Resistance will increase if engine is warm.

If meter readings are other than specified, replace stator.



## Test For Spark (Cranking)



a - Spark Tester 91-850439

b - Connect Ground Lead To Engine Ground

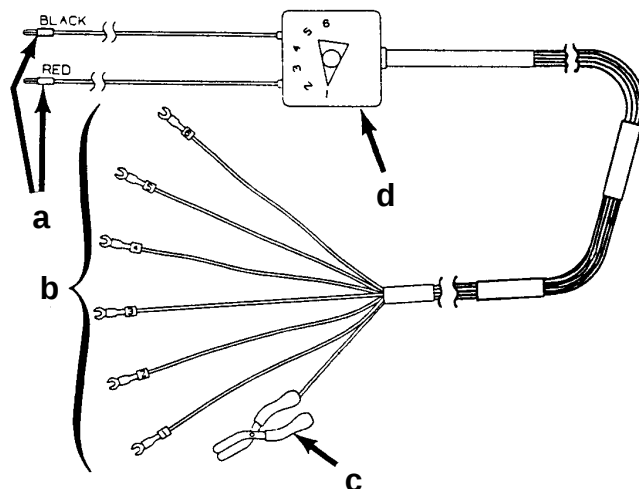
1. Remove the spark plug leads from the spark plugs.
2. Adjust the spark tester to 1/2 in. (12mm) gap setting.
3. Connect the spark plug leads to the tester. Attach the tester ground lead to engine ground.
4. Crank the engine. Spark should jump each tester gap.

### TEST RESULTS

**NOTE:** Normal ignition spark is BLUE in color. A YELLOW or RED spark indicates a weak ignition.

- Normal spark on all cylinders. Go to Primary Voltage Test (Engine Running).
- Intermittent, weak or no spark output on all cylinders usually indicates a defective trigger. Go to Trigger Test.
- Intermittent, weak or no spark output on any one cylinder indicates a bad ground, defective ignition coil, defective spark plug lead, or switch box. Go to Ignition Coil Test.

## Primary Voltage Test (Engine Running)



a - Plug into Meter

b - Attach to Appropriate Terminals

c - Attach to Engine Ground

d - Selector Switch

1. If the ignition system tests OK, it may be necessary to check the output voltage while running the engine under load up to 4000 RPM. Using Test Harness 91-14443A1 allows performing DVA Tests from the driver seat inside the boat. Refer to DVA Tests preceding.



## Ignition (Key) Switch Test

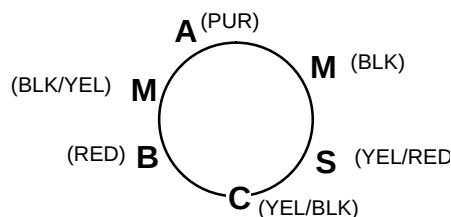
1. Disconnect remote control wiring harness and instrument panel connector.

**NOTE:** Wiring diagram for control boxes is located in SECTION 2D.

2. Set ohmmeter on R x 1 scale for the following tests:

### COMMANDER KEY SWITCH

BLK • BLACK  
PUR • PURPLE  
RED • RED  
YEL • YELLOW



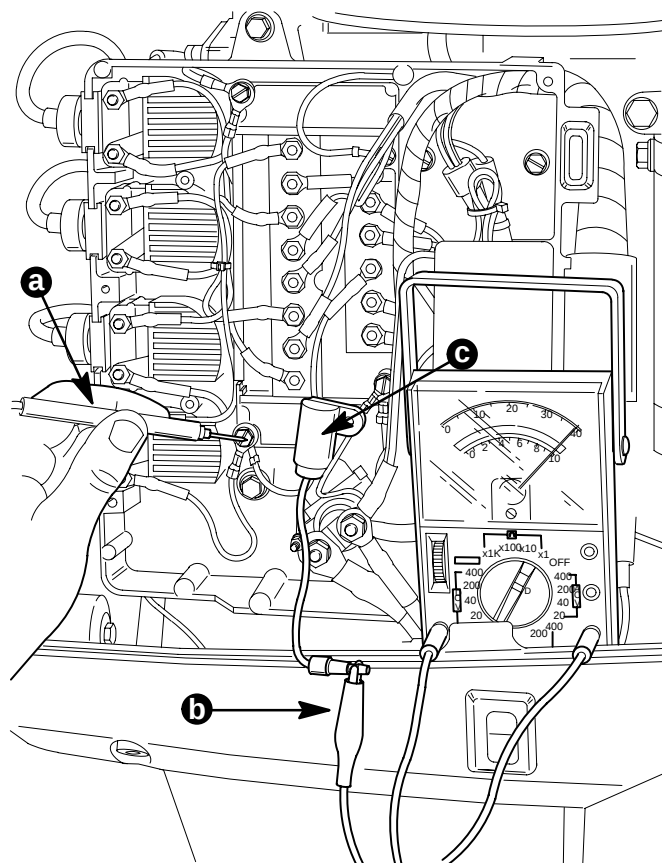
| KEY POSITION | CONTINUITY SHOULD BE INDICATED AT THE FOLLOWING POINTS: |         |     |         |     |         |
|--------------|---------------------------------------------------------|---------|-----|---------|-----|---------|
|              | BLK                                                     | BLK/YEL | RED | YEL/RED | PUR | YEL/BLK |
| OFF          | •                                                       | •       |     |         |     |         |
| RUN          |                                                         |         | •   | •       | •   |         |
| START        |                                                         |         | •   | •       | •   |         |
| CHOKE*       |                                                         |         | •   | •       | •   | •       |

\* Key switch must be positioned to "RUN" or "START" and key pushed in to actuate choke, for this continuity test.

3. If meter readings are other than specified in the preceding test, verify that switch and not wiring is faulty. If wiring checks OK, replace switch.

## Mercury (Tilt) Stop Switch Test

1. Remove mounting screw that secures mercury switch to outboard.
2. Connect Ohmmeter (R x 1 scale) between black lead and black/yellow lead or terminal stud on mercury switch.
3. Test mercury switch as follows:
  - a. Position mercury switch as it would be installed when engine is in "down" position. The meter should indicate no continuity.
  - b. Tilt mercury switch up. The meter should indicate continuity.
  - c. If these readings are not obtained, replace mercury switch.



54638

- a - Red Ohm Lead  
b - Black Ohm Lead  
c - Mercury Switch



# Flywheel Removal and Installation

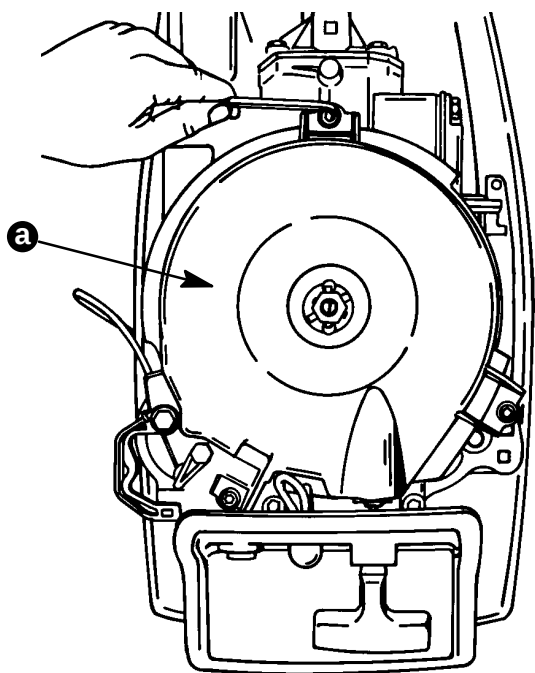
## Flywheel Removal

### ⚠ CAUTION

To prevent accidental starting of outboard while removing engine components, on electric start models - remove engine battery cables from battery and verify ignition key is in the "OFF" position. When servicing manual start engines, verify lanyard switch is in the "OFF" position.

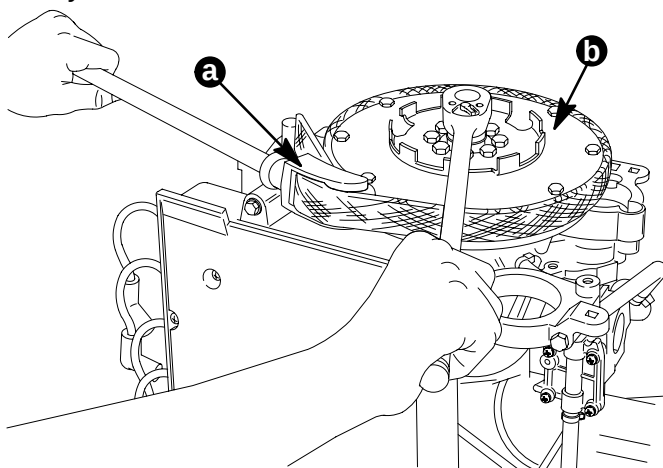
#### MANUAL START MODEL

1. Remove 3 bolts securing rewind starter and remove rewind from outboard.



a - Rewind Starter

2. Use strap wrench to hold flywheel while removing flywheel nut and washer.

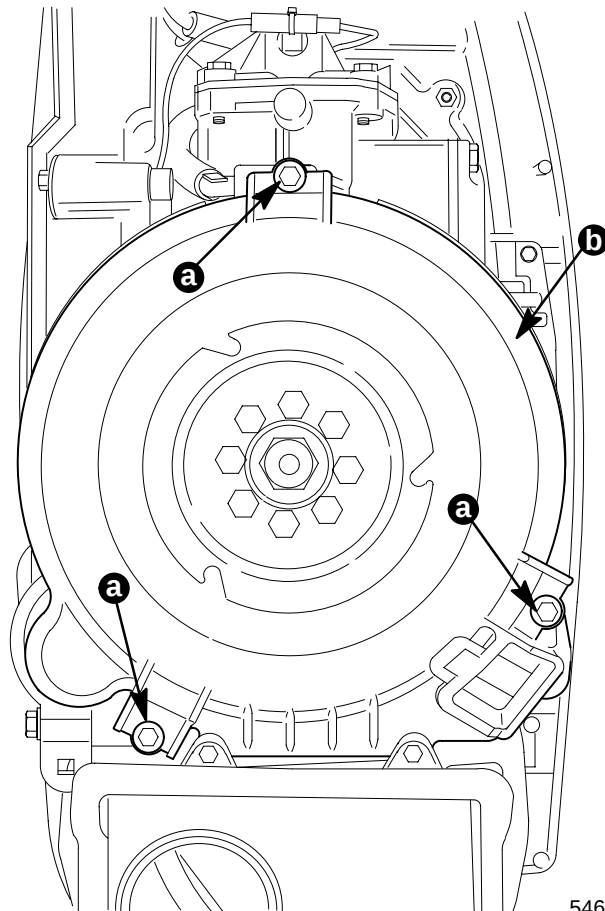


54639

a - Strap Wrench  
b - Flywheel

#### ELECTRIC START MODEL

1. Remove 3 bolts securing flywheel cover and remove cover from outboard.

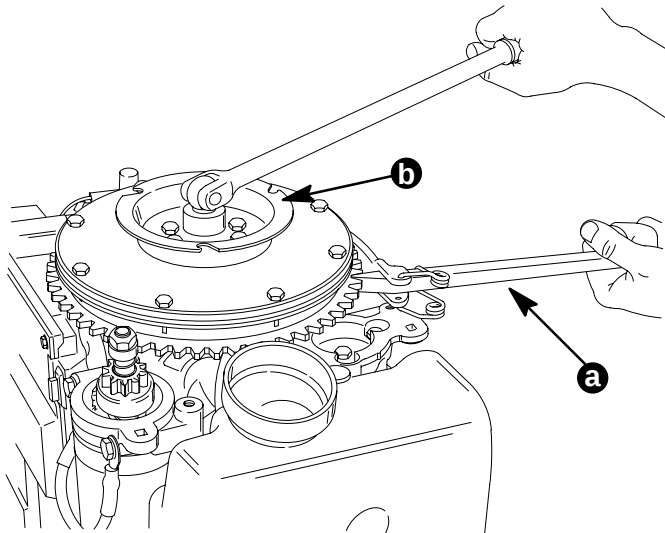


54640

a - Bolts  
b - Flywheel Cover



2. Use flywheel holder (91-52344) to hold flywheel while removing flywheel nut and washer.



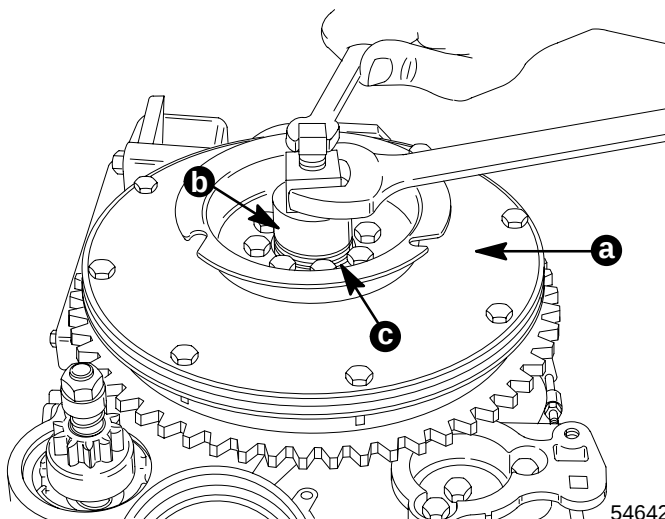
54641

- a - Flywheel Holder (91-52344)  
b - Flywheel

**NOTE:** Use flywheel puller (91-73687A1) on both manual and electric start type flywheel. Always install crankshaft protector cap onto end of crankshaft before threading flywheel puller into flywheel. Do not strike flywheel puller bolt with hammer as crankshaft may be damaged.

### ⚠ CAUTION

Do not apply heat to flywheel or strike flywheel with hammer as flywheel or electrical components under flywheel may be damaged.



54642

- a - Flywheel  
b - Flywheel Puller (91-73687A1)  
c - Crankshaft Protector Cap (Hidden); Place on end of Crankshaft

## Flywheel Installation

### ⚠ CAUTION

Inspect magnet side of flywheel for any debris clinging to magnets. Installing flywheel with debris on magnets will cause damage to flywheel and/or electrical components located under flywheel when outboard is initially started.

1. Secure flywheel on crankshaft with flat washer and nut.
2. On electric start type flywheel, use flywheel holder (91-52344) to hold flywheel while tightening flywheel nut. On manual start type flywheel, use strap wrench to hold flywheel while tightening flywheel nut.
3. Torque flywheel nut to 75 lb. ft. (101.7 N·m).
4. Reinstall rewind starter, if manual start, or flywheel cover, if electric start, with 3 bolts. Torque bolts to 100 lb. in. (11.3 N·m).

## Ignition Components

### ⚠ CAUTION

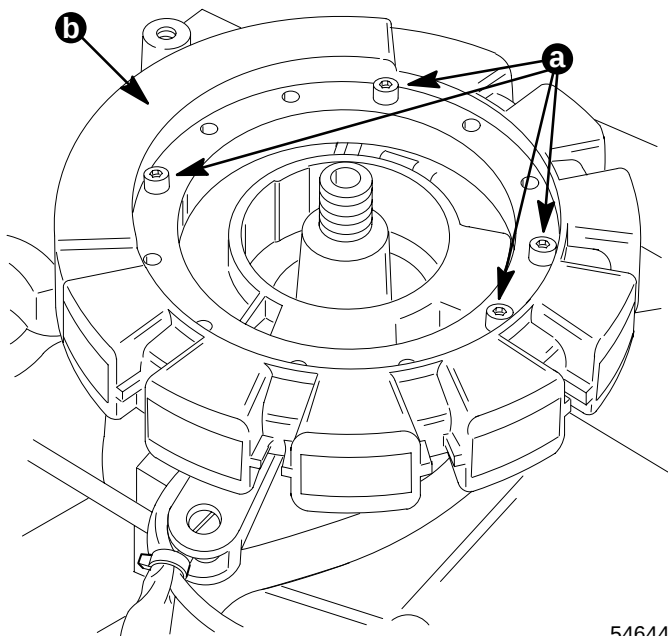
To prevent accidental starting of outboard while removing or installing engine components, on electric start models – remove engine battery cables from battery and verify ignition key is in the “OFF” position. When servicing manual start engines, verify lanyard switch is in the “OFF” position.

## Stator Assembly Removal

1. Remove top cowl.
2. Remove 3 bolts securing rewind starter or flywheel cover and remove rewind or cover, whichever is applicable.
3. Remove flywheel as outlined in “FLYWHEEL REMOVAL AND INSTALLATION”, preceding.



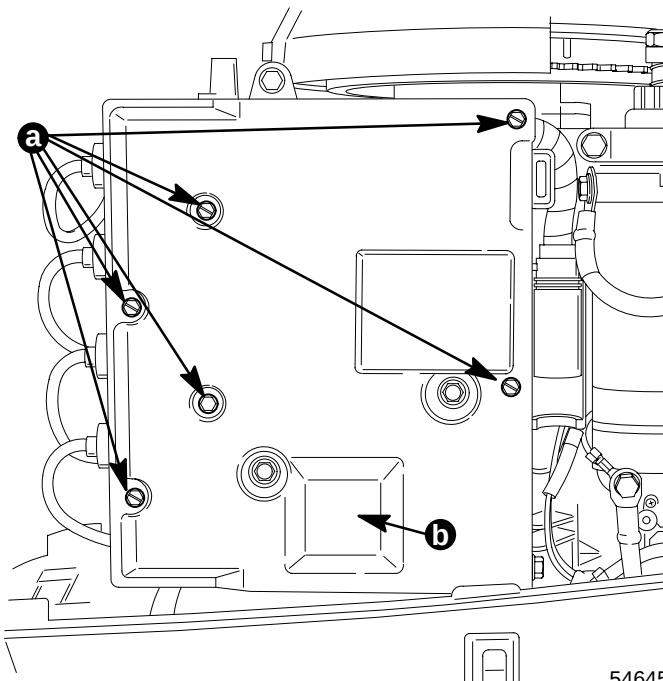
4. Remove 4 screws which secure stator to upper cap.



54644

a - Screws  
b - Stator

5. Remove 6 bolts securing electrical box access cover and remove cover.



54645

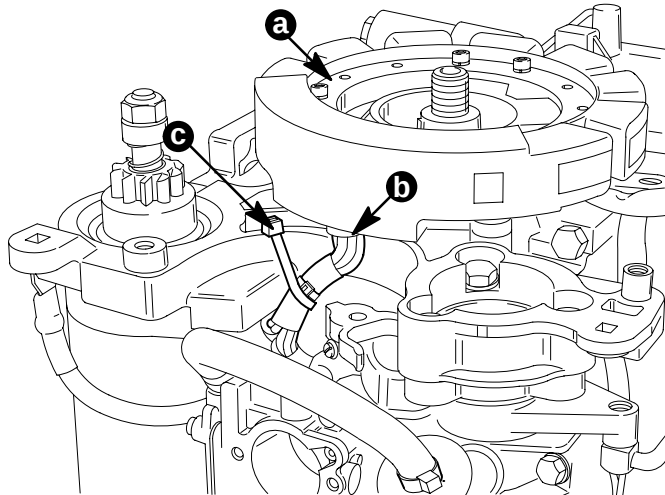
a - Bolts  
b - Access Cover

6. Disconnect stator wiring from their respective terminals and remove stator assembly from outboard.



## Black Stator Installation

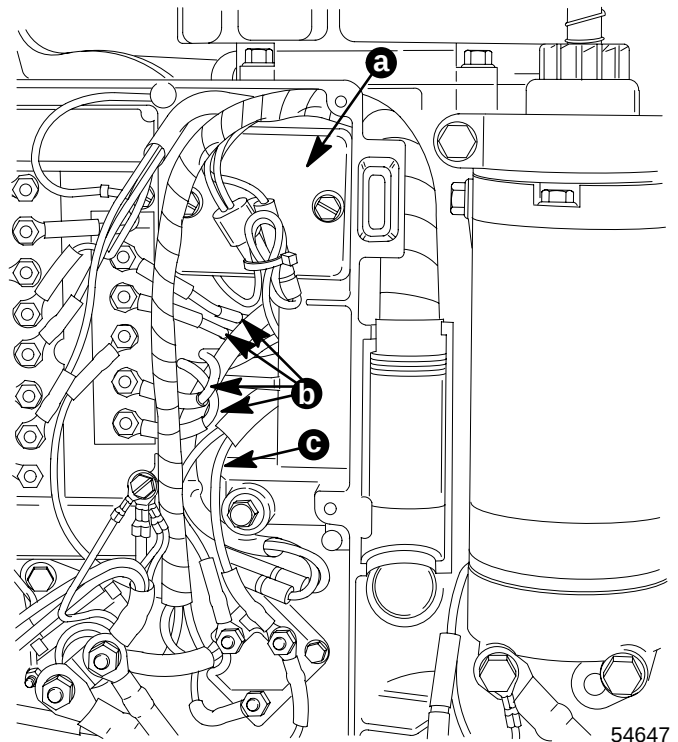
1. Apply Loctite Grade A (92-32609-1) to threads of 4 stator attaching screws.
2. Install stator on upper end cap and torque attaching screws to 35 lb. in. (3.9 N·m).
3. Route stator wiring into electrical component box.



54646

- a - Stator
- b - Wiring
- c - Sta-Strap

**NOTE:** Stator wiring is routed behind starter motor and enters electrical box through access holes under warning module.



54647

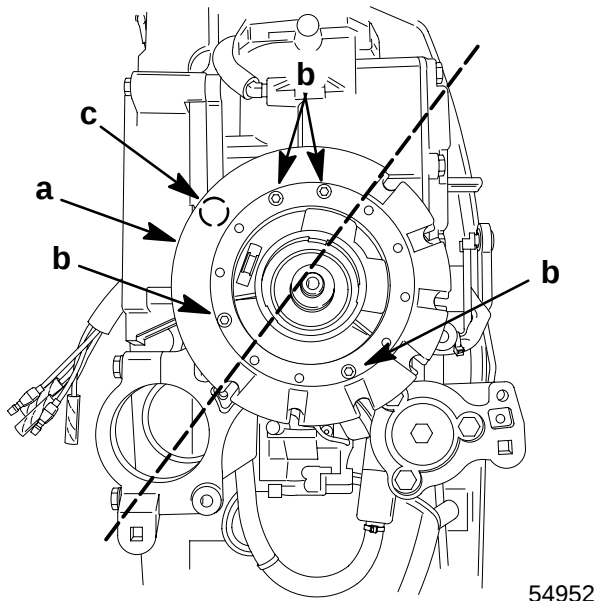
- a - Warning Module
- b - Stator Wiring to Switch Box
- c - Stator Wiring to Rectifier

4. Reconnect wires to proper terminals. Refer to wiring diagrams, Section 2D. Torque terminal nuts to 30 lb. in. (3.4 N·m).
5. Reinstall electrical box access cover.
6. Reinstall flywheel as outlined in "FLYWHEEL REMOVAL AND INSTALLATION", preceding.
7. On manual start models, reinstall rewind starter. On electric models, reinstall flywheel cover. On either manual or electric models, rewind or cover attaching bolts should be torqued to 100 lb. in. (11.3 N·m).
8. Reinstall top cowl.



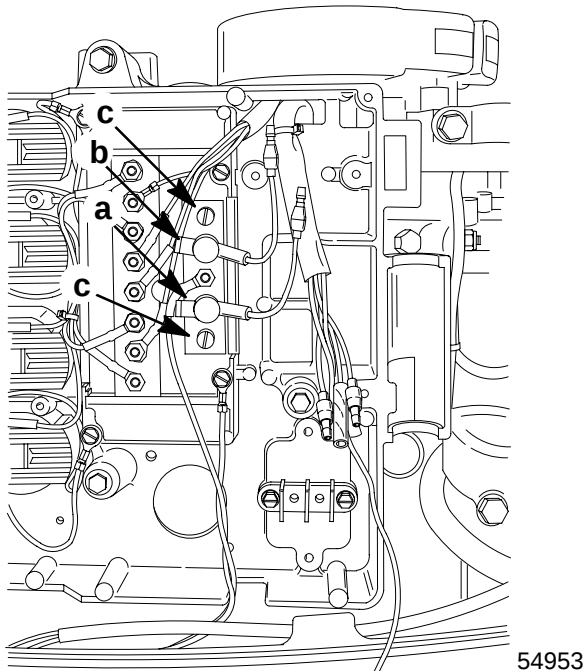
## Red Stator Installation

1. Position stator on powerhead as shown. Secure stator with 4 screws. Apply Loctite 271 to screw threads. Torque screws to 35 lb. in. (4.0 N·m).



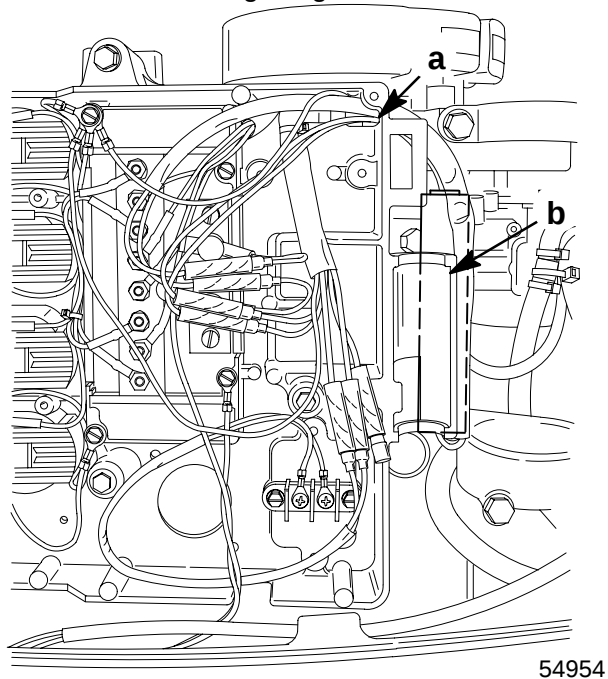
- a - Stator
- b - Screws [Torque to 35 lb. in. (4.0 N·m)]
- c - Stator Harness

2. Install BLUE and BLUE/WHITE cable adapters to BLUE and BLUE/WHITE terminals on switch box. Torque terminal nuts to 30 lb. in. (3.5 N·m). Install cap nuts on unused terminals.



- a - BLUE Cable Adapter
- b - BLUE/WHITE Cable Adapter
- c - Cap Nuts

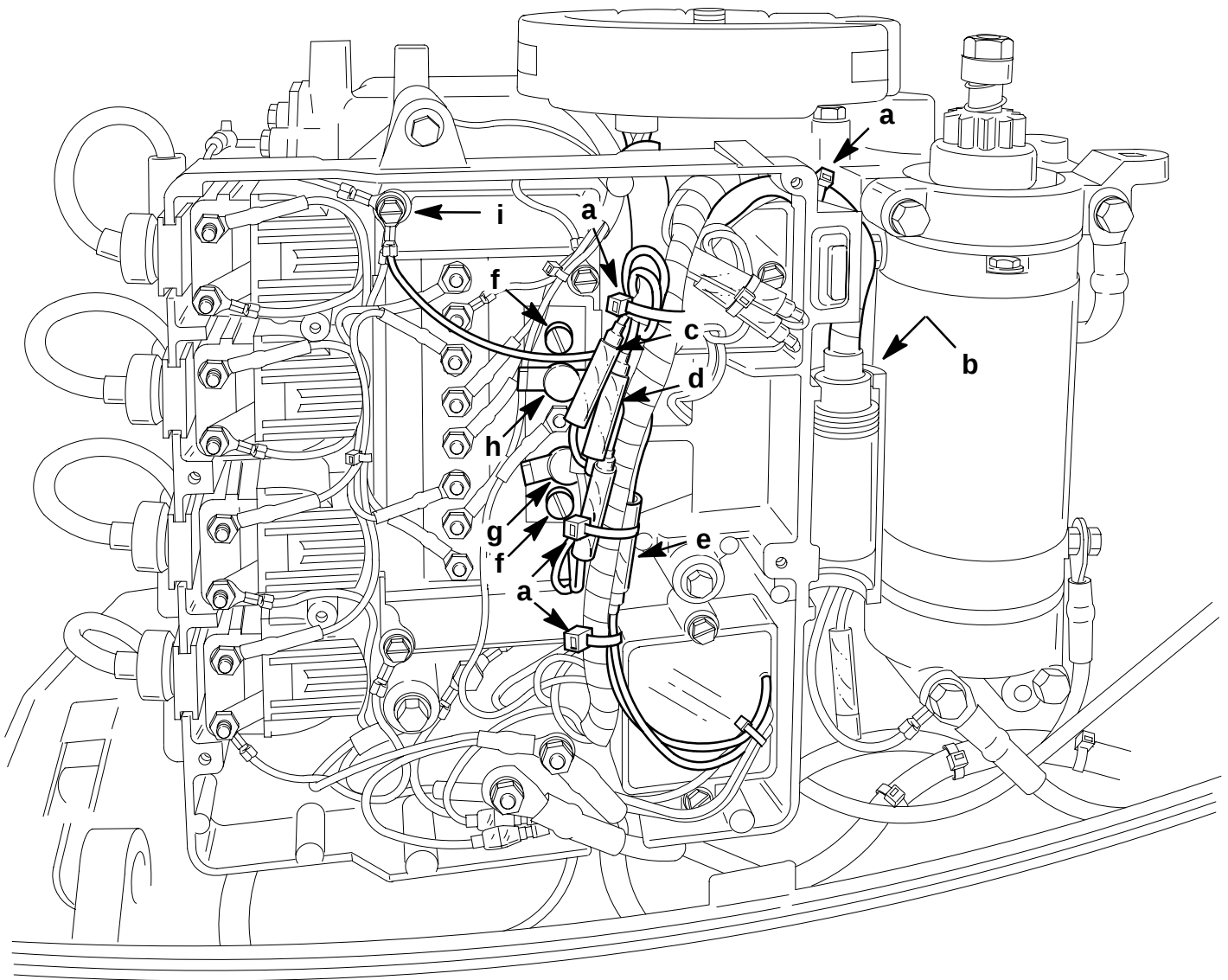
3. Install adapter module routing adapter wires through opening in upper right corner of electrical box. Connect stator, adapter module and switch box wires per appropriate model wiring diagram in Section 2D Wiring Diagrams.



- a - Upper Right Corner
- b - Adapter Module



**Electric Models** – Secure adapter module and wiring with sta-straps.

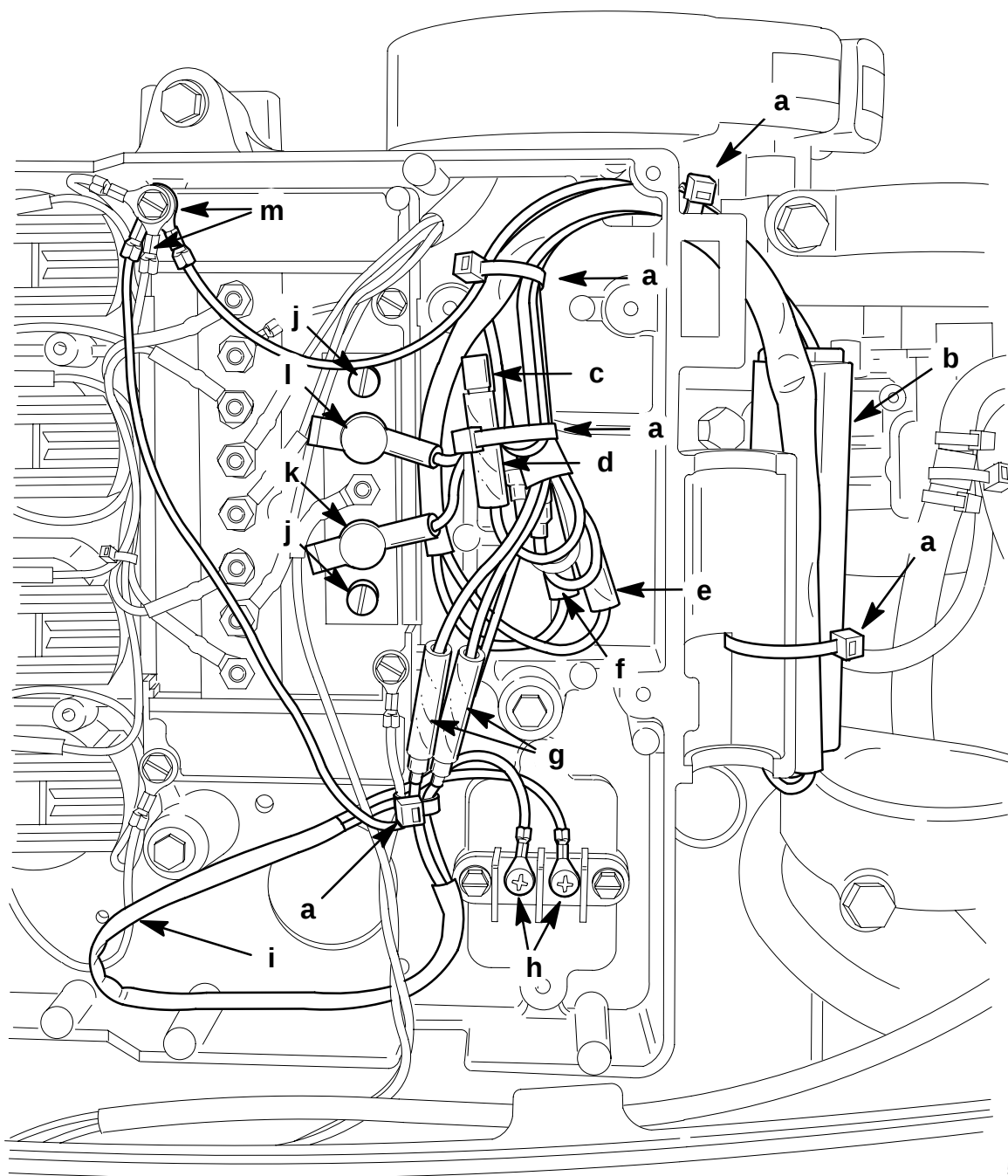


54957

- a - Sta-Straps
- b - Adapter Module (Hidden)
- c - Adapter Module WHITE/GREEN Lead
- d - Adapter Module GREEN/WHITE Lead
- e - Stator YELLOW Leads
- f - Caps
- g - Adapter Module BLUE Lead
- h - Adapter Module BLUE/WHITE Lead
- i - Adapter Module BLACK Lead – Torque bolt to 40 lb. in.  
(4.5 N·m)



**Manual Models – Secure adapter module and wiring with sta-straps.**



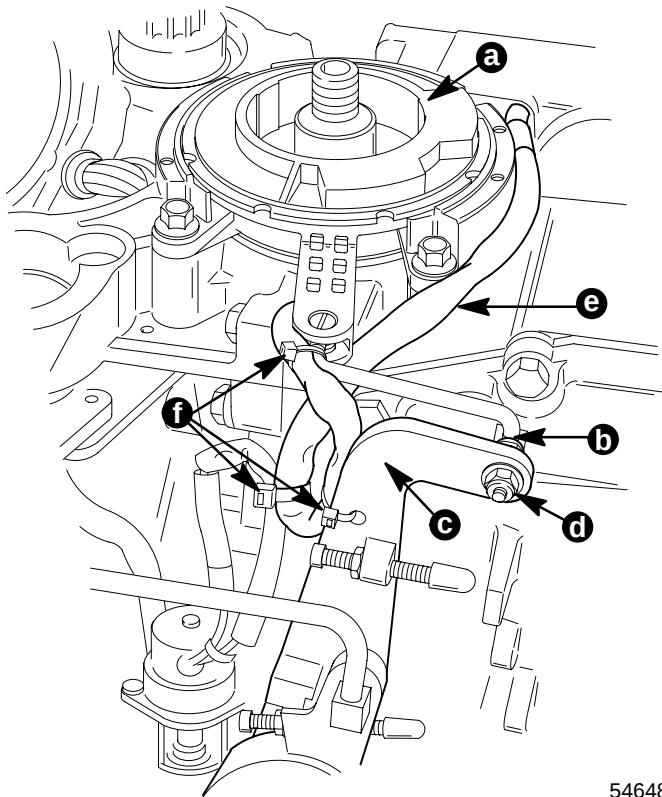
54955

- a - Sta-Straps
- b - Adapter Module
- c - Insulator Plug
- d - Stator BLUE/WHITE Lead (not used)
- e - Adapter Module WHITE/GREEN Lead
- f - Adapter Module GREEN/WHITE Lead
- g - Stator YELLOW Leads
- h - Terminal Block
- i - Harness Extension – Secure to Terminal Block w/screws (retained)
- j - Caps
- k - Adapter Module BLUE Lead
- l - Adapter Module BLUE/WHITE Leads
- m - Adapter Module BLACK Leads – Torque bolt to 40 lb. in. (4.5 N·m)



## Trigger Plate Assembly Removal

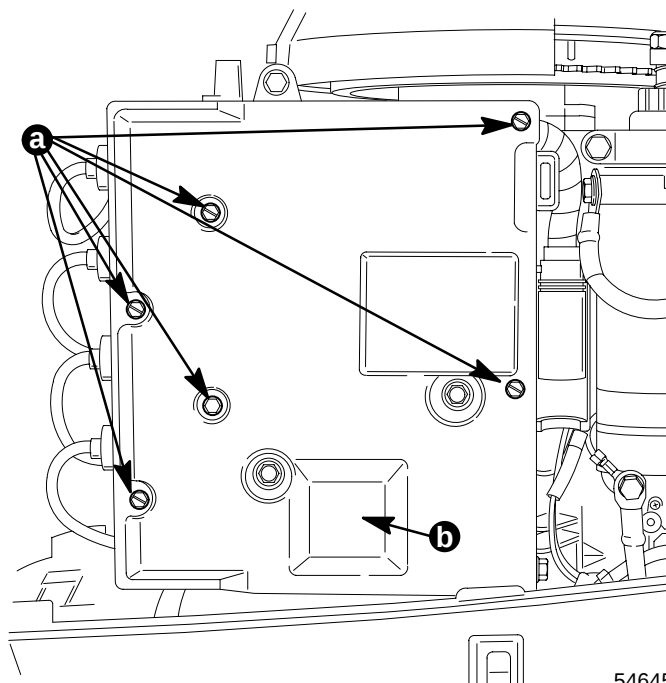
1. Remove top cowl.
2. Remove 3 bolts securing rewind starter or flywheel cover and remove or cover, whichever is applicable.
3. Remove flywheel as outlined in "FLYWHEEL REMOVAL AND INSTALLATION", preceding.
4. Remove 4 screws which secure stator assembly to upper end cap. Lift stator off end cap and move to the side.
5. Remove locknut that secures link rod swivel into spark arm. Pull link rod swivel out of arm.



- a - Trigger Plate Assembly  
b - Link Rod Swivel  
c - Spark Arm  
d - Lock Nut  
e - Trigger Harness  
f - Sta-Straps

54648

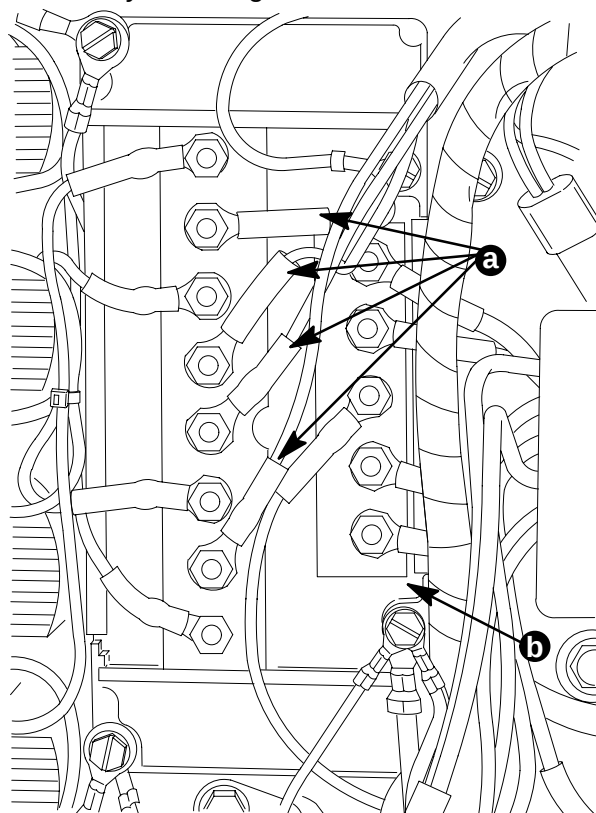
6. Remove 6 bolts from electrical box access cover and remove cover.



54645

- a - Bolts  
b - Access Cover

7. Disconnect trigger leads from their respective terminals on switch box. Remove trigger plate assembly from engine.



54649

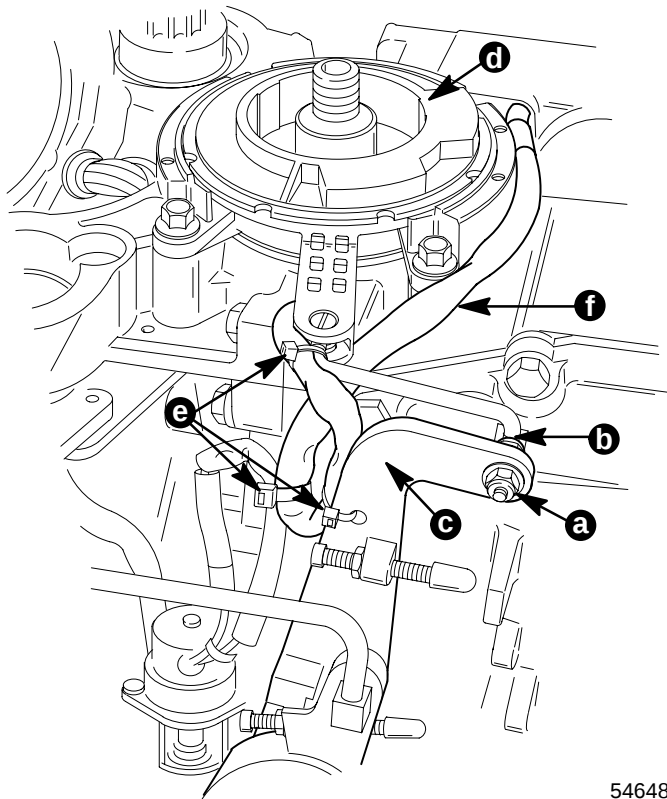
- a - Trigger Leads  
b - Switch Box

8. If trigger is defective, remove and retain link rod from trigger.



## Trigger Plate Assembly Installation

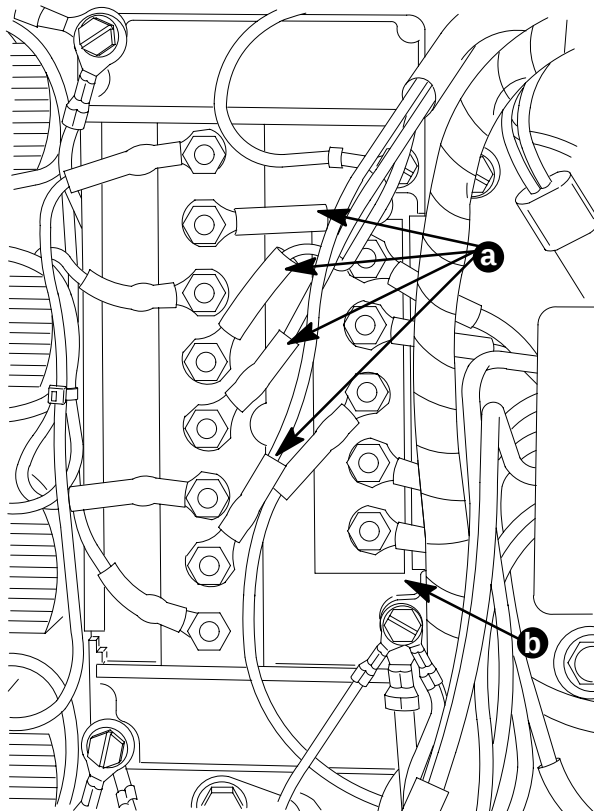
1. If link rod was removed from trigger, reassemble to trigger.
2. Place trigger plate assembly in upper end cap. Fasten link rod swivel to spark arm lever with lock nut.
3. Route and secure trigger harness as shown.



54648

- a - Lock Nut
- b - Link Rod Swivel
- c - Spark Arm
- d - Trigger Plate Assembly
- e - Sta-Straps
- f - Trigger Harness (Route as Shown)

4. Reconnect trigger wires to proper terminals of switch box. Refer to wiring diagram, Section 2D. Torque terminal nuts to 30 lb. in. (3.4 N·m).



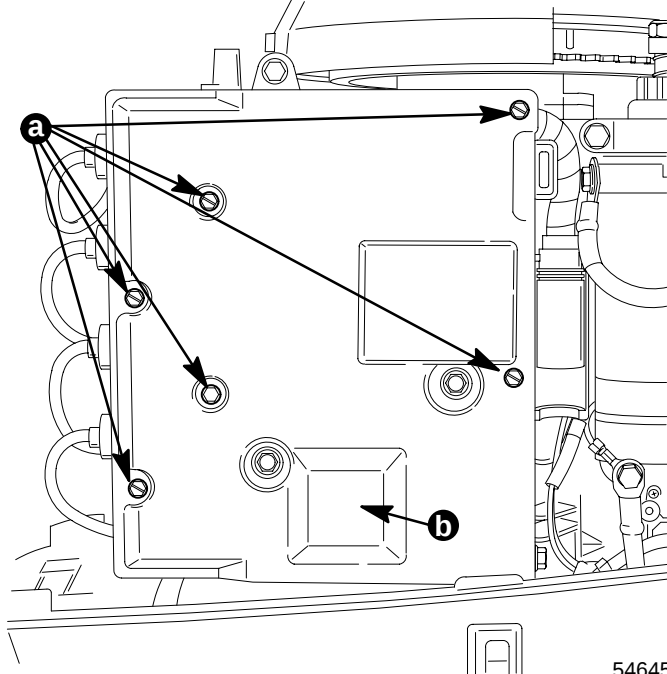
54649

- a - Trigger Harness
  - b - Switch Box
5. Reinstall electrical box access cover and secure cover with 6 bolts.
  6. Reinstall stator as outlined in "STATOR ASSEMBLY INSTALLATION", previously.
  7. Reinstall flywheel as outlined in "FLYWHEEL INSTALLATION", previously.
  8. Reinstall rewind starter if manual start or flywheel cover if electric start. On either manual or electric models rewind or cover attaching bolts should be torqued to 100 lb. in. (11.3 N·m).
  9. Reinstall top cowl.



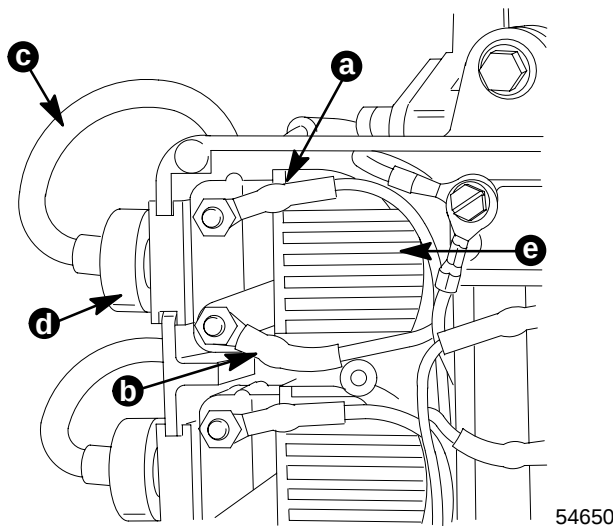
## Ignition Coil Removal

1. Remove top cowl.
2. Remove 6 bolts from electrical box access cover and remove cover.



a - Bolts  
b - Access Cover

3. Disconnect wires from positive (+) and negative (-) terminals on defective coil.
4. Remove spark plug boot from spark plug.
5. Remove spark plug high tension lead/coil tower boot assembly from coil tower and discard defective coil.



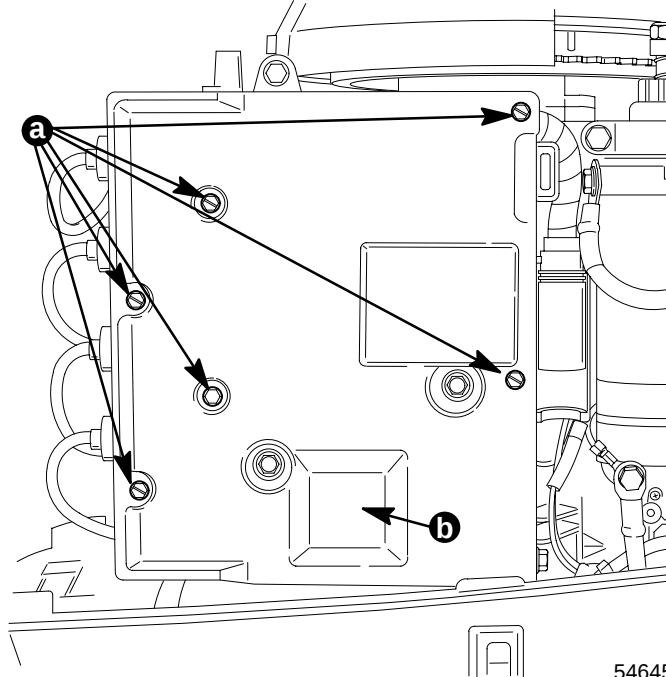
a - Positive (+) Lead  
b - Negative (-) Lead  
c - High Tension Lead  
d - Coil Tower Boot  
e - Coil

## Ignition Coil Installation

1. Install spark plug high tension lead/coil tower boot assembly (retained) onto new coil.
2. Position secondary coil into electrical box.
3. Reconnect positive (+) and negative (-) leads to their respective terminals on coil with 2 nuts. Torque nuts to 30 lb. in. (3.4 N·m).
4. Reconnect spark plug boot to spark plug.
5. Reinstall electrical box access cover and secure cover with 6 bolts.
6. Reinstall top cowl.

## Switch Box Removal

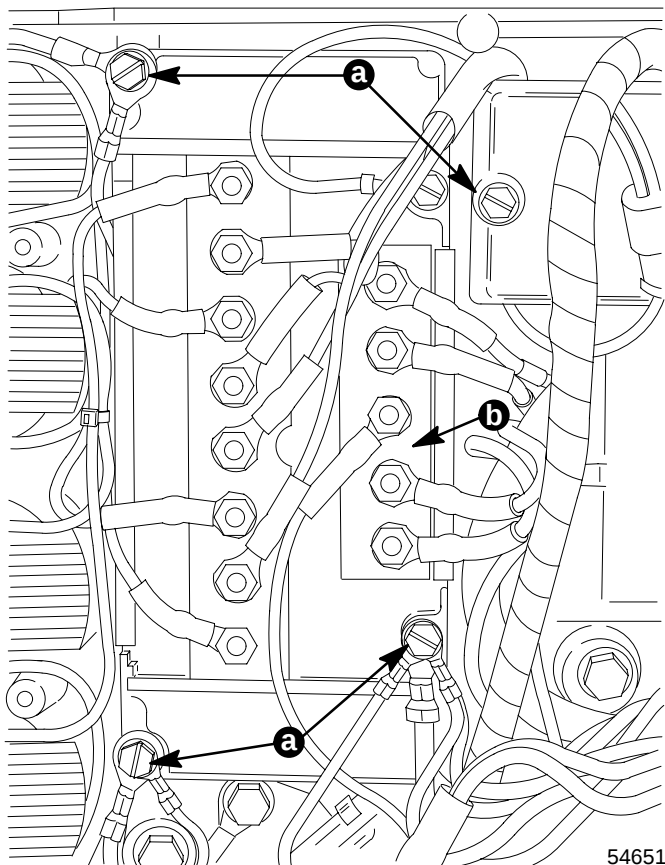
1. Remove top cowl.
2. Remove 6 bolts from electrical box access cover and remove cover.



a - Bolts  
b - Access Cover



3. Disconnect all leads from switch box.
4. Remove 4 bolts from switch box and remove switch box.



a - Bolts  
b - Switch Box

## Switch Box Installation

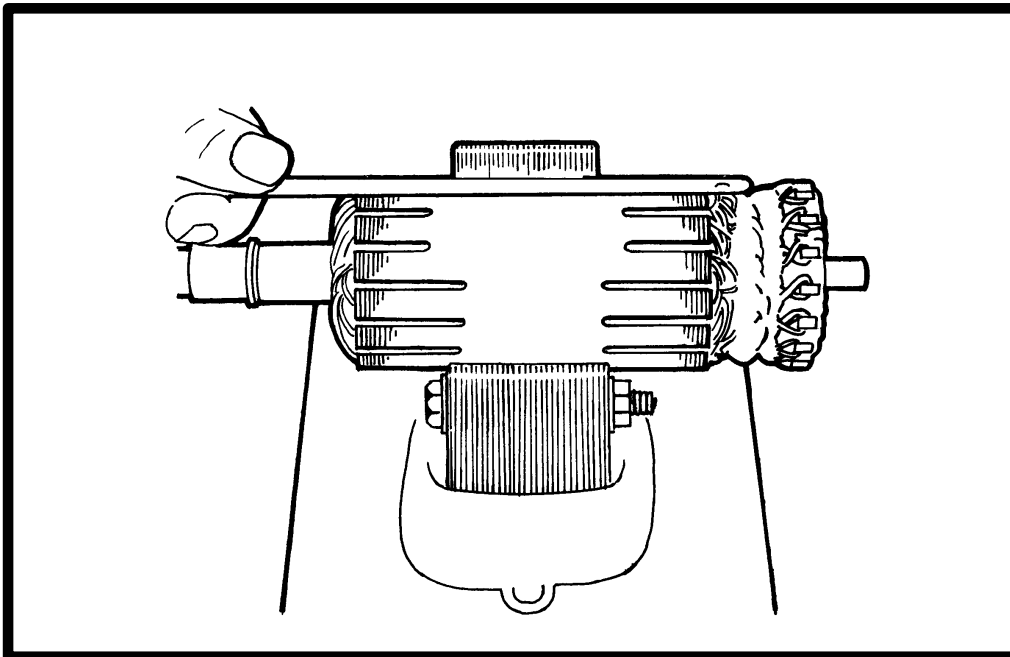
1. Secure switch box to electrical component box with 4 bolts and their respective ground leads. Torque bolts to 40 lb. in. (4.5 N·m).
2. Reconnect leads to switch box terminals. Refer to "WIRING DIAGRAM", SECTION 2D. Torque switch box terminal nuts to 30 lb. in. (3.4 N·m).
3. Reinstall electrical box access cover and secure cover with 6 bolts.
4. Reinstall top cowl.



# ELECTRICAL AND IGNITION

2

B



## BATTERY, CHARGING SYSTEM and STARTING SYSTEM



# Table of Contents

|                                              | Page  |
|----------------------------------------------|-------|
| Battery .....                                | 2B-1  |
| Precautions .....                            | 2B-1  |
| Operating Outboard without Battery .....     | 2B-1  |
| Specific Gravity Readings .....              | 2B-1  |
| Specific Gravity Cell Comparison Test ..     | 2B-2  |
| Electrolyte Level .....                      | 2B-2  |
| Charging a Discharged Battery .....          | 2B-2  |
| Winter Storage of Batteries .....            | 2B-3  |
| Battery Charging System .....                | 2B-3  |
| Description .....                            | 2B-3  |
| Battery Charging System                      |       |
| Troubleshooting .....                        | 2B-4  |
| Stator Test (Alternator Coils Only) .....    | 2B-4  |
| Voltage Regulator Test .....                 | 2B-5  |
| Alternator System Test .....                 | 2B-5  |
| Manual Start Models – Stator Output          |       |
| Test .....                                   | 2B-5  |
| Electric Start Models With Rectifier ....    | 2B-5  |
| Electric Start Models With Voltage           |       |
| Regulator/Rectifier .....                    | 2B-6  |
| Rectifier Test .....                         | 2B-7  |
| Starter System .....                         | 2B-8  |
| Starter System Components .....              | 2B-8  |
| Description .....                            | 2B-8  |
| Troubleshooting the Starter Circuit .....    | 2B-8  |
| Starter Circuit Troubleshooting Flow         |       |
| Chart .....                                  | 2B-9  |
| Starter Removal and Installation .....       | 2B-10 |
| Removal .....                                | 2B-10 |
| Installation .....                           | 2B-10 |
| Bosch Starter .....                          | 2B-11 |
| Disassembly .....                            | 2B-11 |
| Starter Cleaning, Inspection and Testing ... | 2B-12 |
| Cleaning and Inspection .....                | 2B-12 |
| Testing .....                                | 2B-12 |
| Armature Test for Shorts .....               | 2B-12 |
| Armature Test for Ground .....               | 2B-12 |
| Checking Positive Brushes and                |       |
| Terminal .....                               | 2B-13 |
| Testing Negative Brushes for Ground          |       |
| (Bosch) .....                                | 2B-13 |
| Reassembly .....                             | 2B-14 |
| Starter Solenoid Test .....                  | 2B-16 |



# Battery

## Precautions

When charging batteries, an explosive (hydrogen) gas mixture forms in each cell. Part of this gas escapes thru holes in vent plugs and may form an explosive atmosphere around battery if ventilation is poor. This explosive gas may remain in or around battery for several hours after it has been charged. Sparks or flames can ignite this gas and cause an internal explosion which may shatter the battery.

The following precautions should be observed to prevent an explosion.

1. DO NOT smoke near batteries being charged or which have been charged very recently.
2. DO NOT break live circuits at terminals of batteries because a spark usually occurs at the point where a live circuit is broken. Always be careful when connecting or disconnecting cable clamps on chargers. Poor connections are a common cause of electrical arcs which cause explosions.
3. DO NOT reverse polarity of battery terminals to cable connections.
4. If battery is still connected to outboard DO NOT operate any outboard or boat electrical systems that are powered by the battery, while charging the battery.

### ⚠ CAUTION

If battery acid comes into contact with skin or eyes, wash skin immediately with a mild soap. Flush eyes with water immediately and see a doctor.

### ⚠ WARNING

Hydrogen and oxygen gases are produced during normal battery operation or charging. Sparks or flame can cause this mixture to ignite and explode, if they are brought near the battery. Sulphuric acid in battery can cause serious burns, if spilled on skin or in eyes. Flush or wash away immediately with clear water.

## Operating Outboard without Battery

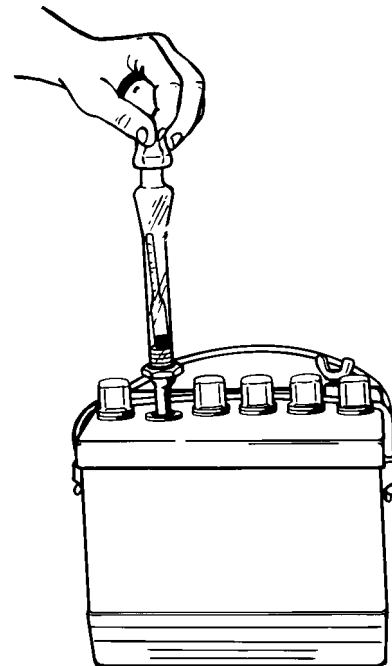
If desired (or in an emergency), outboards equipped with an alternator can be started and operated without a battery (either disconnected or removed) if "Warning", below, is followed.

### ⚠ WARNING

Before operating outboards with battery leads disconnected from battery, the leads **MUST BE** taped off (insulated) or positioned in a manner that prevents a completed circuit between the leads. Electric wiring harness **MUST REMAIN CONNECTED** to electric starting models in order to "Stop" the outboard with the ignition key.

## Specific Gravity Readings

Use a hydrometer to measure specific gravity of electrolyte in each cell.



22532

Hydrometer measures percentage of sulphuric acid in battery electrolyte in terms of specific gravity. As a battery drops from a charged to a discharged condition, acid leaves the solution and enters the plates, causing a decrease in specific gravity of electrolyte. An indication of concentration of electrolyte is obtained with a hydrometer.



When using a hydrometer, observe the following points:

1. Hydrometer must be clean (inside and out) to insure an accurate reading.
2. Never take hydrometer readings immediately after water has been added. Water must be thoroughly mixed with electrolyte by charging for at least 15 minutes at a rate high enough to cause vigorous gassing.
3. If hydrometer has built-in thermometer, draw liquid in several times to ensure correct temperature before taking reading.
4. Hold hydrometer vertically and draw in just enough liquid from battery cell so that float is free-floating. Hold hydrometer at eye level so that float is vertical and free of outer tube, then take reading at surface of liquid. Disregard curvature where liquid rises against float stem due to capillarity.
5. Avoid dropping electrolyte on boat or clothing, as it is extremely corrosive. Wash off immediately with baking soda solution.

Specific gravity of electrolyte varies not only with percentage of acid in liquid but also with temperature. As temperature drops, electrolyte contracts, so that specific gravity increases. Unless these variations in specific gravity are taken into account, specific gravity obtained by hydrometer may not give a true indication of concentration of acid in electrolyte.

A fully charged battery will have a specific gravity reading of approximately 1.270 at an electrolyte temperature of 80° F (27° C). If electrolyte temperature is above or below 80° F, additions or subtractions must be made in order to obtain a hydrometer reading corrected to 80° F standard. For every 10° F (3.3° C) above 80° F, add 4 specific gravity points (.004) to hydrometer reading. Example: A hydrometer reading of 1.260 at 110° F (43° C) would be 1.272 corrected to 80° F, indicating a fully charged battery.

For every 10° below 80° F, subtract 4 points (.004) from the reading. Example: A hydrometer reading of 1.272 at 0° F (-18° C) would be 1.240 corrected to 80° F, indicating a partially charged battery.

### SPECIFIC GRAVITY CELL COMPARISON TEST

This test may be used when an instrumental tester is not available. To perform this test, measure specific gravity of each cell, regardless of state of charge, and interpret results as follows: If specific gravity readings show a difference between highest and lowest cell of .050 (50 points) or more, battery is defective and should be replaced.

## Electrolyte Level

Check electrolyte level in battery regularly. A battery in use in hot weather should be checked more frequently because of more rapid loss of water. If electrolyte level is found to be low, then distilled water should be added to each cell until liquid level rises approx. 3/16" (4.8mm) over plate. DO NOT OVER-FILL because this will cause loss of electrolyte and result in poor performance, short life and excessive corrosion.

### ⚠ CAUTION

**During service, only distilled water should be added to the battery, not electrolyte.**

Liquid level in cells should never be allowed to drop below top of plates, as portion of plates exposed to air may be permanently damaged with a resulting loss in performance.

## Charging a Discharged Battery

The following basic rule applies to any battery charging situation:

1. Any battery maybe charged at any rate (in amperes) as long as spewing of electrolyte (from violent gassing) does not occur and as long as electrolyte temperature does not exceed 125° F (52° C). If spewing of electrolyte occurs, or if electrolyte temperature exceeds 125° F, charging rate (in amperes) must be reduced or temporarily halted to avoid damage to the battery.
2. Battery is fully charged when, over a 2-hour period at a low charging rate (in amperes), all cells are gassing freely (not spewing liquid electrolyte), and no change in specific gravity occurs. Full charge specific gravity is 1.260 - 1.275, corrected for electrolyte temperature with electrolyte level at 3/16" (4.8mm) over plate, unless, electrolyte loss has occurred (from age or over-filling) in which case specific gravity reading will be lower. For most satisfactory charging, lower charging rates in amperes are recommended.



3. If, after prolonged charging, specific gravity of at least 1.230 on all cells cannot be reached, battery is not in optimum condition and will not provide optimum performance; however, it may continue to provide additional service, if it has performed satisfactorily in the past.
4. To check battery voltage while cranking engine with electric starting motor, place red (+) lead to tester on positive (+) battery terminal and black (-) lead of tester on negative (-) battery terminal. If the voltage drops below 9-1/2 volts while cranking, the battery is weak and should be recharged or replaced.

## Winter Storage of Batteries

Battery companies are not responsible for battery damage either in winter storage or in dealer stock if the following instructions are not observed:

1. Remove battery from its installation as soon as possible and remove all grease, sulfate and dirt from top surface by running water over top of battery. Be sure, however, that vent caps are tight beforehand, and blow off all excess water thoroughly with compressed air. Check water level, making sure that plates are covered.
2. When adding distilled water to battery, be extremely careful not to fill more than 3/16" (4.8mm) over plate inside battery. Battery solution or electrolyte expands from heat caused by charging. Overfilling battery will cause electrolyte to overflow (if filled beyond 3/16" over plate).
3. Grease terminal bolts well with Quicksilver 2-4-C Multi-Lube and store battery in COOL-DRY place. Remove battery from storage every 30-45 days, check water level (add water if necessary), and put on charge for 5 or 6 hours at 6 amperes. **DO NOT FAST CHARGE.**
4. If specific gravity drops below 1.240, check battery for reason and recharge. When gravity reaches 1.260, discontinue charging. To check specific gravity, use a hydrometer, which can be purchased locally.
5. Repeat preceding charging procedure every 30-45 days, as long as battery is in storage, for best possible maintenance during inactive periods to ensure a good serviceable battery in spring. When ready to place battery back in service, remove excess grease from terminals (a small amount is desirable on terminals at all times), recharge again as necessary and reinstall battery.

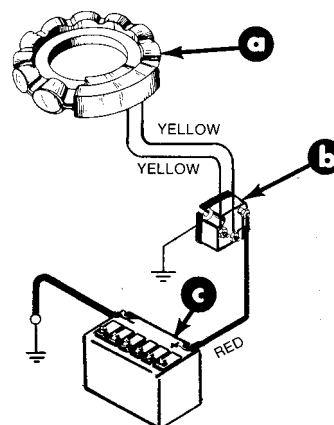
## ⚠ WARNING

Hydrogen and oxygen gases are produced during normal battery operation or charging. Sparks or flame can cause this mixture to ignite and explode, if they are brought near the battery. Sulphuric acid in battery can cause serious burns, if spilled on skin or in eyes. Flush or wash away immediately with clear water.

## Battery Charging System

### Description

The battery charging system components are the alternator, rectifier and battery. Alternating current (generated in alternator coils) flows to the rectifier, which changes the alternating current to direct current for charging the battery.



- a - Alternator
- b - Rectifier
- c - Battery

The charging system may be damaged by: 1) reversed battery cables, 2) running the engine with battery cables disconnected and cable ends touching each other, 3) an open circuit, such as a broken wire or loose connection, and 4) shorting across the battery terminals.



## Battery Charging System Troubleshooting

A fault in the battery charging system usually will cause the battery to become undercharged. Check battery electrolyte level, and charge battery. See "Electrolyte Level", and "Charging a Discharged Battery", preceding.

If battery will NOT accept a satisfactory charge, replace battery.

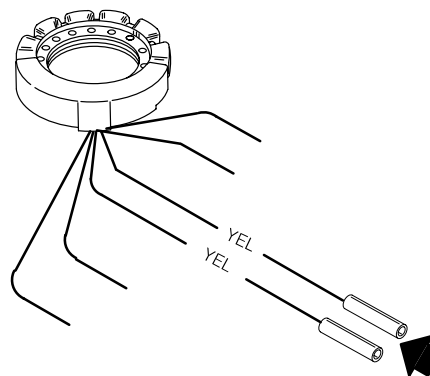
If battery accepts a satisfactory charge, determine the cause of the charging system problem as follows:

Visually check the following:

1. Check for correct battery polarity [red cable to positive (+) battery terminal]. If polarity was incorrect, check for damaged rectifier. See "Rectifier Test", following.
2. Check for loose or corroded battery connections.
3. Visually inspect wiring between stator and battery for cuts, chafing; and disconnected, loose, or corroded connections.
4. Excessive electrical load (from too many accessories) will cause battery to run down.

If visual inspection determines that battery connections and wiring is OK, perform the following stator and rectifier test:

## Stator Test (Alternator Coils Only)



**NOTE:** Stator can be tested without removing from engine.

1. Disconnect both yellow (stator leads).
2. Use an ohmmeter and perform the following test.
3. Replace stator if readings are outside ranges shown.

### STATOR TEST (BLACK STATOR)

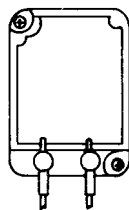
| 9 AMP Stator (398-818535A5)               |           |             |
|-------------------------------------------|-----------|-------------|
| Test Leads To –                           | Ohm Scale | Ohm Reading |
| YEL and YEL                               | R x 1     | .8-1.1      |
| 9 AMP Stator (398-8778A_)                 |           |             |
| Test Leads To –                           | Ohm Scale | Ohm Reading |
| YEL and YEL                               | R x 1     | .5-1.0      |
| 16 AMP Stator (398-9710A33 & 398-9710A42) |           |             |
| Test Leads To –                           | Ohm Scale | Ohm Reading |
| YEL and YEL                               | R x 1     | .10-.50     |

### STATOR TEST (RED STATOR)

| Electric Start Engines 9 Amp Stator  |           |             |
|--------------------------------------|-----------|-------------|
| Test Leads To –                      | Ohm Scale | Ohm Reading |
| YEL and YEL                          | R x 1     | .4–1.0      |
| Electric Start Engines 16 Amp Stator |           |             |
| Test Leads To –                      | Ohm Scale | Ohm Reading |
| YEL and YEL                          | R x 1     | 0.165–0.181 |
| Manual Start Engines                 |           |             |
| Test Leads To –                      | Ohm Scale | Ohm Reading |
| YEL and YEL                          | R x 1     | 0.17–0.19   |



## Voltage Regulator Test



### LAMPS BURN OUT WHEN ENGINE IS REVVED UP

The voltage regulator is defective. Replace voltage regulator.

### LAMPS BURN DIM AT WIDE-OPEN-THROTTLE

Run outboard at midrange (approximately 3000 RPM) with 3 number 94 lamps connected to voltage regulator output leads. Note lamp brightness.

Disconnect the leads at one terminal of regulator. Connect the leads together using a screw and nut. Isolate (tape) connection.

Run outboard at midrange (approximately 3000 RPM) and note lamp brightness. If lamps are considerably brighter than with leads connected to regulator, the regulator is defective. If lamps are NOT considerably brighter, check the alternator (refer to "Stator Test", previously).

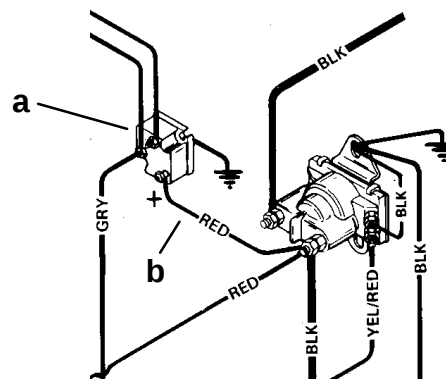
## Alternator System Test

### MANUAL START MODELS – STATOR OUTPUT TEST

The stator that comes with manual start models is NOT designed to produce its rated amperage at low engine speeds (to charge batteries) but rather as a power source for running lights. However, if a rectifier kit is installed on the engine to enable the stator to charge a battery, the following approximate output can be checked at the listed RPM with an in-series ammeter:

|                     | RPM  | AMPERES |
|---------------------|------|---------|
| Manual Start Stator | Idle | 0       |
|                     | 1000 | 0       |
|                     | 2000 | 6       |
|                     | 3000 | 9       |

## ELECTRIC START MODELS WITH RECTIFIER



a - Rectifier  
b - Red Lead

**IMPORTANT: Rectifier must be functioning properly for accurate test results to be obtained.**

1. Remove RED lead from (+) terminal of rectifier.
2. Connect RED (+) ammeter lead to rectifier (+) terminal and BLACK (–) ammeter lead to RED rectifier lead.
3. With engine running at the indicated RPM, the ammeter should indicate the following approximate amperes:

|                    | RPM  | AMPERES |
|--------------------|------|---------|
| 9 Amp Black Stator | Idle | 6       |
|                    | 1000 | 7       |
|                    | 2000 | 8       |
|                    | 3000 | 8       |

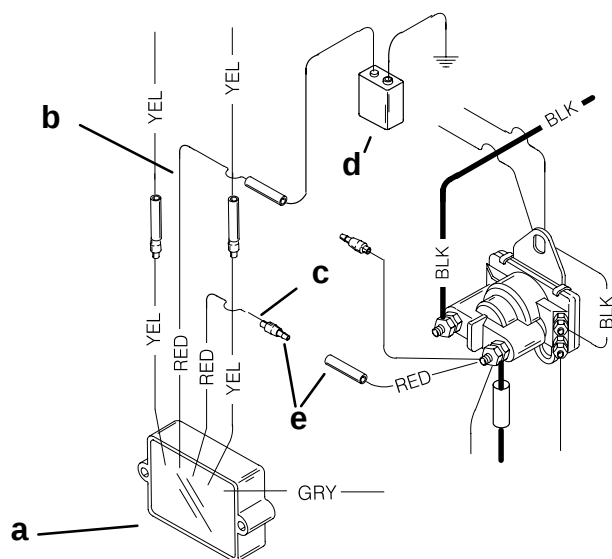
|                                                                                | RPM  | AMPERES |
|--------------------------------------------------------------------------------|------|---------|
| 9 Amp Red Stator<br>(Used with Fly-wheels having Magnets Installed With Epoxy) | Idle | 5       |
|                                                                                | 1000 | 8       |
|                                                                                | 2000 | 9.5     |
|                                                                                | 3000 | 10.0    |

|                                                                                         | RPM  | AMPERES |
|-----------------------------------------------------------------------------------------|------|---------|
| 9 Amp Red Stator<br>(Used with Fly-wheels having Magnets Installed With Retaining Ring) | Idle | 3.5     |
|                                                                                         | 1000 | 5.5     |
|                                                                                         | 2000 | 7       |
|                                                                                         | 3000 | 7.5     |

4. If proper ampere readings are not obtained, replace stator.



## ELECTRIC START MODELS WITH VOLTAGE REGULATOR/RECTIFIER



- a - Voltage Regulator/Rectifier  
b - Red Lead (Smaller Diameter)  
c - Red (Larger Diameter)  
d - 9 Volt Transistor Battery  
e - Connect Ammeter Between Red Leads

1. Check battery voltage at battery with engine running.
2. If battery voltage is above 14.5 volts, replace voltage regulator/rectifier. Check condition of battery as overcharging may have damaged battery.
3. If battery voltage is below 14.5 volts, charge battery. If battery can not be satisfactorily charged, replace battery.
4. If cranking voltage is acceptable, disconnect the two red leads coming from the voltage regulator/rectifier.
5. Connect the smaller diameter red lead to the (+) terminal of a 9 volt transistor battery. Connect the negative (-) terminal of the 9 volt battery to engine ground.

6. Connect RED (+) ammeter lead to larger diameter RED lead, and BLACK (-) ammeter lead to POSITIVE on starter solenoid.
7. With engine running at the indicated RPM, the ammeter should indicate the following approximate amperes:

|                           | RPM  | AMPERES |
|---------------------------|------|---------|
| <b>9 Amp Black Stator</b> | Idle | 6       |
|                           | 1000 | 7       |
|                           | 2000 | 8       |
|                           | 3000 | 8       |

|                            | RPM  | AMPERES |
|----------------------------|------|---------|
| <b>16 Amp Black Stator</b> | Idle | 3       |
|                            | 1000 | 10      |
|                            | 2000 | 17      |
|                            | 3000 | 18      |
|                            | 4000 | 18.5    |
|                            | 5000 | 18.5    |

|                          | RPM  | AMPERES |
|--------------------------|------|---------|
| <b>16 Amp Red Stator</b> | Idle | 2       |
|                          | 1000 | 7       |
|                          | 2000 | 15.5    |
|                          | 3000 | 17      |
|                          | 4000 | 17.5    |
|                          | 5000 | 18      |

8. If ammeter reads less than required amperes, test the stator. If stator tests OK, replace voltage regulator/rectifier.

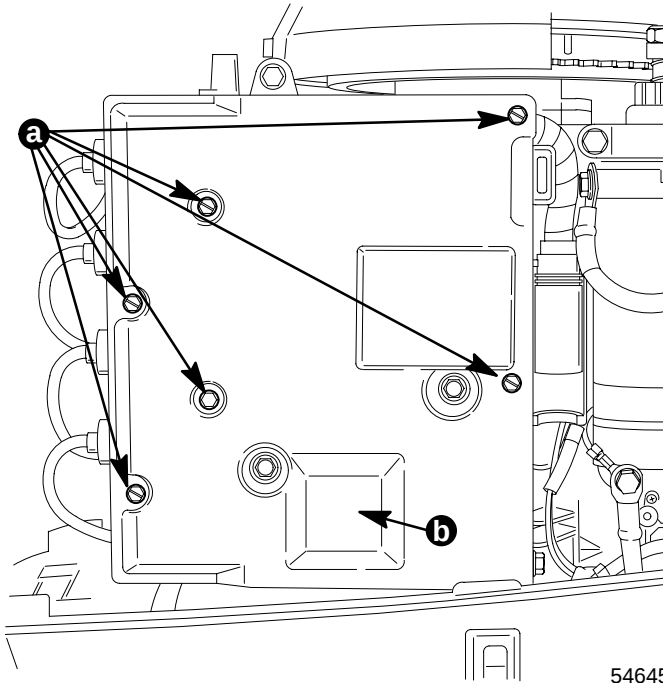


## Rectifier Test

### ⚠ WARNING

**Disconnect battery leads from battery before testing rectifier.**

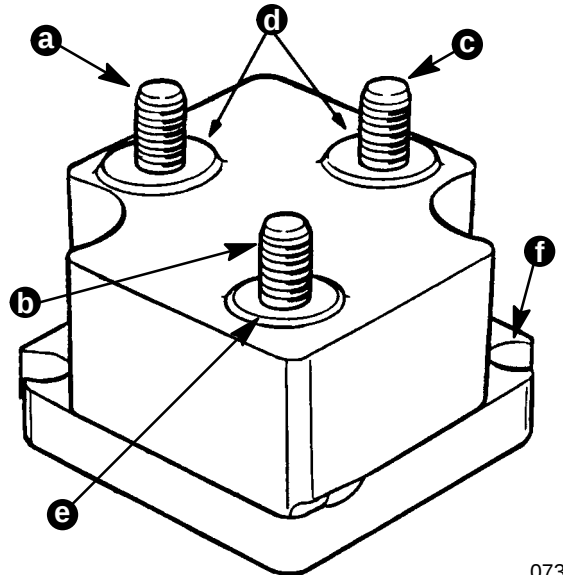
1. To gain access to rectifier, remove 6 bolts from electrical box cover and remove cover.



a - Bolts  
b - Cover

**NOTE:** Rectifier can be tested without removing from engine.

2. Disconnect all wires from terminals on rectifier.
3. Use an ohmmeter (R x 1000 scale) and perform the following test.



a - Terminal  
b - Terminal  
c - Terminal  
d - Alternator Terminals  
e - Positive Terminal  
f - Ground

07300

Connect red meter lead to ground, black lead alternately to terminals "a" and "c".

Continuity Indicated.  
Connect black meter lead to ground, red lead alternately to terminals "a" and "c".

No Continuity Indicated.  
Connect black meter lead to ground, red lead alternately to terminals "a" and "c".

No Continuity Indicated.  
Connect black meter lead to terminal "b", red lead alternately to terminals "a" and "c".

Continuity Indicated.  
Replace rectifier.

No Continuity Indicated.  
Replace rectifier.

Continuity Indicated.  
Connect black meter lead to terminal "b", red lead alternately to terminals "a" and "c".

Continuity Indicated.  
Connect red meter lead to terminal "b", black lead alternately to terminals "a" and "c".

No Continuity Indicated.  
Replace rectifier.

Continuity Indicated.  
Replace rectifier.

No Continuity Indicated.  
Connect red meter lead to terminal "b", black lead alternately to terminals "a" and "c".

No Continuity Indicated.  
Rectifier tests O.K.

Continuity Indicated.  
Replace rectifier.

No Continuity Indicated.  
Replace rectifier.

Continuity Indicated.  
Rectifier tests O.K.



# Starter System

## Starter System Components

The starter system consists of the following parts:

1. Battery.
2. Starter motor solenoid.
3. Neutral start switch.
4. Starter motor.
5. Ignition switch.

## Description

The function of the starting system is to crank the outboard. The battery supplies electrical energy to crank the starter motor. When the ignition switch is turned to "Start" position, the starter solenoid is activated and completes the starter circuit between the battery and starter.

The neutral start switch opens the starter circuit when the shift control lever is not in neutral. This prevents accidental starting when engine is in gear.

### ⚠ CAUTION

The starter motor may be damaged seriously if operated continuously. DO NOT operate continuously for more than 30 seconds. Allow a 2 minute cooling period between starting attempts.

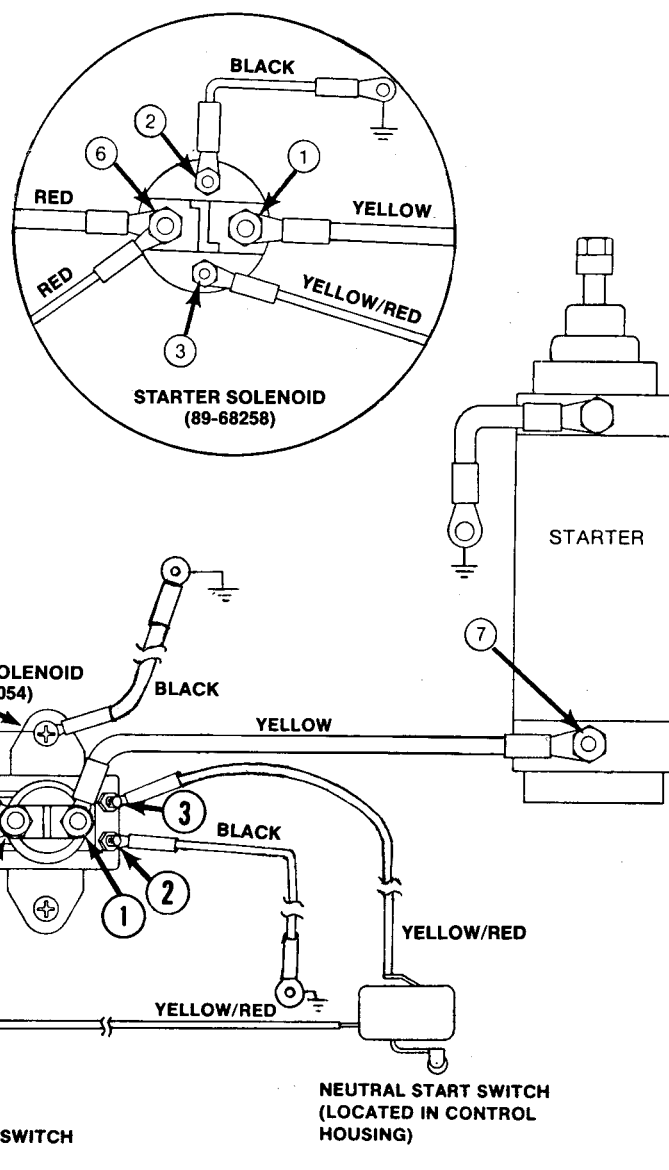
## Troubleshooting the Starter Circuit

Before beginning the starter circuit troubleshooting flowchart, following, check first for the following conditions:

1. Make sure that battery is fully charged.
2. Check that shift control lever is in "neutral" position.
3. Check terminals for corrosion and loose connections.
4. Check cables and wiring for frayed or worn insulation.
5. Check fuse in red wire.

The following "Starter Circuit Troubleshooting Flow Chart" is designed as an aid to troubleshooting the starter circuit. This flow chart will accurately locate any existing malfunction.

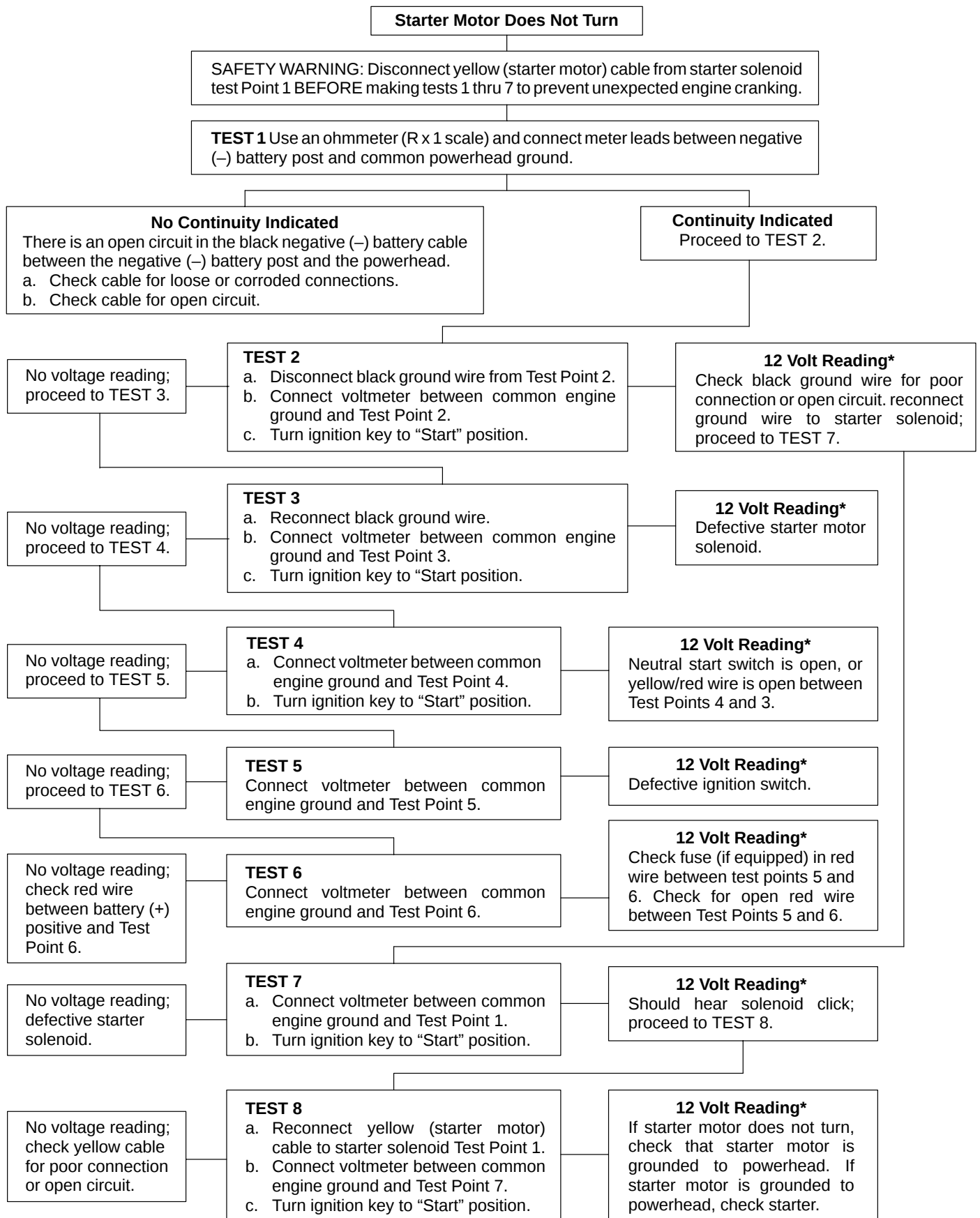
Location of "Test Points" (called out in flow chart on next page) are numbered below.



## Starter Circuit



## Starter Circuit Troubleshooting Flow Chart



### TEST POINTS

Refer to preceding page for Test Point location.

\*Battery Voltage



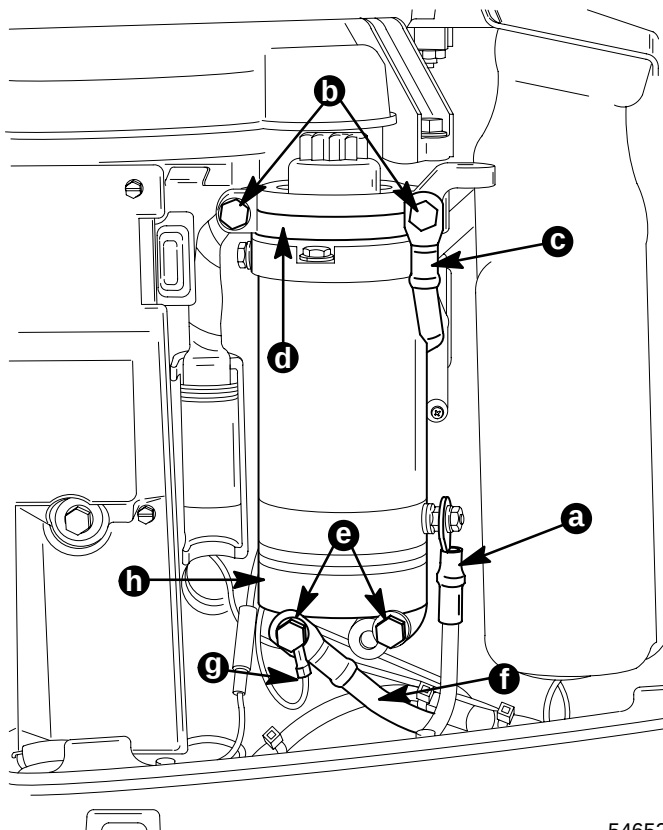
# Starter Removal and Installation

## Removal

### ⚠ WARNING

Before working on outboard, disconnect battery leads from battery and high tension leads from spark plugs.

1. Disconnect battery leads from battery and high tension leads from spark plugs.
2. Disconnect BLACK positive cable from starter motor.
3. Remove two upper mounting bolts, lockwashers and BLACK ground cable from upper starter mounting clamp. Remove clamp.
4. Remove two bottom mounting bolts, lockwashers, BLACK ground cable and BLACK ground wire. Remove lower mounting clamp.
5. Lift starter motor from outboard.

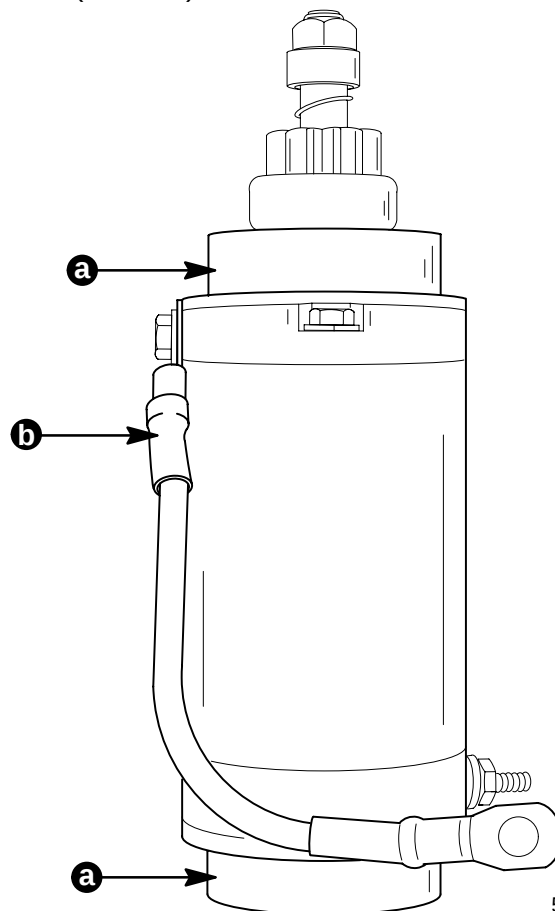


54652

- a - Black Positive Cable
- b - Upper Mounting Bolts
- c - Black Ground Cable
- d - Upper Mounting Clamp
- e - Bottom Mounting Bolts
- f - Black Ground Cable (from Battery)
- g - Black Ground Wire (Starter Motor Solenoid Ground)
- h - Lower Mounting Clamp

## Installation

1. Install collars on starter motor, if removed.
2. Connect BLACK ground cable to starter using bolt and lockwasher, if removed. Torque bolt to 85 lb. in. (9.6 N·m).



54653

- a - Collars
- b - Black Ground Cable

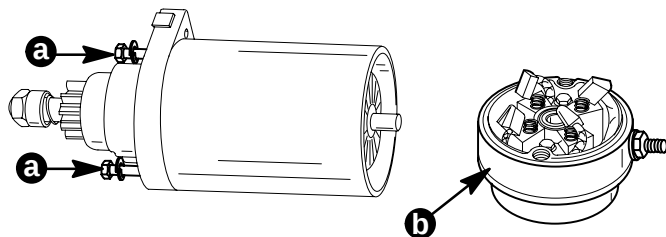
3. Install starter motor to outboard using upper and lower mounting clamps and four mounting bolts. Secure BLACK ground cables and BLACK ground wire under heads of mounting bolts. Torque bolts to 180 lb. in. (20.3 N·m).
4. Connect BLACK positive (+) cable to starter motor. Torque nut to 70 lb. in. (7.9 N·m).



# Bosch Starter

## Disassembly

1. Remove starter as outlined in "Starter Removal and Installation", preceding.
2. Remove 2 thru bolts from starter.

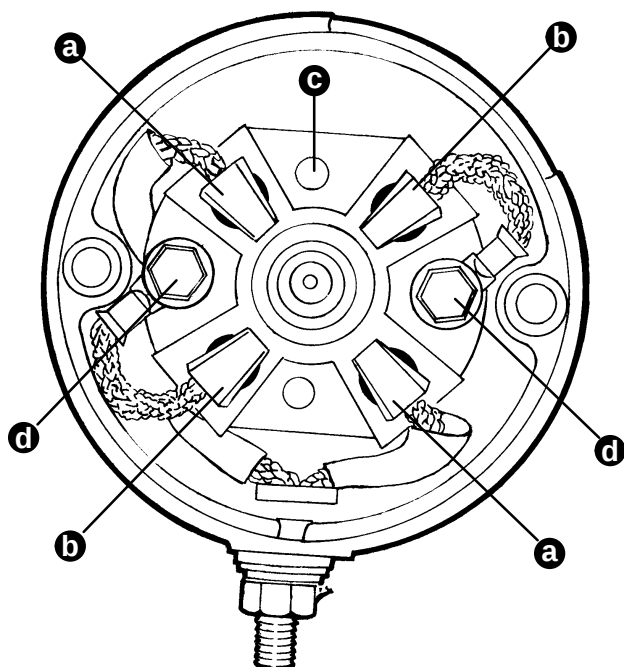


54654

- a - Thru bolts  
b - Commutator End Cap

3. Tap commutator end cap to loosen and remove from starter frame. Be careful not to lose brush springs.
4. Brush replacement is recommended if brushes are pitted, chipped or worn to less than 1/4" (6.4mm). If necessary, remove brushes as follows:

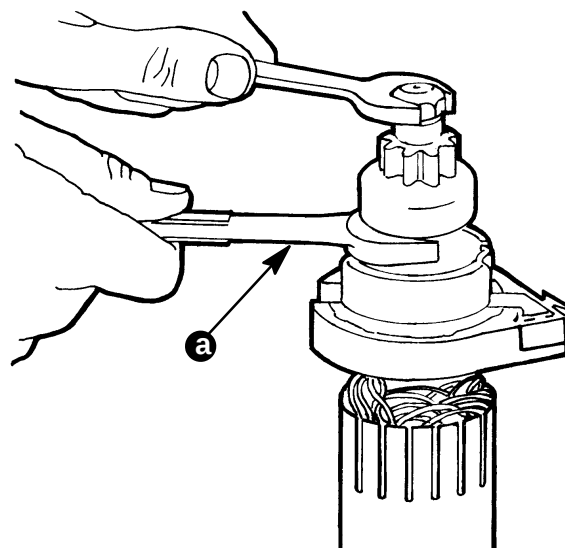
- a. Lift brush holder from end cap. Remove hex nut and washers from positive terminal and remove positive brushes (along with positive terminal) as an assembly.



11656

- a - Brush Holder  
b - Negative Brushes  
c - Positive Brushes  
d - Positive Terminal

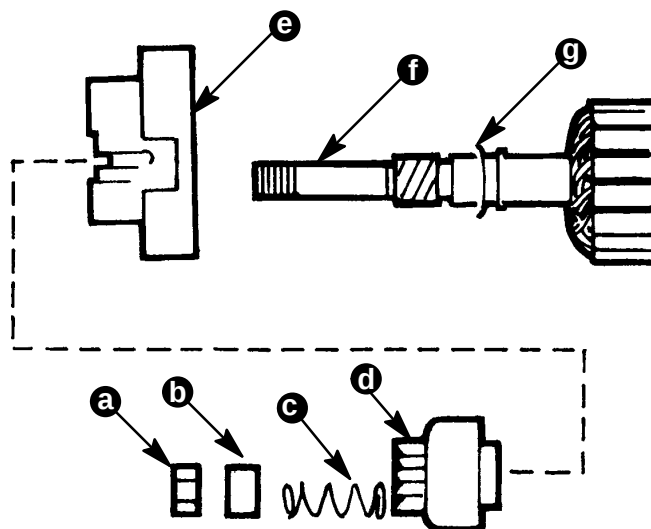
5. Remove armature (along with drive end cap) from starter frame.
6. If necessary, remove parts from armature shaft by first removing locknut. Then remove parts from shaft.



11659

- a - Place Wrench on Hex Portion of Drive Assembly.

## Removing Locknut



11658

- a - Locknut  
b - Spacer  
c - Spring  
d - Drive Assembly  
e - Drive End Cap  
f - Armature Shaft  
g - Washer

## Parts Removed from Armature Shaft



# Starter Cleaning, Inspection and Testing

## Cleaning and Inspection

1. Clean all starter motor parts.
2. Check pinion teeth for chips, cracks or excessive wear.
3. Replace the drive clutch spring and/or collar if tension is not adequate, or if wear is excessive.
4. Check that the brush holder is not damaged or is not holding the brushes against the commutator.
5. Replace brushes that are pitted or worn to less than 1/4" (6.4mm) in length.
6. Replace a damaged or excessively worn bushing in the end cap.
7. Check the armature conductor (commutator bar junction) for a firm connection. A poor connection usually results in a burned commutator bar.
8. Resurface and undercut a rough commutator, as follows:

### ⚠ CAUTION

**Do not turn down the commutator excessively.**

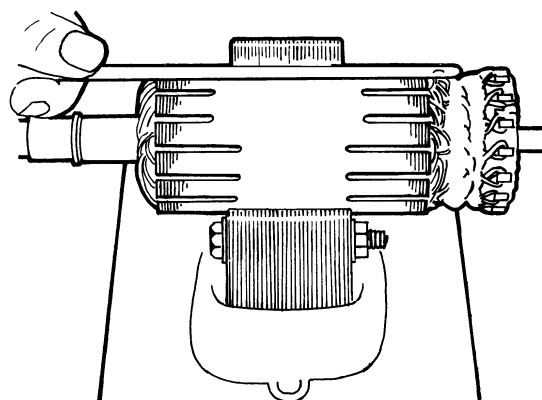
- a. Resurface the commutator and undercut the insulation between the commutator bars 1/32" (0.8mm) to the full width of the insulation and so that the undercut is flat.
  - b. Clean the commutator slots after undercutting.
  - c. Sand the commutator lightly with No. 00 sandpaper to remove burrs, then clean the commutator.
  - d. Recheck the armature on a growler for shorts, as specified in the following procedure ("Testing").
9. Open-circuited armatures often can be saved where an open circuit is obvious and repairable. The most likely place for an open circuit is at the commutator bars, as a result of excessively long cranking periods. Long cranking periods overheat the starter motor so that solder in the connections melts and is thrown out. The resulting poor connections then cause arcing and burning of the commutator bars.

10. Repair bars, that are not too badly burned, by resoldering the leads in bars (using rosin flux solder) and turning down the commutator in a lathe to remove burned material, then undercut the mica.
11. Clean out the copper or brush dust from slots between the commutator bars.
12. Check the armature for ground. See the following procedure ("Testing").

## Testing

### ARMATURE TEST FOR SHORTS

Check armature for short circuits by placing on growler and holding hack saw blade over armature core while armature is rotated. Recheck after cleaning between commutator bars. If saw blade still vibrates, replace armature.

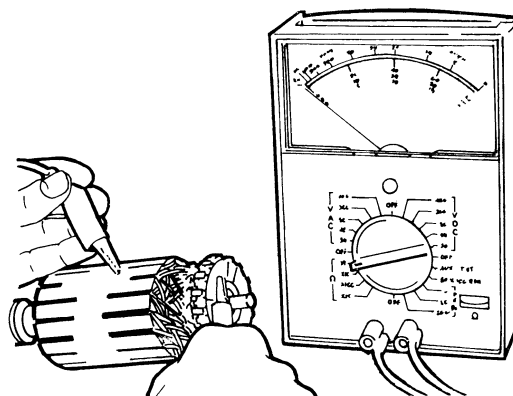


11669

### Armature Tests for Shorts (Bosch)

### ARMATURE TEST FOR GROUND

1. Set VOA meter to (R x 1 scale). Place one lead of VOA meter on armature core or shaft and other lead on commutator.
2. If meter indicates continuity, armature is grounded and must be replaced.



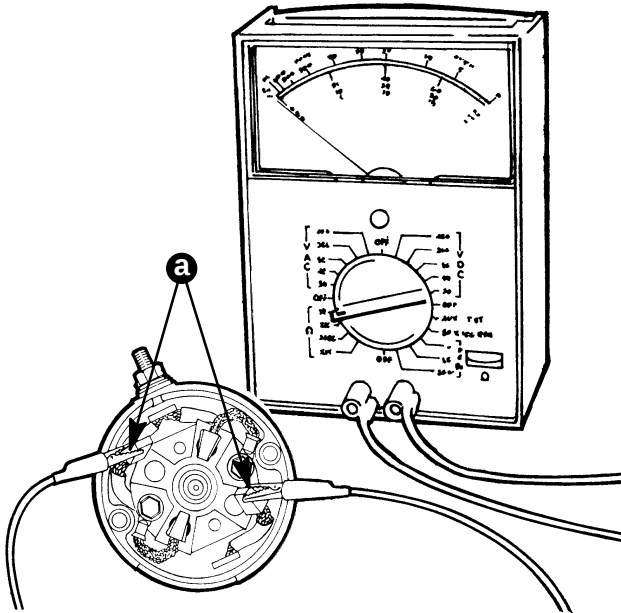
11675

### Armature Test for Ground (Bosch)



## Checking Positive Brushes and Terminal

Set VOA meter to (R x 1 scale). Connect meter leads between positive brushes. Meter must indicate full continuity or zero resistance. If resistance is indicated, check lead to brush and lead to positive terminal solder connection. If connection cannot be repaired, brushes must be replaced.

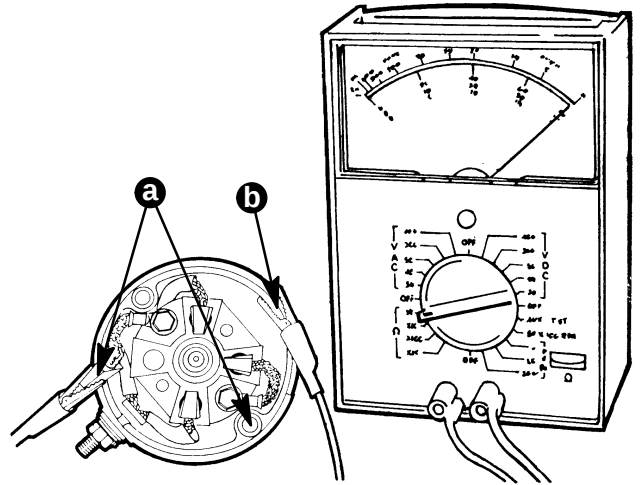


11673

a - Positive (+) Brushes

## Testing Negative Brushes for Ground (Bosch)

Set VOA meter to (R x 1 scale). Place one lead of the VOA on the negative brush and the other lead on the end cap (bare metal). If the meter indicates NO continuity, replace the negative brush. Repeat this procedure on the other negative brush.



11674

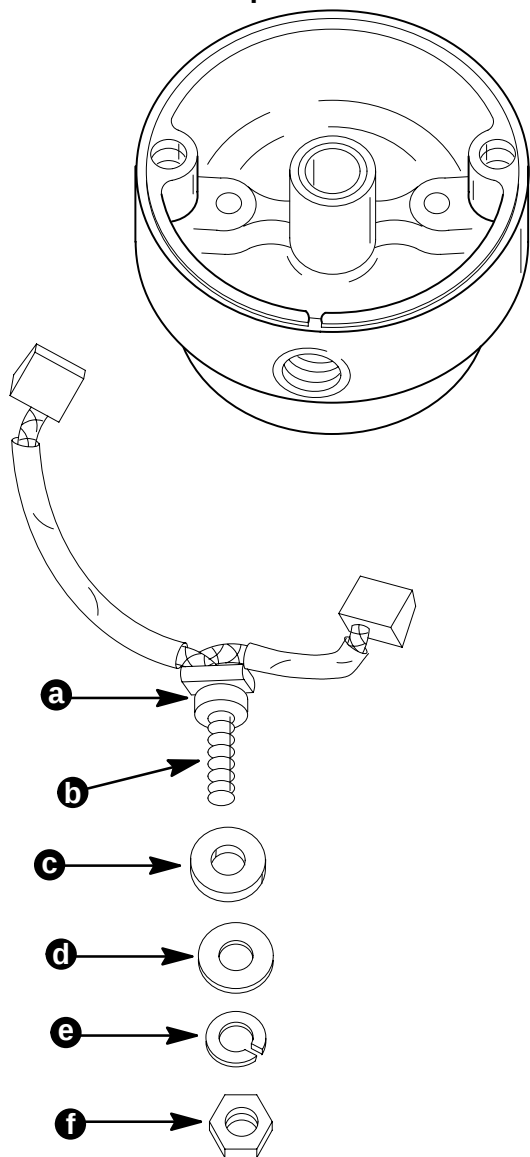
a - Negative (-) Brushes  
b - End Cap



## Reassembly

1. If brushes were removed, replace as follows:
  - a. Install positive brushes (along with positive terminals) into commutator end cap.

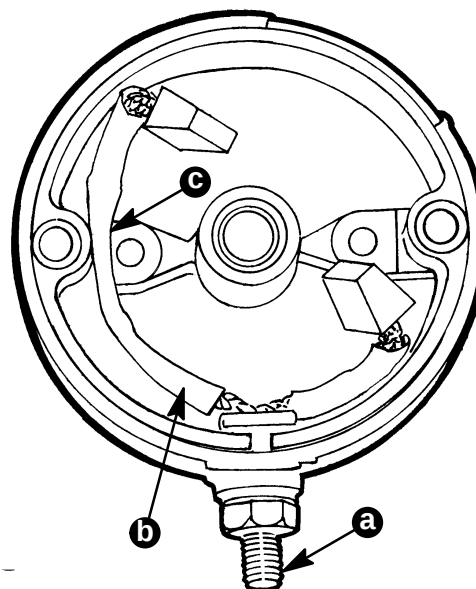
### Positive Brushes Components



- a - Insulating Bushing  
b - Positive (+) Terminal  
c - Insulating Washer  
d - Flat Washer  
e - Lockwasher  
f - Hex Nut

54656

### Positive Brushes Installed

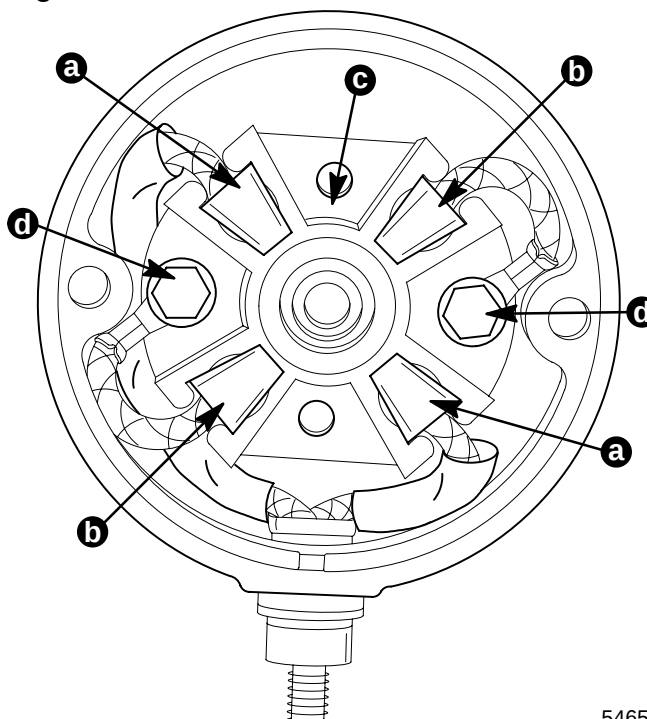


11660

- a - Positive (+) Terminal  
b - Long Brush Lead  
c - Push Lead into Slot

- b. Install negative brushes (along with brush holder).

### Negative Brushes Installed



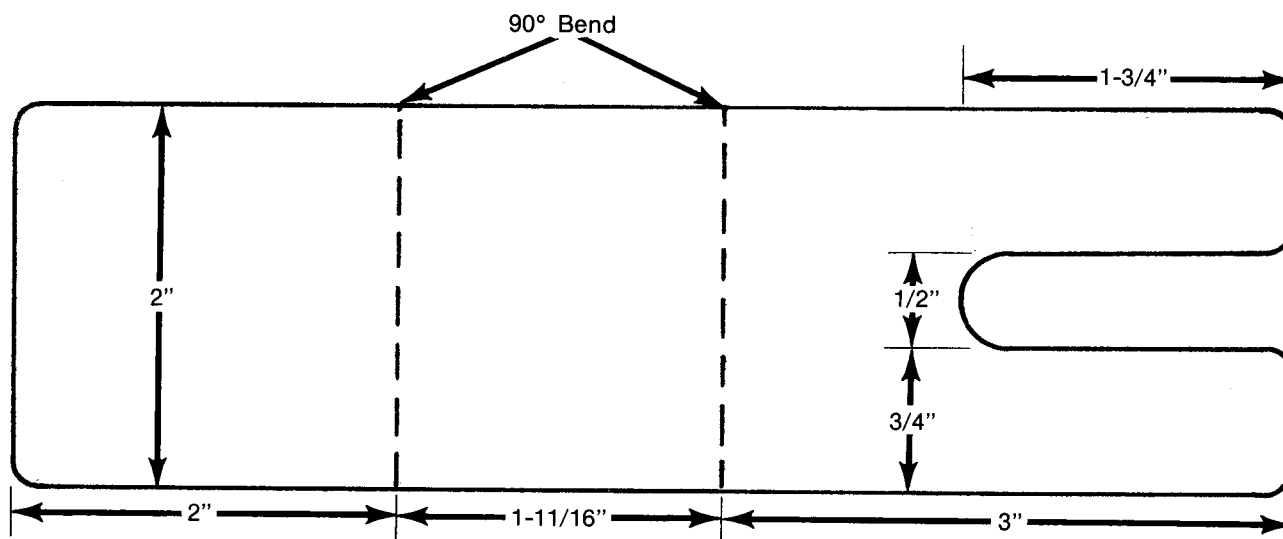
54655

- a - Positive (+) Brushes  
b - Negative (-) Brushes  
c - Brush Holder  
d - Bolts (Fasten Negative Brushes and Holder)

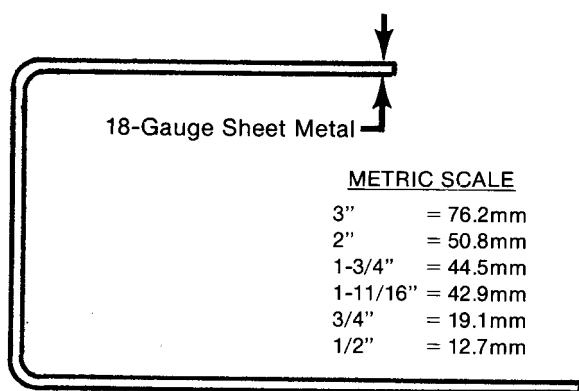


2. If removed, reinstall parts on armature shaft. Use a new locknut and tighten securely on end of shaft.
3. Lubricate helix threads on armature shaft with a drop of SAE 10W oil.
4. Lubricate bushing in drive end plate with a drop of SAE 10W oil.
5. Position armature into start frame so that commutator end of armature is at end of starter frame where permanent magnets are recessed 1" (25.4mm).
6. Lubricate bushing (located in commutator end cap) with one drop of SAE 10W oil. DO NOT over-lubricate.
7. To prevent damage to brushes and springs when installing commutator end cap, it is recommended that a brush retaining tool be made.

### Brush Retainer Tool Dimensions



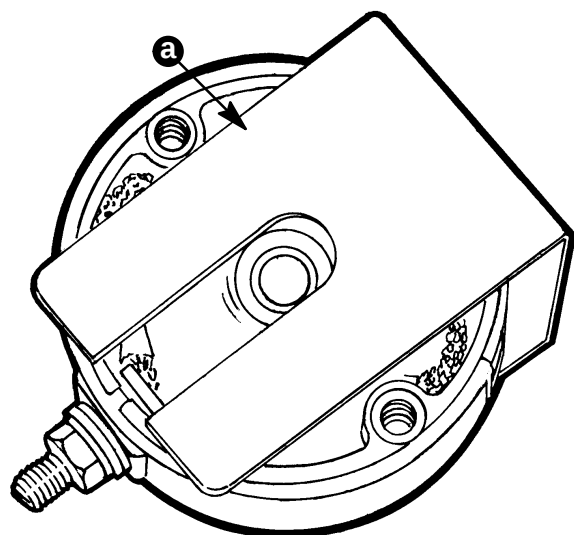
Brush Retaining Tool Layout (Full Size)



Side View (Full Size)



- Place springs and brushes into brush holder and hold in place with brush retainer tool.

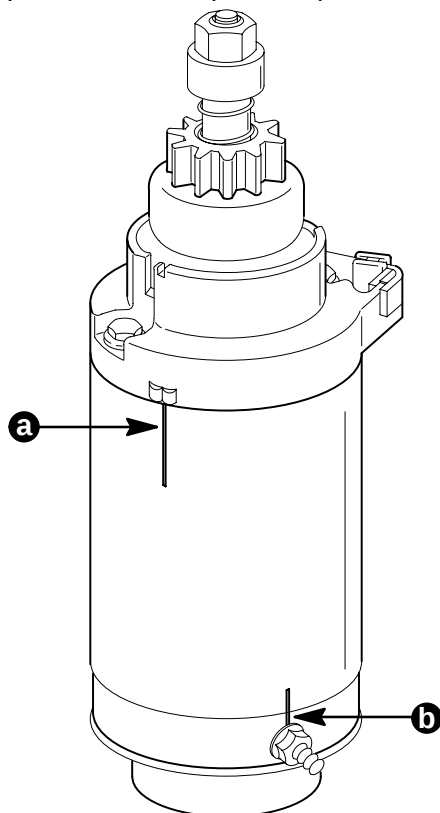


11661

a - Brush Retainer Tool

### Brush Retainer Tool Installed on Commutator End Cap

- Install commutator end cap onto starter frame align mark on frame with positive terminal and remove brush retainer tool. Install thru bolts and torque to 70 lb. in. (7.9 N·m).



54657

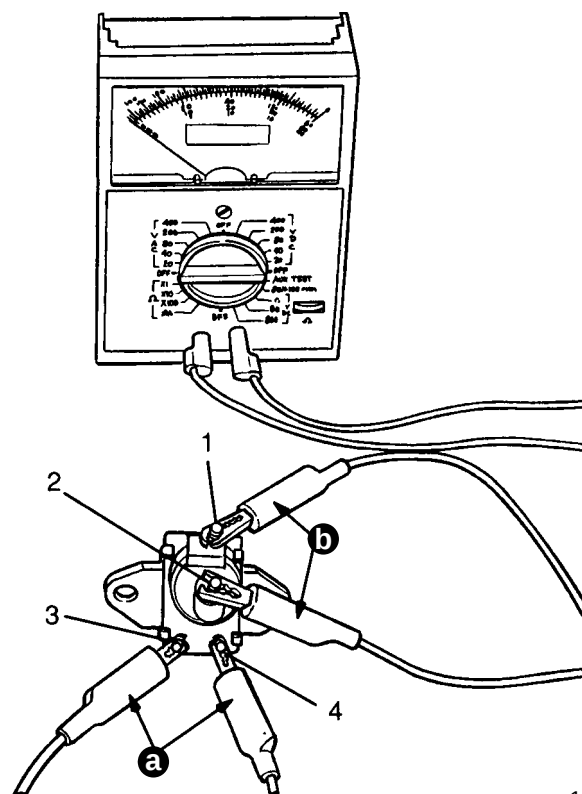
a - Alignment Marks

b - Align Mark with Positive (+) Terminal

## Starter Solenoid Test

Test starter solenoid as follows:

- Disconnect all leads from solenoid terminals.
- Using an ohmmeter (R x 1 scale), connect leads between solenoid terminals 1 and 2, as shown.
- Connect a 12-volt supply between solenoid terminals 3 and 4, as shown. Solenoid should click and meter should read zero ohms.
- If meter does not read zero ohms (full continuity), replace solenoid.



14354

a - 12-Volt Supply

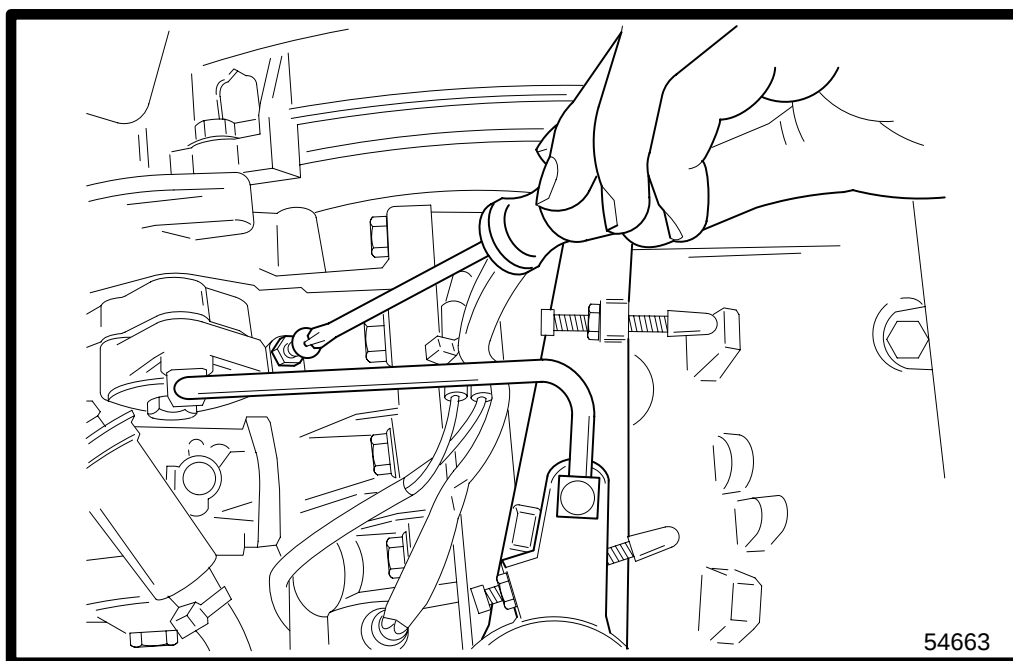
b - Ohmmeter Leads



# ELECTRICAL AND IGNITION

2

C



## TIMING/SYNCHRONIZING/ADJUSTING



# Table of Contents

|                                                                       | Page |
|-----------------------------------------------------------------------|------|
| Timing/Synchronizing/Adjusting .....                                  | 2C-1 |
| Specifications .....                                                  | 2C-1 |
| Special Tools .....                                                   | 2C-1 |
| Timing Adjustments .....                                              | 2C-1 |
| Static Timing (Outboard Not<br>Running) .....                         | 2C-1 |
| Electric Start Models .....                                           | 2C-1 |
| Throttle Primary Pick Up<br>Adjustment .....                          | 2C-1 |
| Maximum Timing Adjustment .....                                       | 2C-3 |
| Throttle Secondary Pick Up Adjustment<br>(Outboard Not Running) ..... | 2C-3 |
| Full Throttle Stop Screw Adjustment<br>(Outboard Not Running) .....   | 2C-4 |
| Carburetor Adjustments .....                                          | 2C-5 |
| Idle Mixture Screw Adjustment .....                                   | 2C-5 |
| Idle RPM Adjustment .....                                             | 2C-5 |



# Timing/Synchronizing & Adjusting

## Specifications

|                            |                            |
|----------------------------|----------------------------|
| Full Throttle RPM Range    | 5000-5500                  |
| Idle RPM (in Forward Gear) | 600-700<br>(3° - 10° ATDC) |
| Maximum Timing             | 30° BTDC<br>@ 5500 RPM     |
| Throttle Primary Pick Up   | 2° BTDC - 2° ATDC          |
| Throttle Secondary Pick Up | 30° BTDC                   |
| Recommended Spark Plug     | NGK BUHW-2                 |
| Firing Order               | 1-3-2-4                    |

## Special Tools

| Part No.   | Description      |
|------------|------------------|
| 91-99379   | Timing Light     |
| 91-59339   | Tachometer       |
| 91-63998A1 | Spark Gap Tester |

## Timing Adjustments

### STATIC TIMING (OUTBOARD NOT RUNNING)

**IMPORTANT:** On **ELECTRIC START MODELS**, outboard battery **MUST BE FULLY CHARGED** when making timing checks. **MANUAL START MODELS MUST BE RUNNING** in order to make any timing checks.

### ELECTRIC START MODELS

1. Remove top cowling.
2. Remove spark plug leads from spark plugs and remove spark plugs from outboard.

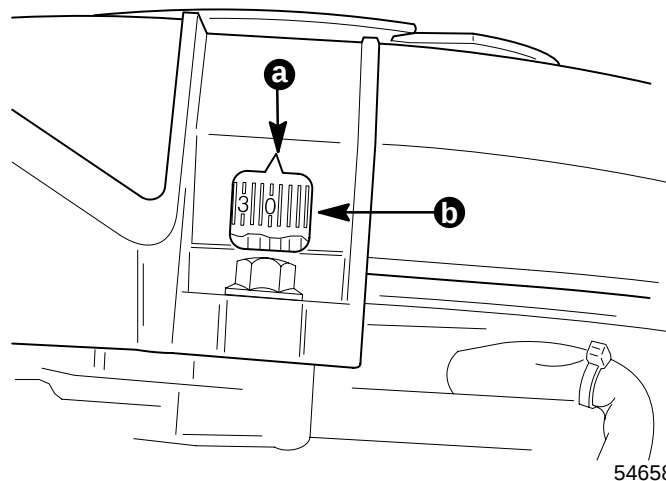
**NOTE:** Removing spark plugs eliminates possibility of outboard accidentally starting and also allows starter motor to turn outboards over faster thus providing more accurate timing readings.

3. Install SPARK GAP TESTER (91-63998A1) between No. 1 (TOP) spark plug lead and engine ground.
4. Connect TIMING LIGHT (91-99379) to No. 1 (TOP) spark plug lead.

**IMPORTANT:** If carburetors were previously removed, it is recommended that they be synchronized prior to making any timing adjustments. Refer to SECTION 3 for proper synchronization procedures.

### THROTTLE PRIMARY PICK UP ADJUSTMENT

1. Engage electric starter and advance throttle/spark arm until specified primary pickup timing mark aligns with "V" notch in timing pointer window of flywheel cover.



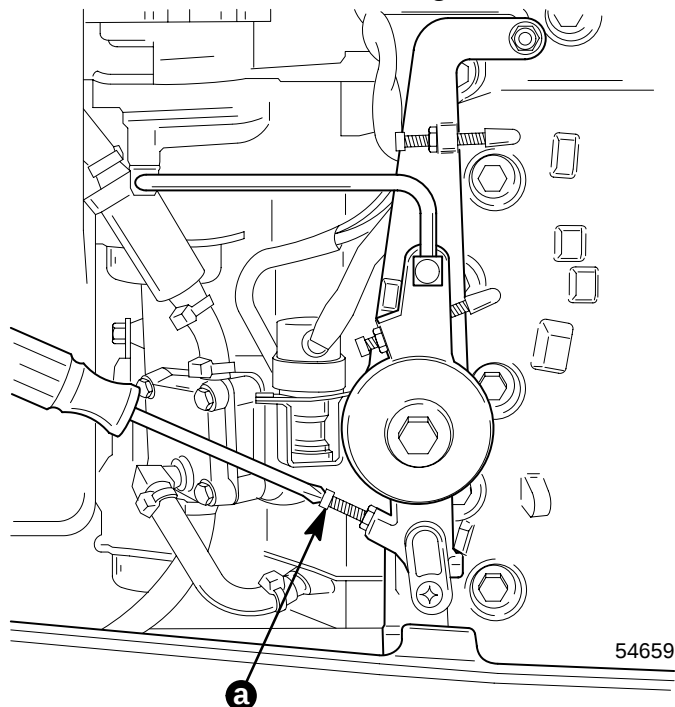
- a - "V" Notch  
b - Window

2. Hold throttle/spark arm steady and turn IDLE RPM SCREW until it just touches its stop. While holding throttle/spark arm against IDLE RPM SCREW STOP, verify specified primary pick up timing mark is still aligned with "V" notch. If timing mark has changed, adjust IDLE RPM SCREW to realign timing mark.



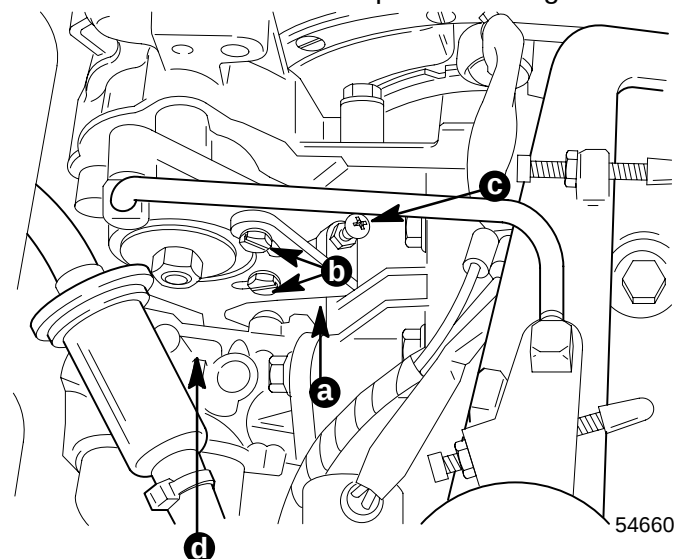
**NOTE:** By holding the throttle/spark arm against the IDLE RPM SCREW STOP, a constant timing reference point is provided while adjusting throttle actuator plate.

**IMPORTANT:** After all timing adjustments have been made, the IDLE RPM SCREW will have to be readjusted to provide the proper idling RPM for the outboard while it is running.



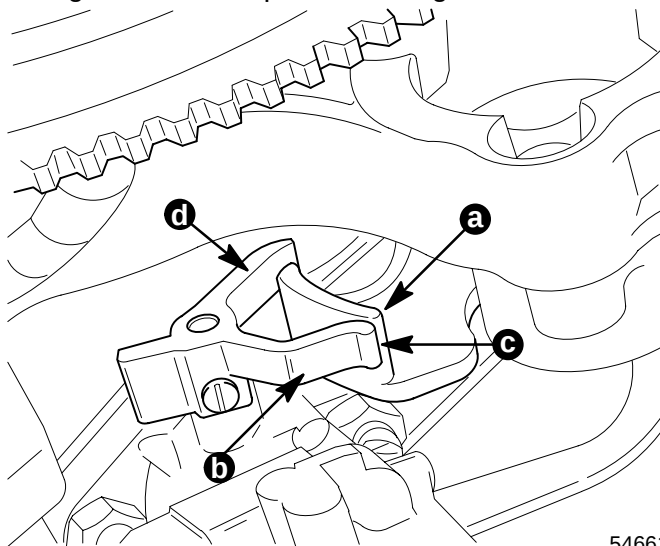
a - Idle RPM Screw

3. Loosen throttle actuator plate retaining screws.



a - Throttle Actuator Plate  
b - Retaining Screws  
c - Secondary Throttle Pick Up Screw  
d - Top Carburetor

4. While holding throttle/spark arm against IDLE RPM SCREW STOP, rotate actuator plate until PRIMARY THROTTLE CAM just touches PRIMARY PICK UP ARM on carburetor cluster. Retighten actuator plate retaining screws.

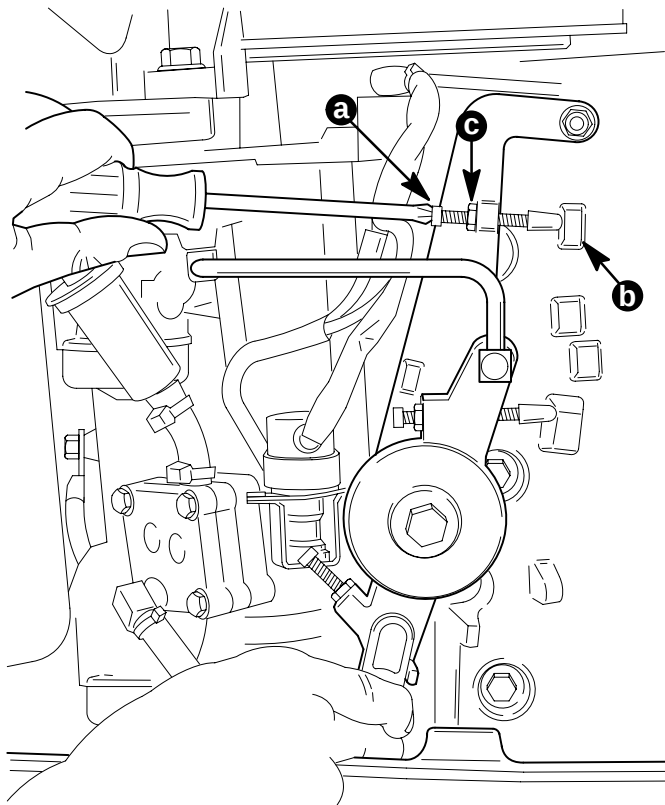


a - Primary Cam  
b - Primary Pick Up Arm  
c - Just Touching  
d - Secondary Lever



## MAXIMUM TIMING ADJUSTMENT

1. Advance throttle/spark arm until MAXIMUM SPARK ADVANCE SCREW is against stop. Engage electric starter. If necessary, adjust maximum spark advance screw to align 32° BTDC mark on flywheel with "V" notch in timing pointer window. Tighten locknut.



54662

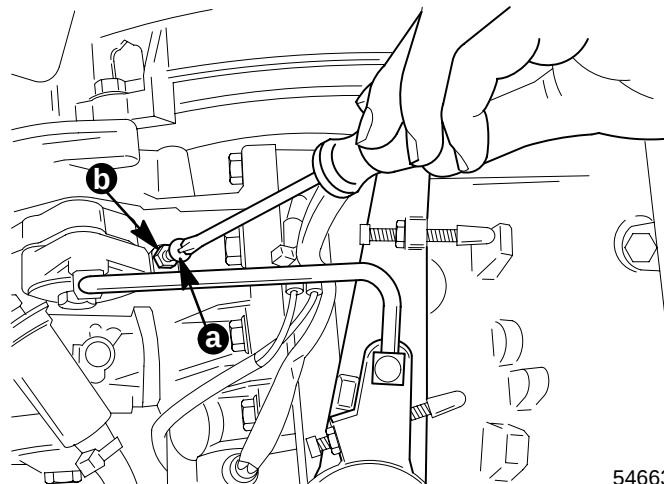
- a - Maximum Spark Advance Screw  
b - Stop  
c - Locknut

**IMPORTANT:** The advance characteristics of this ignition system are such that the ignition timing will retard itself slightly at wide-open-throttle. Thus, setting maximum timing at 32° BTDC at cranking speed should result in retardation to 30° BTDC at 5500 RPM. Therefore, it is recommended that to be assured of maximum performance from this outboard, all timing adjustments made at cranking speed should be verified with the outboard running.

2. Remove timing light and SPARK GAP TESTER from #1 (TOP) spark plug lead.
3. Reinstall spark plugs. Torque spark plugs to 20 lb. ft. (27.1 N·m).
4. Reconnect spark plug high tension leads to spark plugs.

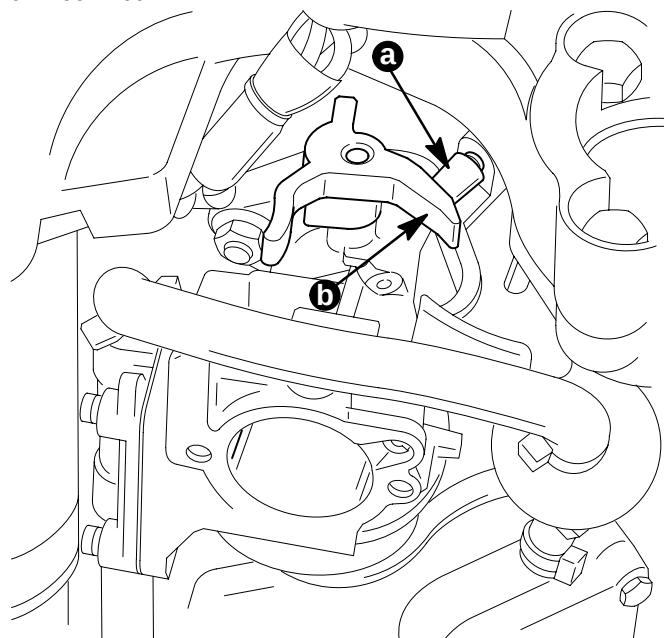
## THROTTLE SECONDARY PICK UP ADJUSTMENT (OUTBOARD NOT RUNNING)

1. With engine not running, advance outboard throttle lever to hold maximum spark advance screw against stop. Adjust secondary throttle pick up screw so that end of screw just touches secondary lever of carburetor cluster. Tighten lock nut.



54663

- a - Secondary Throttle Pick Up Screw  
b - Lock Nut



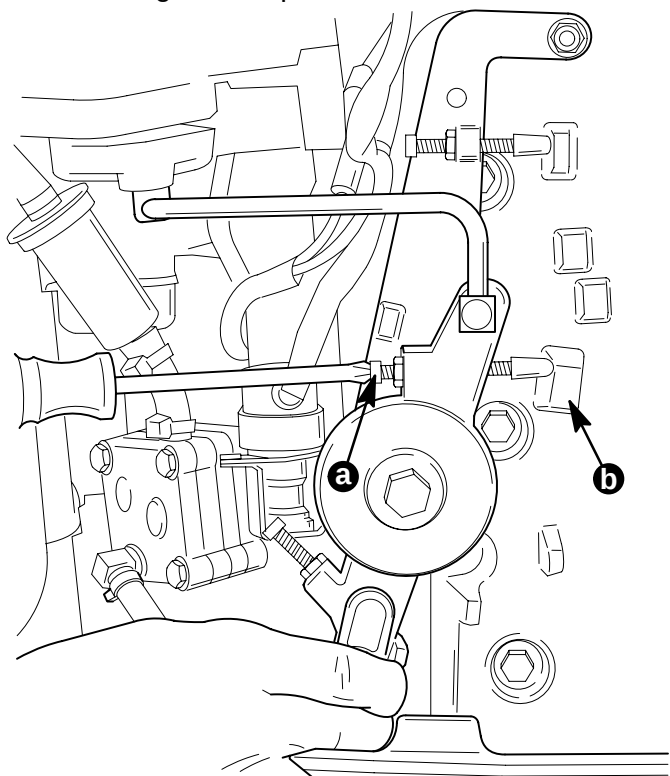
54664

- a - Secondary Throttle Pick Up Screw  
b - Carburetor Cluster, Secondary Cluster



## FULL THROTTLE STOP SCREW ADJUSTMENT (OUTBOARD NOT RUNNING)

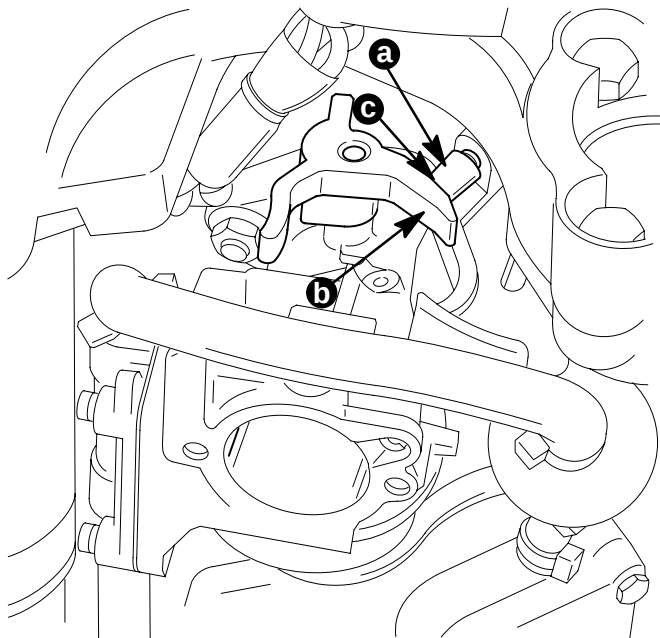
1. Advance throttle lever to hold full throttle stop screw against stop.



54665

- a - Full Throttle Stop Screw  
b - Stop

2. Adjust full throttle stop screw to allow full carburetor shutter opening at wide-open-throttle. Throttle shutters **MUST NOT** act as a throttle stop. .010" - .015" (0.254mm - 0.381mm) free play should exist between secondary pick up screw and carburetor cluster secondary lever. If sufficient free play does not exist, full throttle stop screw **MUST BE** adjusted.



54664

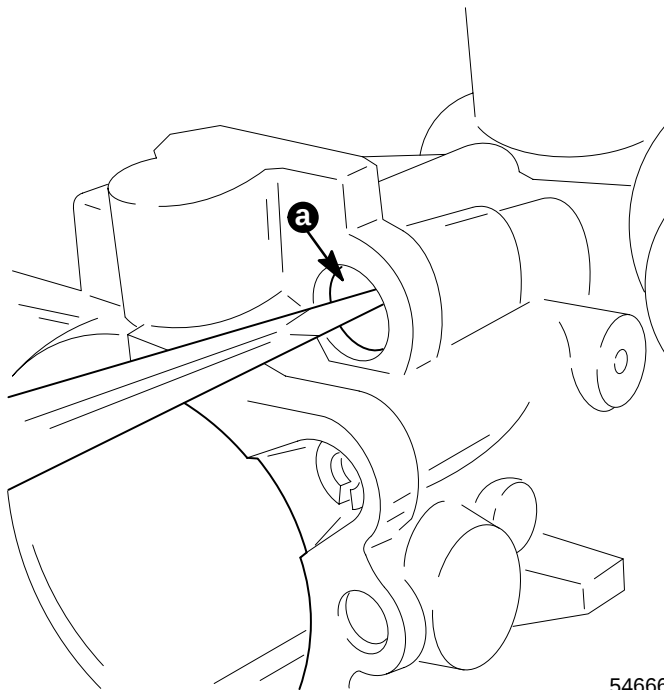
- a - Secondary Pick Up Screw  
b - Carburetor Cluster Secondary Lever  
c - .010 in. - .015 in. (0.254mm - 0.381mm) Clearance



## Carburetor Adjustments

### IDLE MIXTURE SCREW ADJUSTMENT

1. With outboard in test tank or boat and outboard in water, preset carburetor idle mixture screw at 1-1/4 turns out from a lightly seated position.

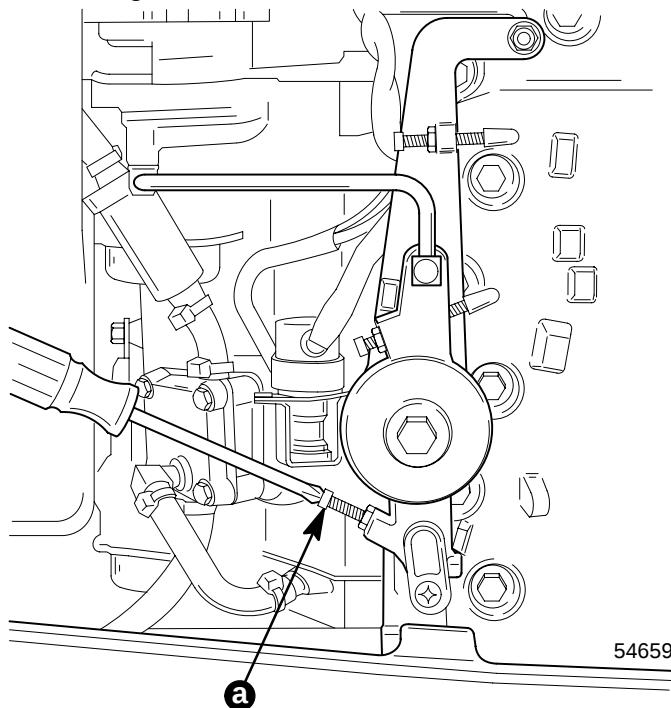


a - Idle Mixture Screw

2. Start outboard and allow to warm up for approximately five minutes.
3. With outboard running, shift into forward gear. Slowly turn idle mixture screw counterclockwise until the corresponding cylinders start to load up or fire unevenly due to an over-rich condition.
4. Slowly turn idle mixture screw clockwise until the cylinders fire evenly and engine picks up speed.
5. Continue turning screw clockwise until too lean a mixture is obtained (outboard slows down and misfires).
6. Set idle mixture screw at a point midway between TOO RICH and TOO LEAN. When in doubt, set slightly RICH rather than TOO LEAN.
7. Do not adjust leaner than necessary to attain reasonably smooth idling. TOO LEAN a mixture is a major cause of hard starting.

### IDLE RPM ADJUSTMENT

1. Place outboard in test tank or boat and outboard in water.
2. Start outboard and allow to warm up for approximately five minutes.
3. With outboard running, shift into forward gear and adjust idle RPM as follows:
  - a. Remove throttle cable barrel from barrel retainer. Adjust idle RPM screw to attain an idle speed of 600 to 700 RPM with outboard running in forward gear. Retighten nut on adjusting screw.



a - Idle RPM Screw

- b. With end of throttle cable connected to throttle lever, hold throttle lever against idle stop. Adjust throttle cable barrel to slip into barrel retainer on cable anchor bracket with a very light preload of throttle lever against idle stop. Lock barrel in place.
- c. Check preload of throttle cable by placing a thin piece of paper between idle stop screw and idle stop. Preload is correct when paper can be removed with some drag but without tearing. Readjust cable barrel if necessary.

**IMPORTANT: Excessive preload on throttle cable will cause difficult shifting from FORWARD to NEUTRAL. Readjust throttle cable if necessary.**





# Table of Contents

## Page

|                                                                                                                        |       |
|------------------------------------------------------------------------------------------------------------------------|-------|
| Wiring Diagram – Model 30 Jet with<br>16 Amp Black Stator .....                                                        | 2D-1  |
| Wiring Diagram – Model 30 Jet with<br>16 Amp Red Stator .....                                                          | 2D-2  |
| Wiring Diagram – Model 30 Jet Tiller<br>Handle with 16 Amp Black Stator .....                                          | 2D-3  |
| Wiring Diagram – Model 30 Jet Tiller<br>Handle with 16 Amp Red Stator .....                                            | 2D-4  |
| Wiring Diagram – Model 40 Electric Start<br>with 9 Amp Black Stator .....                                              | 2D-5  |
| Wiring Diagram – Model 40 Electric Start<br>with 16 Amp Black Stator .....                                             | 2D-6  |
| Wiring Diagram – Model 40 Electric Start<br>with 16 Amp Red Stator .....                                               | 2D-7  |
| Wiring Diagram – Model 40 Electric Start<br>Tiller Handle with 16 Amp Black Stator ....                                | 2D-8  |
| Wiring Diagram – Model 40 Electric Start<br>Tiller Handle with 16 Amp Red Stator ....                                  | 2D-9  |
| Wiring Diagram – Model 40 Manual Start<br>with Black Stator .....                                                      | 2D-10 |
| Wiring Diagram – Model 40 Manual Start<br>with Red Stator .....                                                        | 2D-11 |
| Power Trim Wiring Diagram .....                                                                                        | 2D-12 |
| Commander 2000 Side Mount Remote Control<br>(Power Trim/Tilt Electric Start with Warning<br>Horn) Wiring Diagram ..... | 2D-13 |
| Commander 2000 Side Mount Remote Control<br>(Electric Start with Warning Horn) Wiring<br>Diagram .....                 | 2D-14 |
| Commander 2000 Side Mount Remote Control<br>(Manual) Wiring Diagram .....                                              | 2D-15 |
| Key/Choke Switch Continuity Test (Commander<br>2000 Side Mount Remote Control) .....                                   | 2D-16 |
| Panel Mount Remote Control Wiring<br>Diagram .....                                                                     | 2D-17 |
| Remote Key Switch and Warning Horn .....                                                                               | 2D-18 |

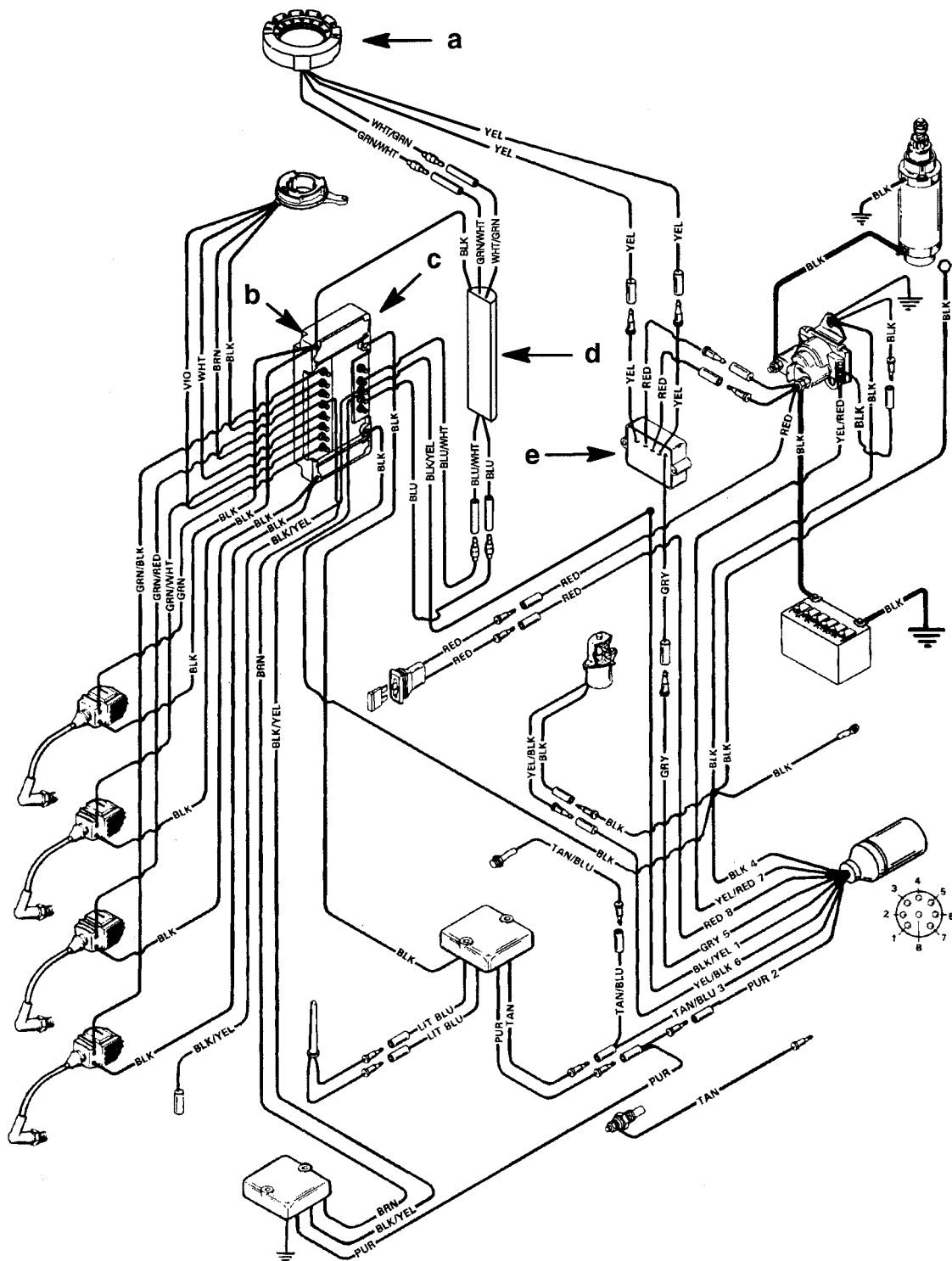


- 15- Ignition Coil #2 Cylinder
- 16- Ignition Coil #3 Cylinder
- 17- Ignition Coil #4 Cylinder
- 18- Low Oil Sensor
- 19- RPM Limiter
- 20- To Female Connector on Remote Control Harness Plug
- 21- To Bottom Cowl



# Wiring Diagram – Model 30 Jet with 16 Amp Red Stator

BLK = Black  
BLU = Blue  
BRN = Brown  
GRY = Gray  
GRN = Green  
ORN = Orange  
PNK = Pink  
PUR = Purple  
RED = Red  
Tan = Tan  
WHT = White  
YEL = Yellow  
LIT = Light  
DRK = Dark



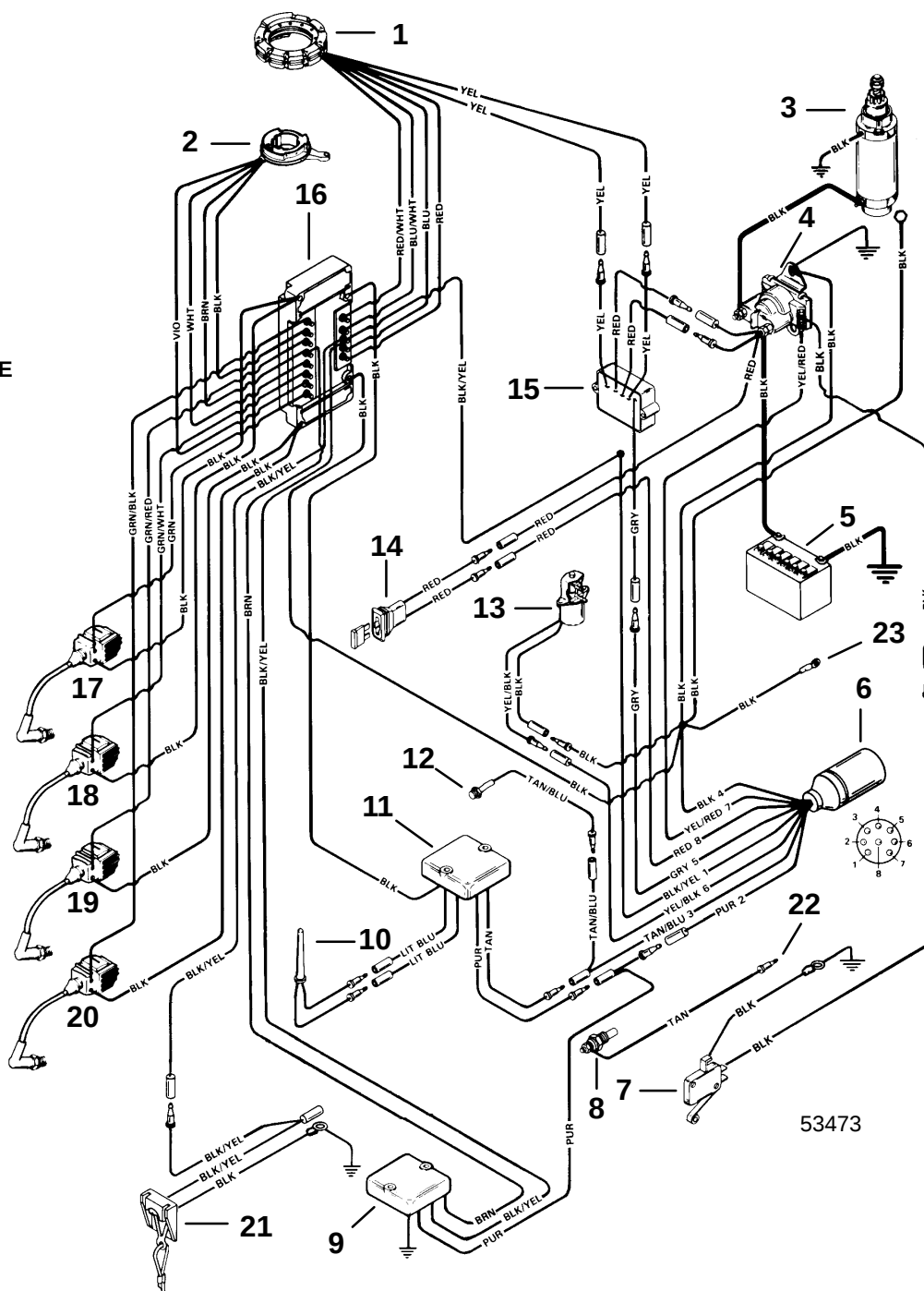
54944

- a - 16 Ampere Stator
- b - Ground Connection
- c - Switch Box
- d - Stator Adaptor
- e - Voltage Regulator



# Wiring Diagram – Model 30 Jet Tiller Handle with 16 Amp Black Stator

BLK = BLACK  
BLU = BLUE  
BRN = BROWN  
GRY = GRAY  
GRN = GREEN  
PUR = PURPLE  
RED = RED  
TAN = TAN  
WHT = WHITE  
YEL = YELLOW  
LIT BLU = LIGHT BLUE



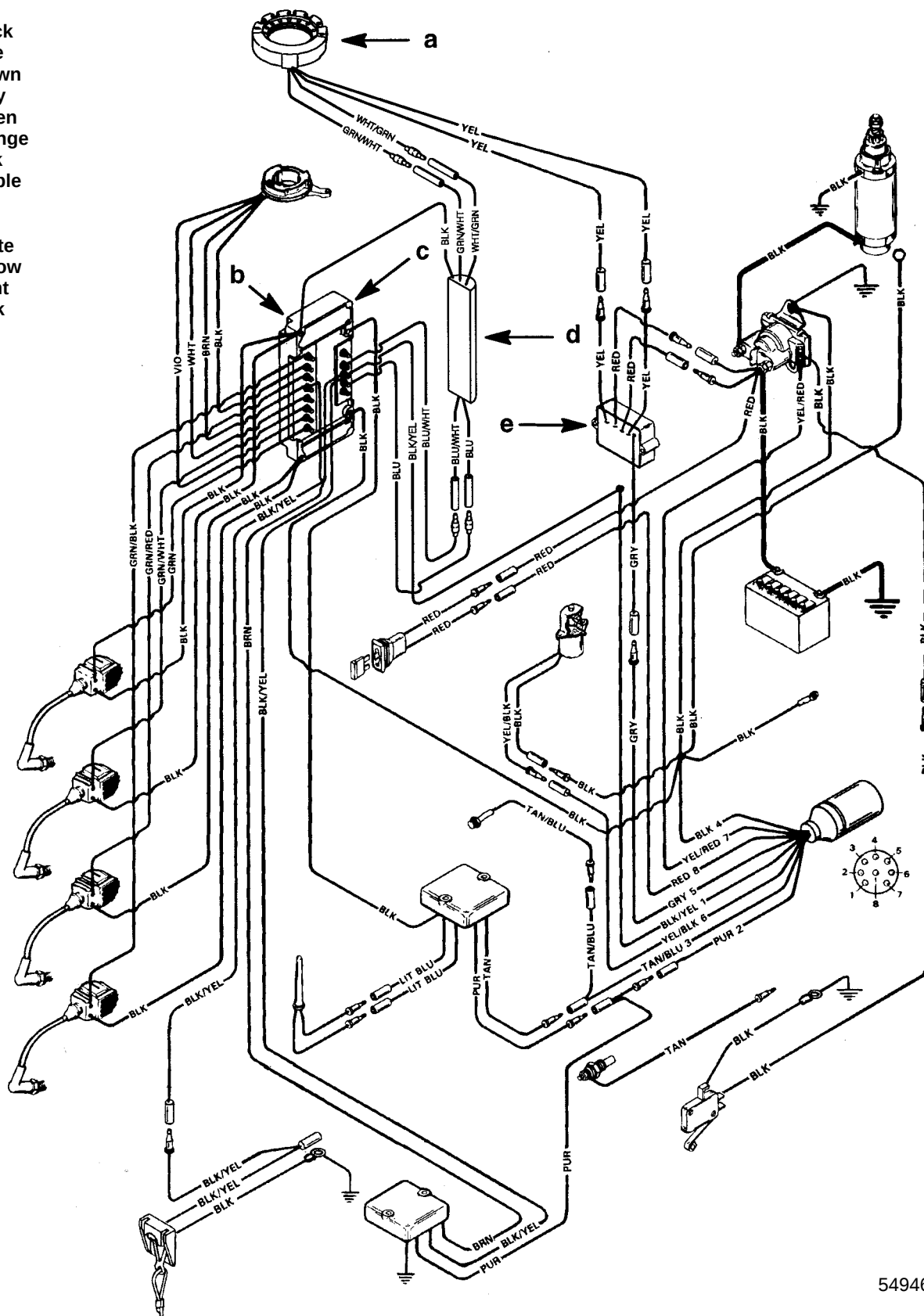
- 1 - Stator
- 2 - Trigger
- 3 - Starter
- 4 - Starter Solenoid
- 5 - Battery
- 6 - Engine Harness
- 7 - Neutral Start Switch
- 8 - Temperature Gauge Sender
- 9 - RPM Limiter
- 10 - Low Oil Sensor
- 11 - Warning Module
- 12 - Overheat Switch
- 13 - Enrichment Valve

- 14 - 20 Ampere Fuse
- 15 - Voltage Regulator/Rectifier
- 16 - Switch Box
- 17 - Ignition Coil #1 Cylinder
- 18 - Ignition Coil #2 Cylinder
- 19 - Ignition Coil #3 Cylinder
- 20 - Ignition Coil #4 Cylinder
- 21 - Emergency Stop Switch
- 22 - To Female Connector on Remote Control Harness Plug
- 23 - To Bottom Cowl



# Wiring Diagram – Model 30 Jet Tiller Handle with 16 Amp Red Stator

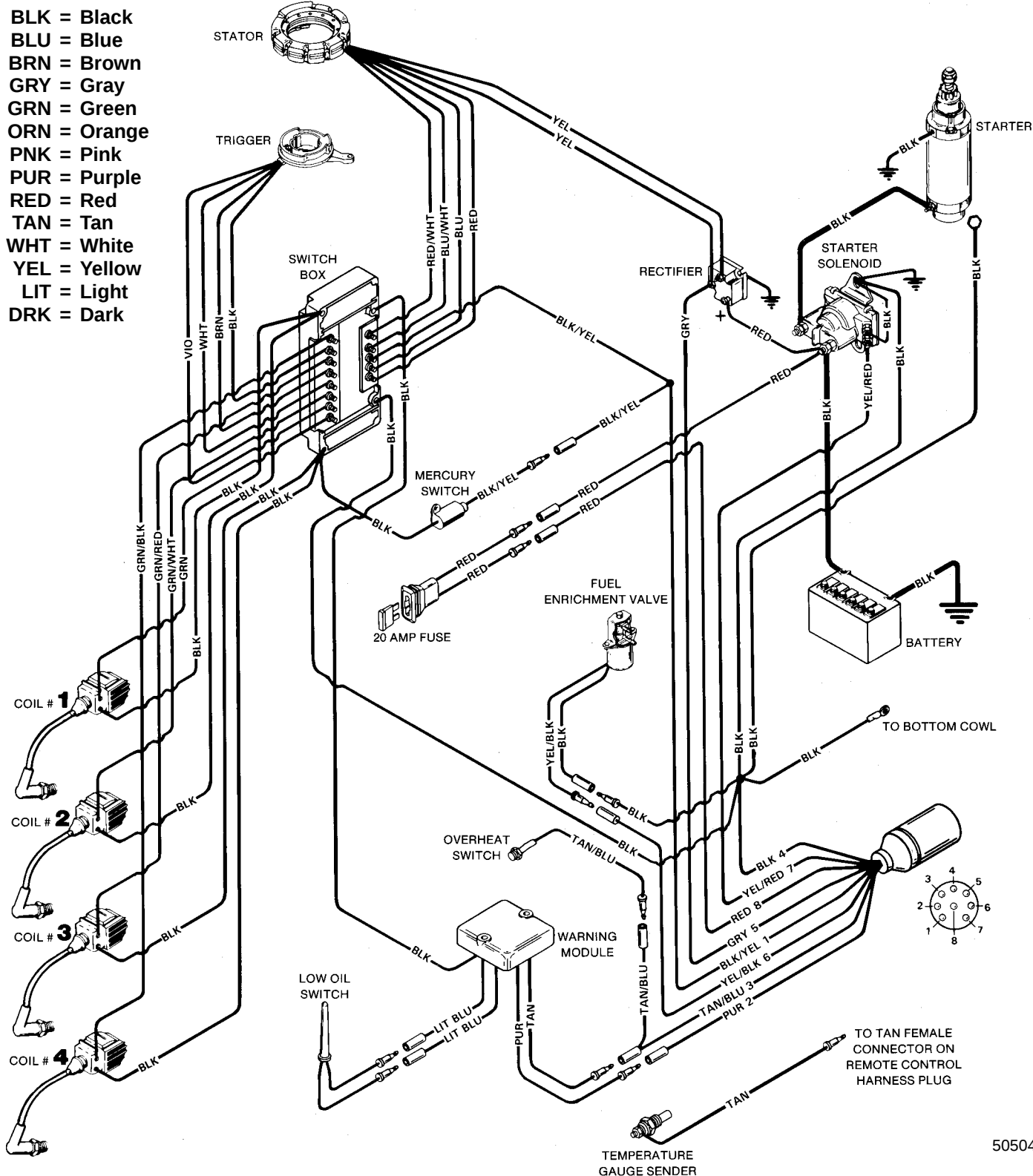
BLK = Black  
BLU = Blue  
BRN = Brown  
GRY = Gray  
GRN = Green  
ORN = Orange  
PNK = Pink  
PUR = Purple  
RED = Red  
Tan = Tan  
WHT = White  
YEL = Yellow  
LIT = Light  
DRK = Dark



54946



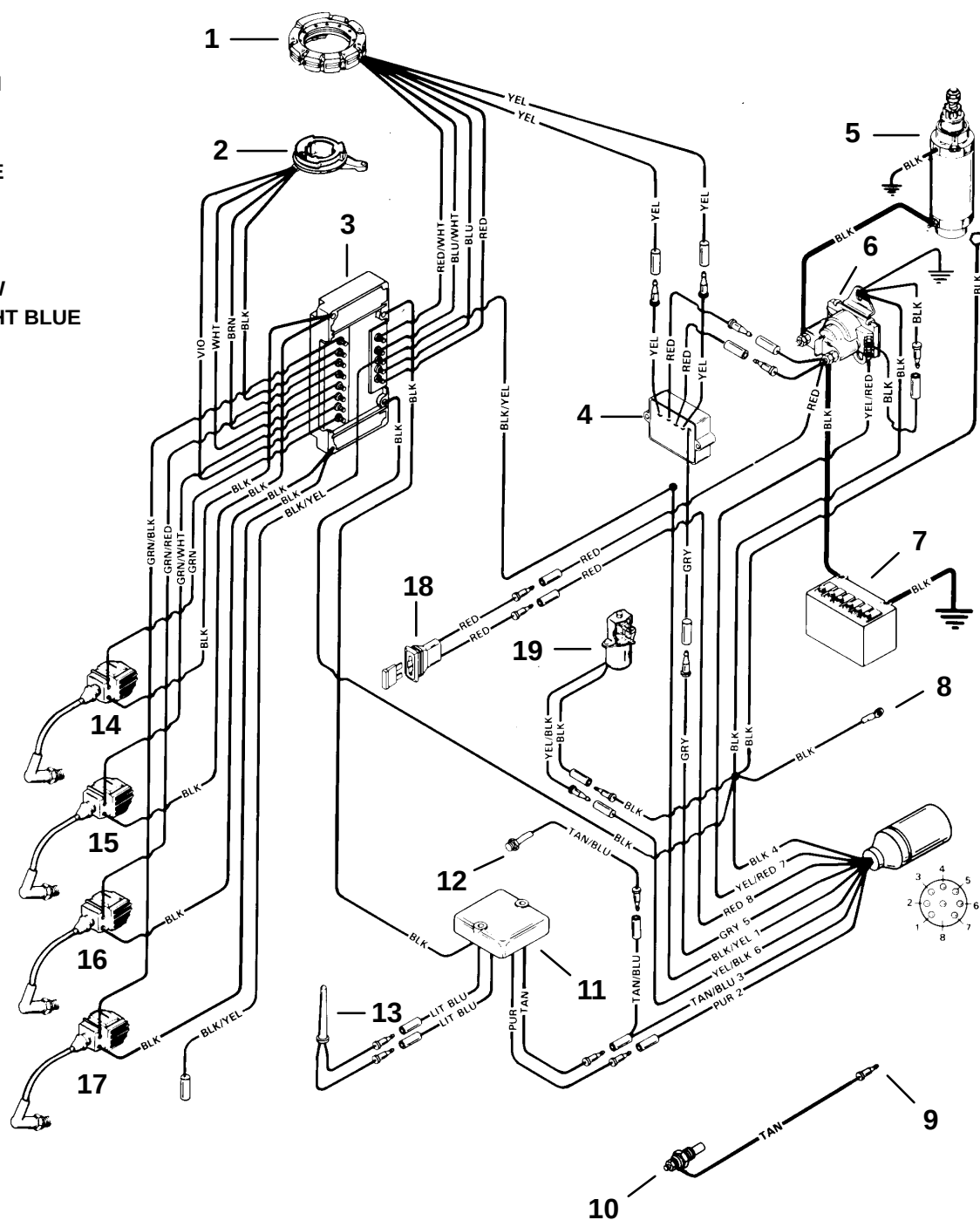
# Wiring Diagram – Model 40 Electric Start with 9 Amp Black Stator





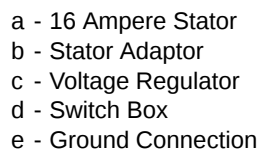
# Wiring Diagram – Model 40 Electric Start with 16 Amp Black Stator

BLK = BLACK  
BLU = BLUE  
BRN = BROWN  
GRY = GRAY  
GRN = GREEN  
PUR = PURPLE  
RED = RED  
TAN = TAN  
WHT = WHITE  
YEL = YELLOW  
LIT BLU = LIGHT BLUE



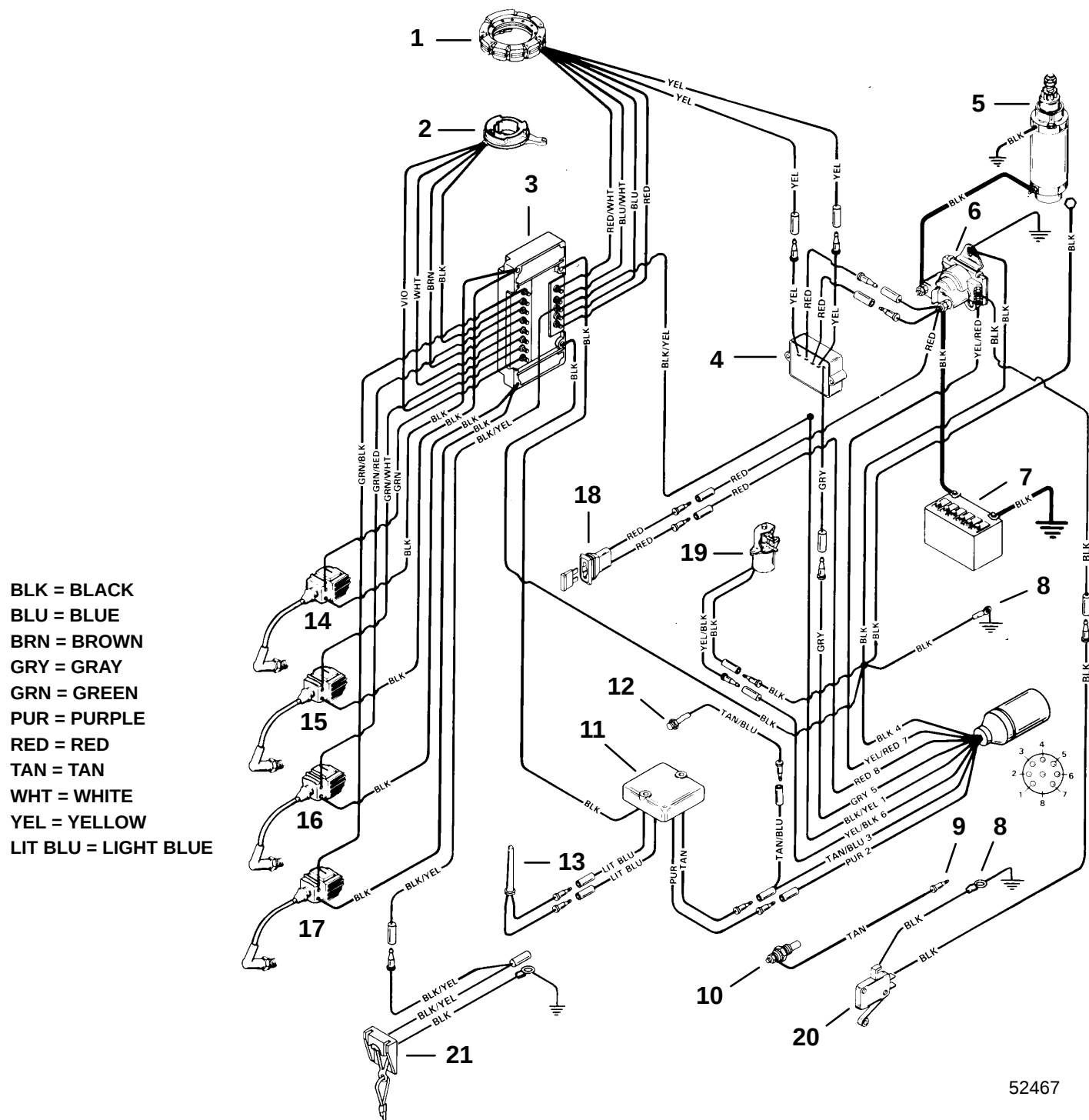
52468

- |                                                            |                           |
|------------------------------------------------------------|---------------------------|
| 1 - Stator                                                 | 13- Low Oil Switch        |
| 2 - Trigger                                                | 14- Coil No. 1            |
| 3 - Switch Box                                             | 15- Coil No. 2            |
| 4 - Voltage Regulator                                      | 16- Coil No. 3            |
| 5 - Starter                                                | 17- Coil No. 4            |
| 6 - Starter Solenoid                                       | 18- 20 Ampere Fuse        |
| 7 - Battery                                                | 19- Fuel Enrichment Valve |
| 8 - To Bottom Cowl                                         |                           |
| 9 - To Tan Female Connector on Remote Control Harness Plug |                           |
| 10- Temperature Gauge Sender                               |                           |
| 11- Warning Module                                         |                           |
| 12- Overheat Module                                        |                           |





# Wiring Diagram – Model 40 Electric Start Tiller Handle with 16 Amp Black Stator



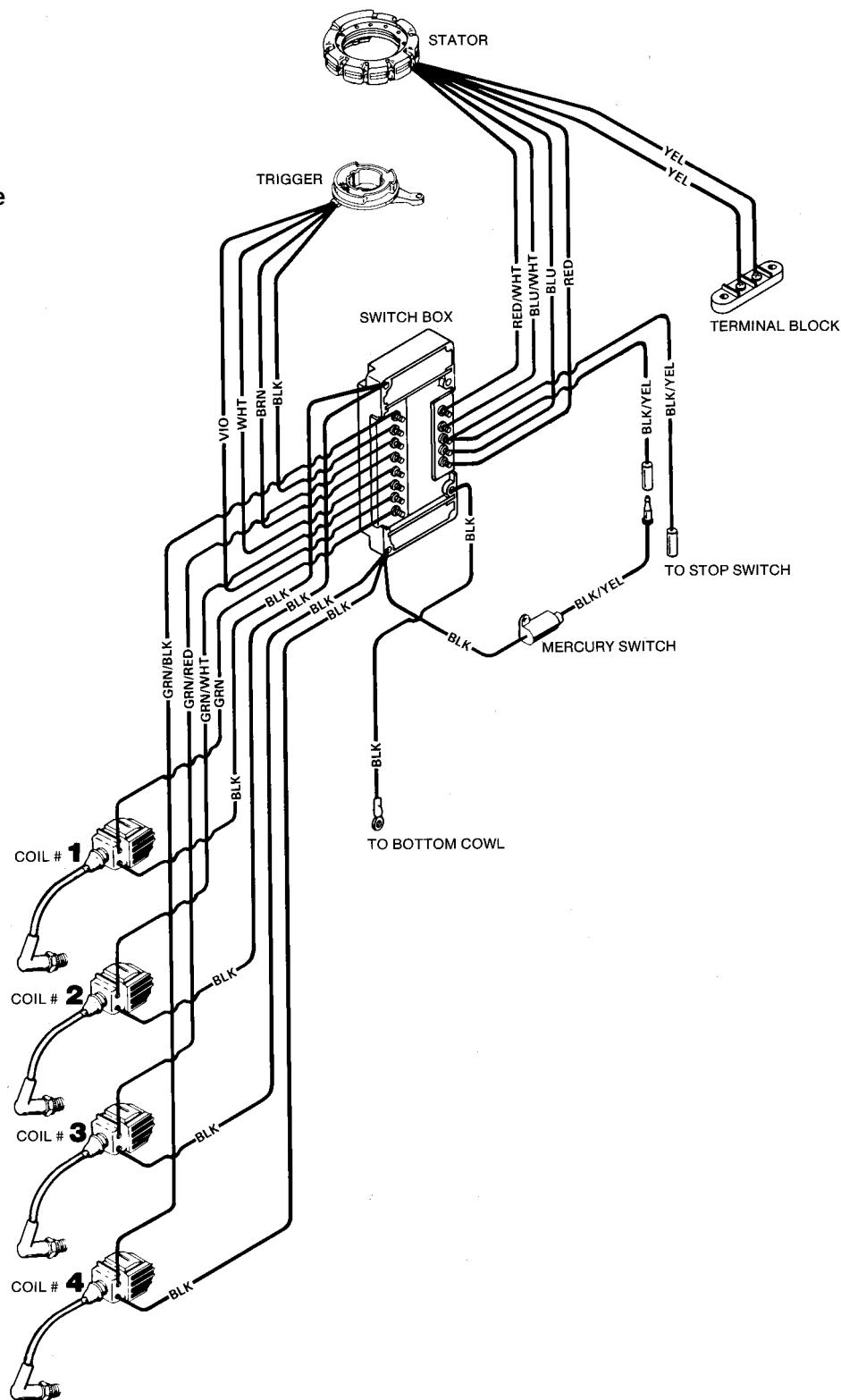
- |                                                            |                           |
|------------------------------------------------------------|---------------------------|
| 1 - Stator                                                 | 11- Warning Module        |
| 2 - Trigger                                                | 12- Overheat Switch       |
| 3 - Switch Box                                             | 13- Low Oil Sensor        |
| 4 - Voltage Regulator                                      | 14- Coil No. 1            |
| 5 - Starter                                                | 15- Coil No. 2            |
| 6 - Starter Solenoid                                       | 16- Coil No. 3            |
| 7 - Battery                                                | 17- Coil No. 4            |
| 8 - To Bottom Cowl                                         | 18- 20 Ampere Fuse        |
| 9 - To Tan Female Connector on Remote Control Harness Plug | 19- Fuel Enrichment Valve |
| 10- Temperature Gauge Sender                               | 20- Neutral Start Switch  |
|                                                            | 21- Emergency Stop Switch |





# Wiring Diagram – Model 40 Manual Start with Black Stator

BLK = Black  
BLU = Blue  
BRN = Brown  
GRY = Gray  
GRN = Green  
ORN = Orange  
PNK = Pink  
PUR = Purple  
RED = Red  
TAN = Tan  
WHT = White  
YEL = Yellow  
LIT = Light  
DRK = Dark

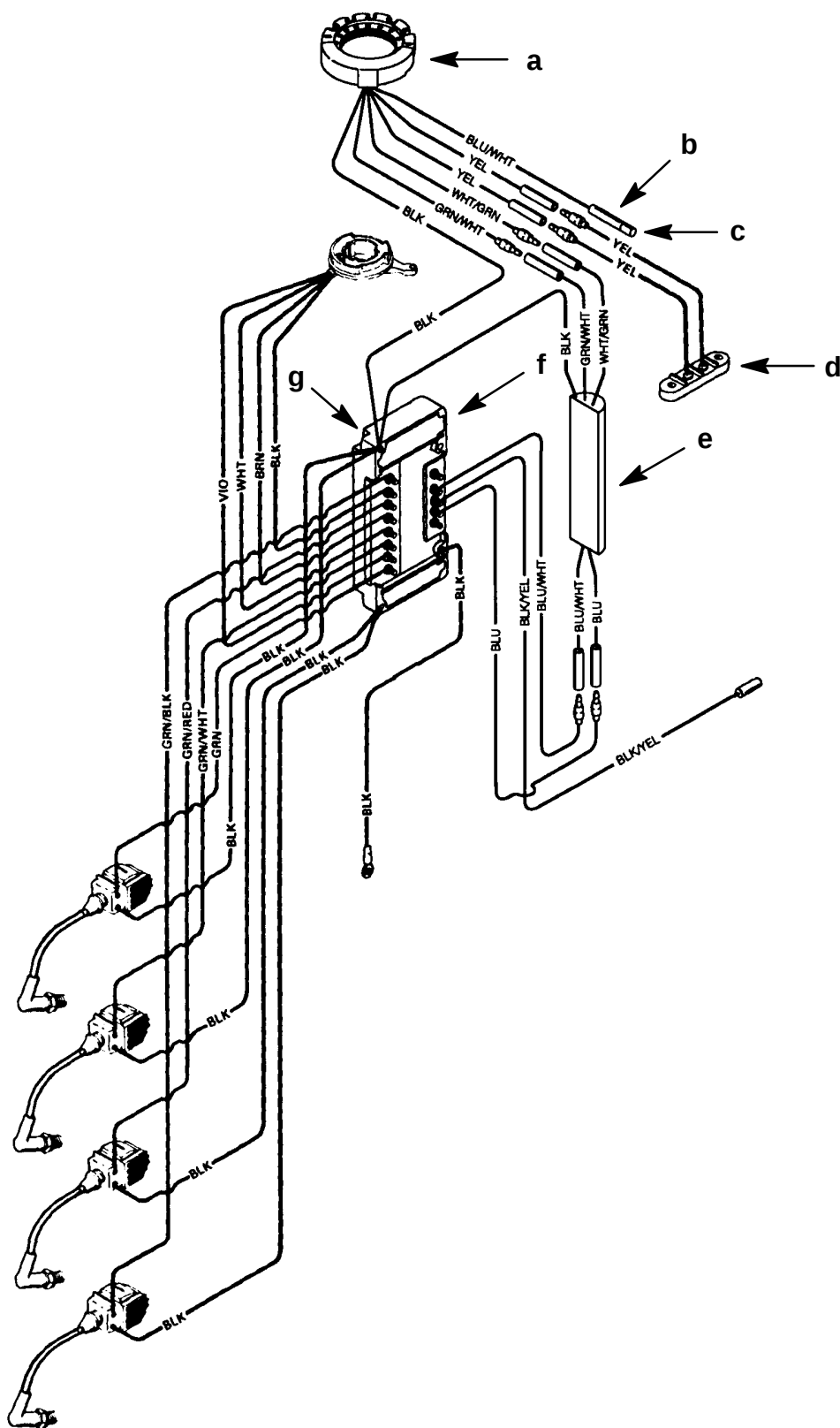


50503



# Wiring Diagram – Model 40 Manual Start with Red Stator

BLK = Black  
BLU = Blue  
BRN = Brown  
GRY = Gray  
GRN = Green  
ORN = Orange  
PNK = Pink  
PUR = Purple  
RED = Red  
Tan = Tan  
WHT = White  
YEL = Yellow  
LIT = Light  
DRK = Dark

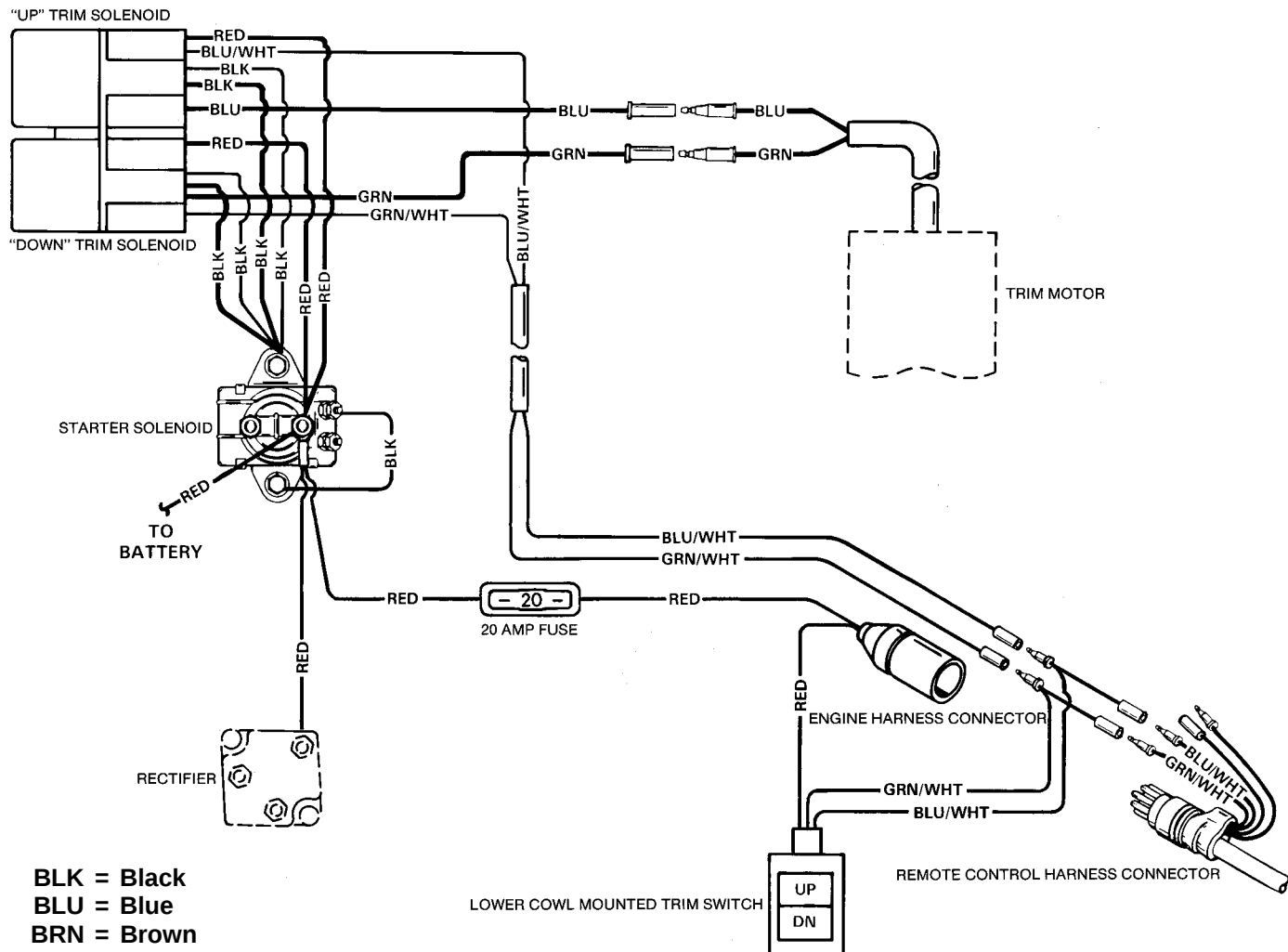


54948

- a - Lighting Coil Stator
- b - BLUE/WHITE Lead – Not Used
- c - Plug
- d - Terminal Block
- e - Stator Adaptor
- f - Switch Box
- g - Ground Connection



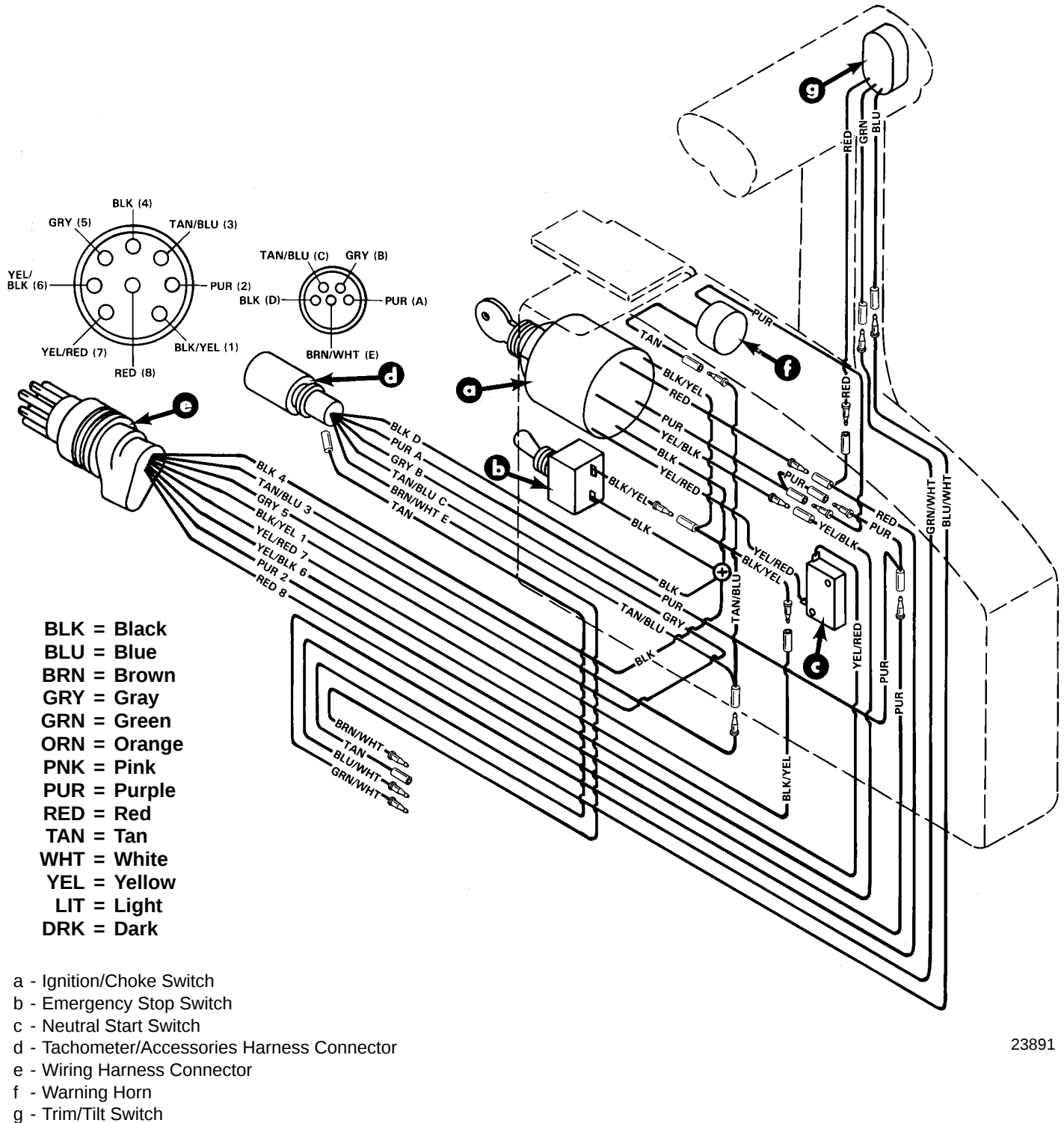
# Power Trim Wiring Diagram



50516



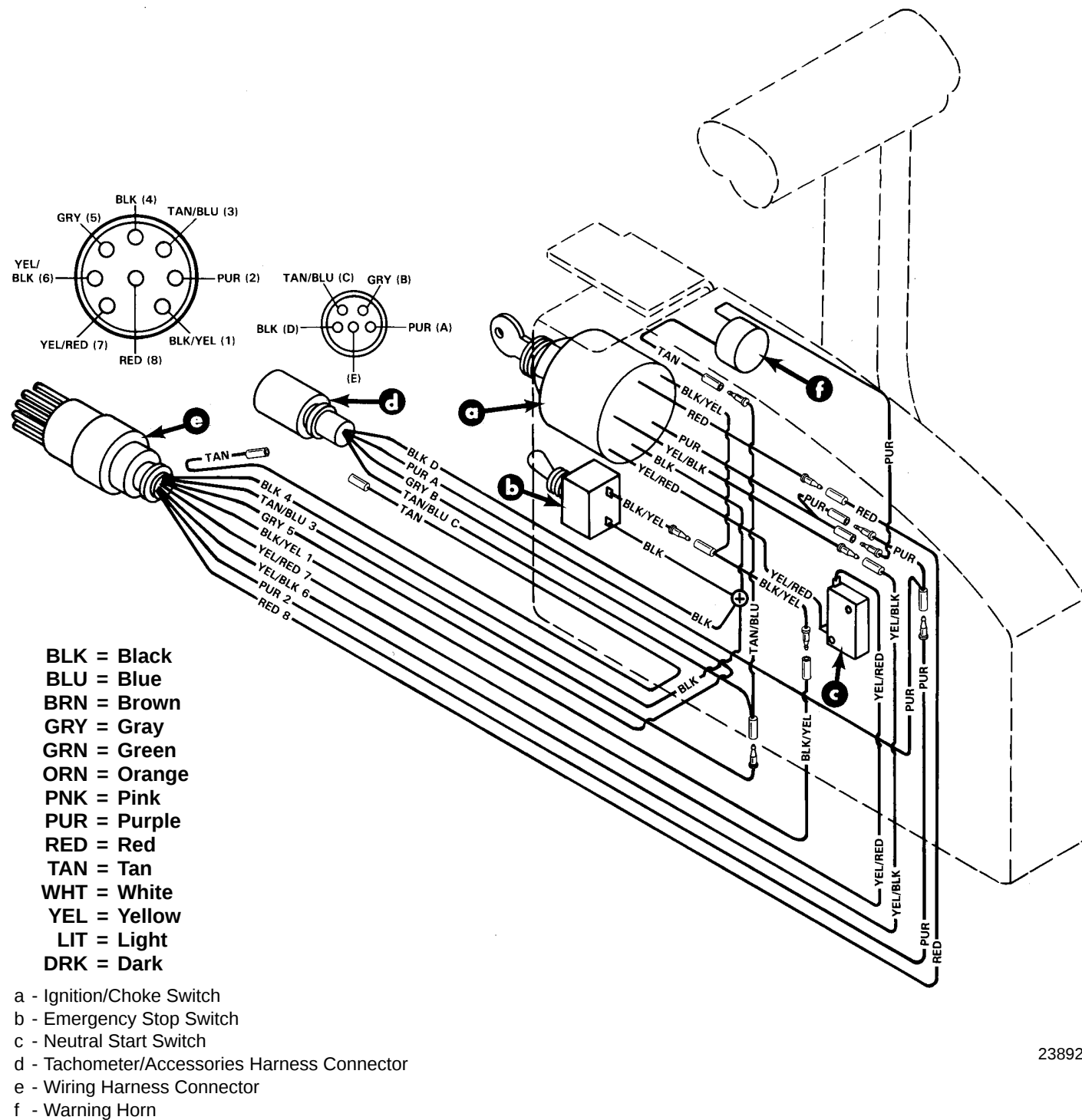
# Commander 2000 Side Mount Remote Control (Power Trim/Tilt Electric Start with Warning Horn) Wiring Diagram



23891



# Commander 2000 Side Mount Remote Control (Electric Start with Warning Horn) Wiring Diagram

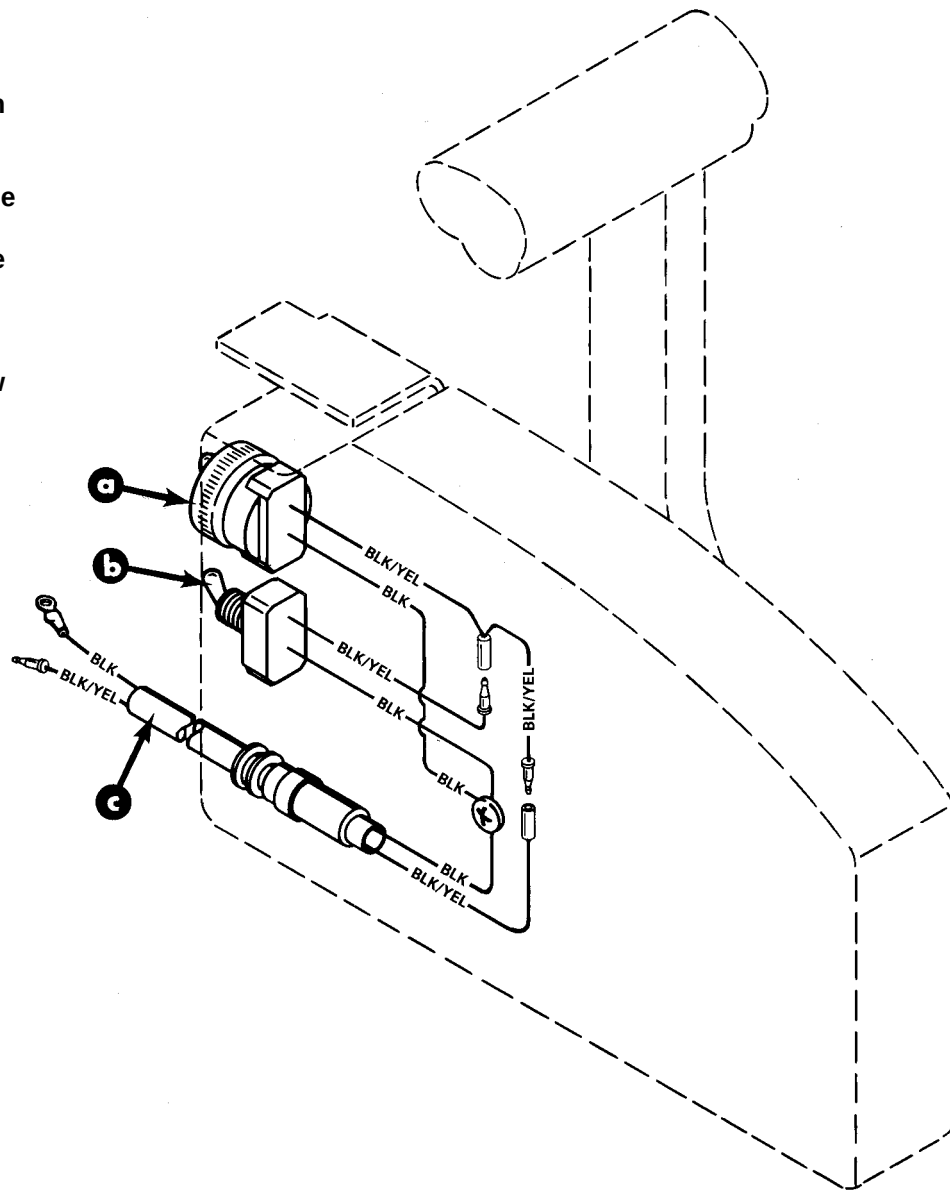


23892



# Commander 2000 Side Mount Remote Control (Manual) Wiring Diagram

BLK = Black  
BLU = Blue  
BRN = Brown  
GRY = Gray  
GRN = Green  
ORN = Orange  
PNK = Pink  
PUR = Purple  
RED = Red  
TAN = Tan  
WHT = White  
YEL = Yellow  
LIT = Light  
DRK = Dark



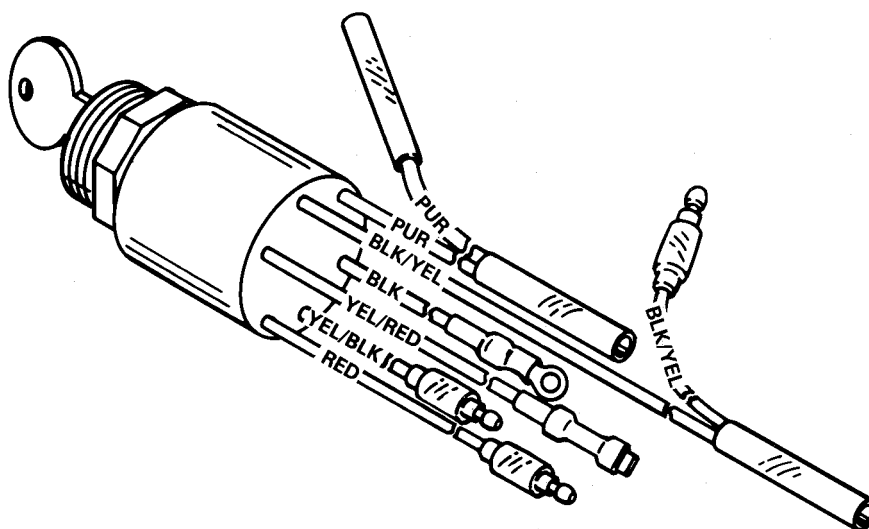
- a - RUN-OFF Switch  
b - Emergency Stop Switch  
c - Stop Switch Harness

23893



## Key/Choke Switch Continuity Test (Commander 2000 Side Mount Remote Control)

BLK = Black  
BLU = Blue  
BRN = Brown  
GRY = Gray  
GRN = Green  
ORN = Orange  
PNK = Pink  
PUR = Purple  
RED = Red  
TAN = Tan  
WHT = White  
YEL = Yellow  
LIT = Light  
DRK = Dark



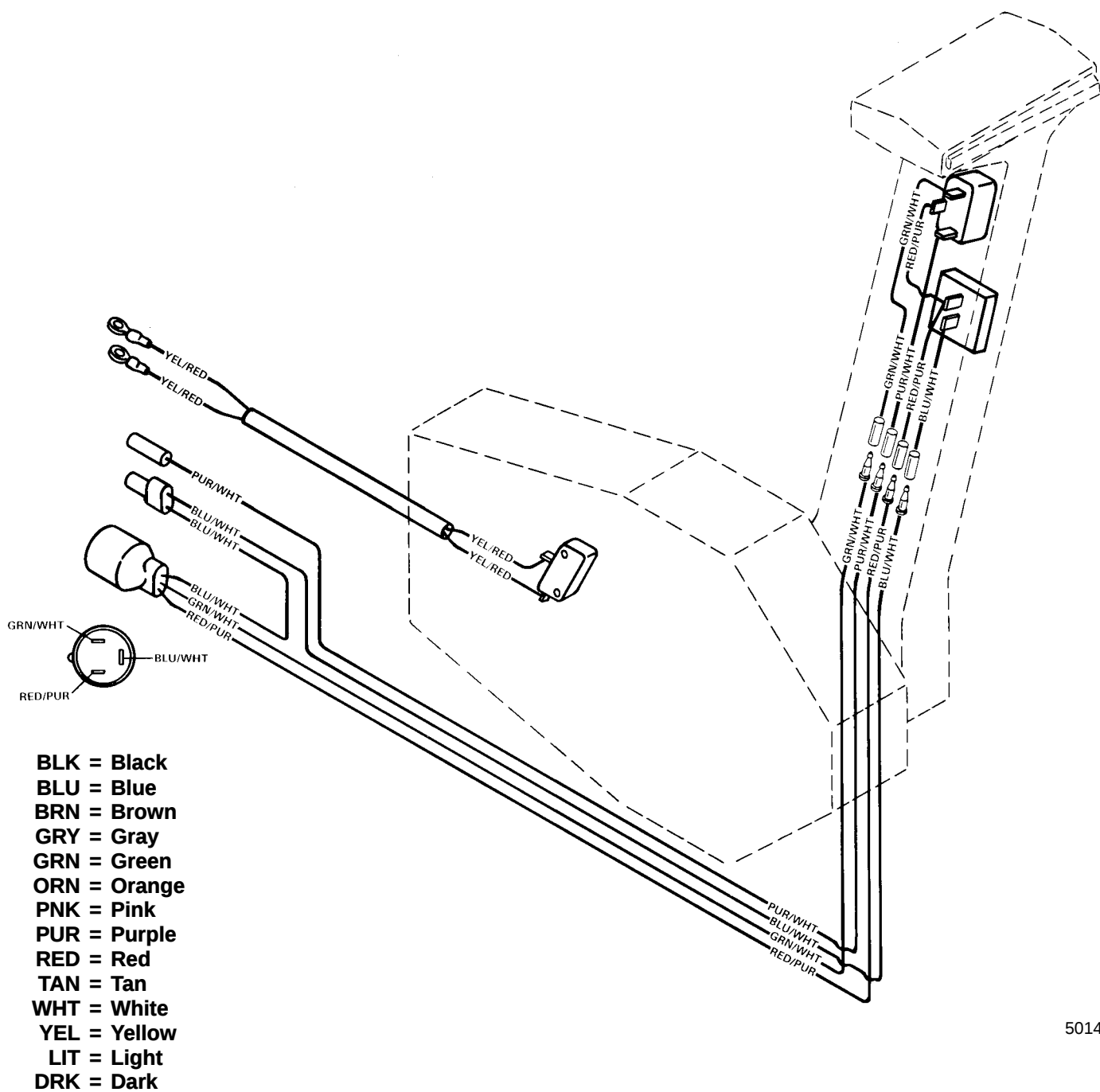
23894

|               |                     |
|---------------|---------------------|
| "OFF"         | BLK/YEL - BLK       |
| "RUN"         | RED - PUR           |
| "START"       | RED - PUR - YEL/RED |
| PUSH (CHOKE)* | RED - YEL/BLK       |

\*Key switch must be positioned to "RUN" or "START" and key pushed in to actuate choke, for this continuity test.



# Panel Mount Remote Control Wiring Diagram

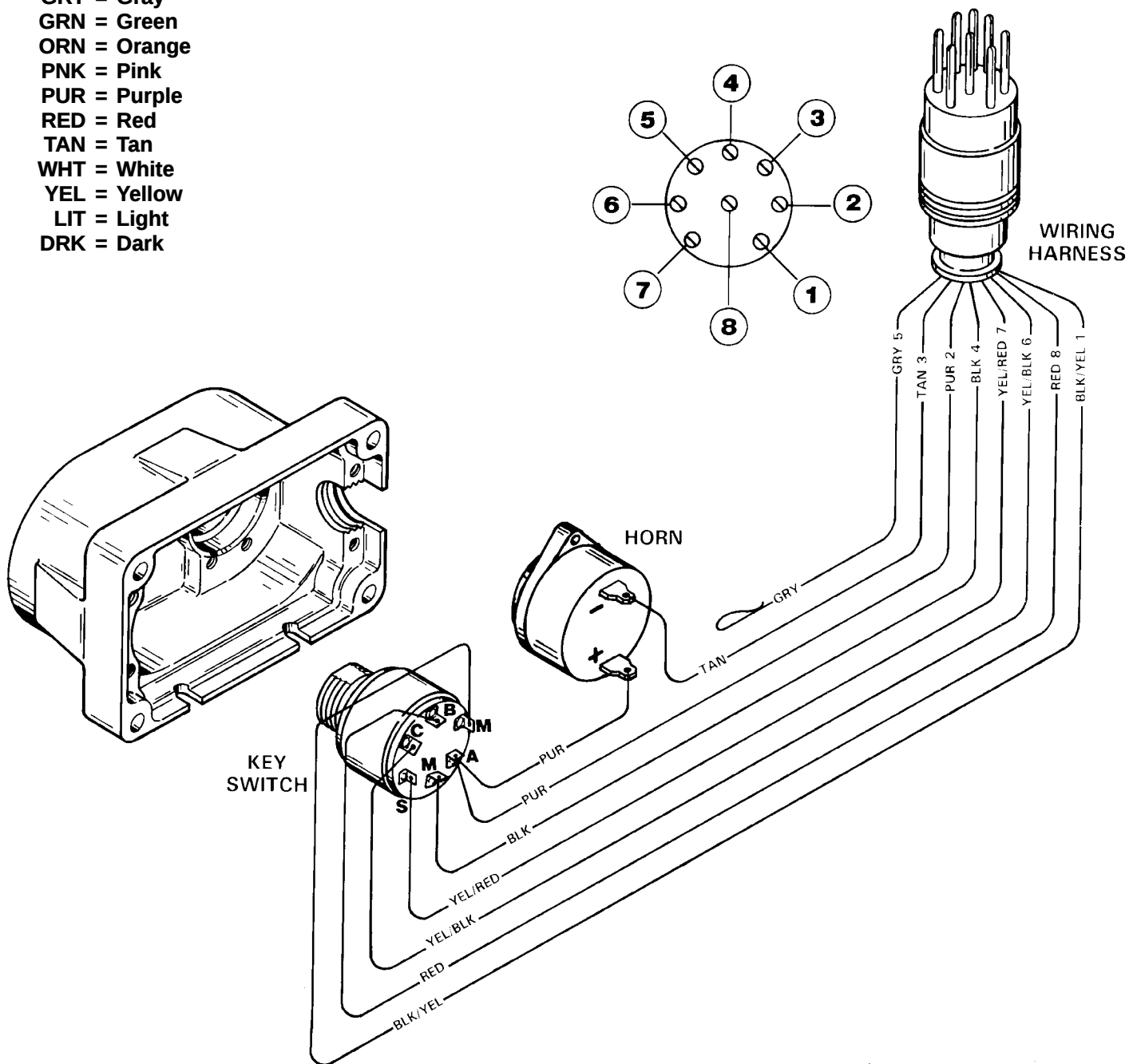


50148



# Remote Key Switch and Warning Horn

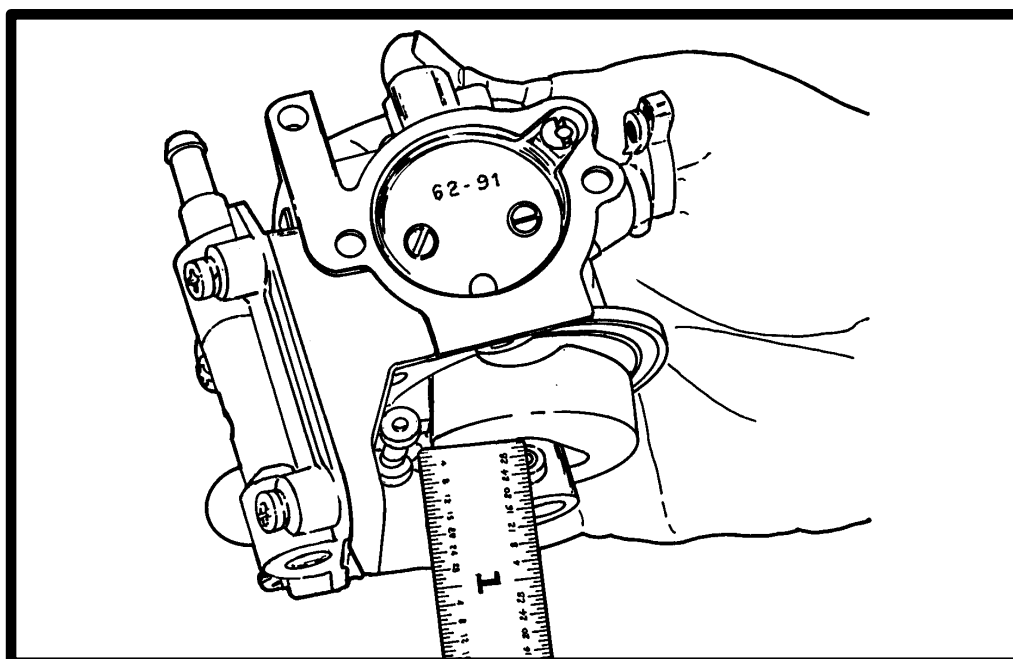
BLK = Black  
BLU = Blue  
BRN = Brown  
GRY = Gray  
GRN = Green  
ORN = Orange  
PNK = Pink  
PUR = Purple  
RED = Red  
TAN = Tan  
WHT = White  
YEL = Yellow  
LIT = Light  
DRK = Dark





# FUEL SYSTEM AND CARBURETION

3





# Table of Contents

|                                                                         | Page |
|-------------------------------------------------------------------------|------|
| Specifications .....                                                    | 3-1  |
| Special Tools .....                                                     | 3-1  |
| Fuel System (Carburetor) .....                                          | 3-2  |
| Fuel System (Fuel Pump) .....                                           | 3-3  |
| Fuel Pump .....                                                         | 3-4  |
| General Information .....                                               | 3-4  |
| Fuel Pump Description/Operation .....                                   | 3-4  |
| Checking for Restricted Fuel Flow<br>Caused by Anti-Siphon Valves ..... | 3-4  |
| Testing .....                                                           | 3-4  |
| Troubleshooting Fuel Pump .....                                         | 3-4  |
| Fuel Pump Removal<br>(Electric Start Model) .....                       | 3-5  |
| Fuel Pump Disassembly .....                                             | 3-6  |
| Fuel Pump Exploded View (Design 1) .....                                | 3-7  |
| Cleaning and Inspection .....                                           | 3-8  |
| Check Valve Reassembly (Design 1) .....                                 | 3-8  |
| Fuel Pump Installation (Design 1) .....                                 | 3-9  |
| Fuel Pump Exploded View (Design 2) .....                                | 3-10 |
| Cleaning and Inspection .....                                           | 3-11 |
| Check Valve Reassembly (Design 2) .....                                 | 3-11 |
| Fuel Pump Installation (Design 2) .....                                 | 3-11 |
| Carburetion System .....                                                | 3-12 |
| Fuel System - Troubleshooting .....                                     | 3-12 |
| Troubleshooting Charts .....                                            | 3-12 |
| Checking for Restricted Fuel Flow<br>Caused by Anti-Siphon Valves ..... | 3-13 |
| Carburetor Adjustments .....                                            | 3-13 |
| Initial Starting Adjustment .....                                       | 3-13 |
| Idle Speed Adjustment .....                                             | 3-13 |
| Idle Mixture Screw Adjustment .....                                     | 3-14 |
| Float Adjustment .....                                                  | 3-14 |
| Float Level and Float Drop<br>Adjustment .....                          | 3-14 |
| Float Level (WMA7B Carburetor) .....                                    | 3-14 |
| Float Drop (WMA7B Carburetor<br>Only) .....                             | 3-15 |
| Float Level (WMA9 Carburetor) .....                                     | 3-15 |
| Float Drop (WMA9 Carburetor<br>Only) .....                              | 3-15 |
| Main (High Speed) Jet Adjustment .....                                  | 3-15 |
| Vent Jet .....                                                          | 3-16 |
| High Altitude Jetting .....                                             | 3-16 |
| Carburetor Jet Orifice Sizes WMA7B .....                                | 3-16 |
| Carburetor Jet Orifice Sizes WMA9 .....                                 | 3-16 |

|                                                       | Page |
|-------------------------------------------------------|------|
| Enrichment System (Electric Start Models) ..          | 3-17 |
| Enrichener Hose Routed to Carburetor<br>Flanges ..... | 3-17 |
| Enrichener Hose Routed to Balance<br>Tube .....       | 3-17 |
| Primer System .....                                   | 3-18 |
| Hose Installation .....                               | 3-18 |
| Enrichener Valve (Manual Operation) .....             | 3-18 |
| Enrichment Valve Test .....                           | 3-19 |
| Enrichener Valve Replacement .....                    | 3-19 |
| Fuel Line and Primer Bulb Assembly .....              | 3-20 |
| Maintenance .....                                     | 3-20 |
| Fuel Line Clamp Removal and<br>Installation .....     | 3-20 |
| Carburetor Removal (Manual Start<br>Model) .....      | 3-21 |
| Carburetor Disassembly (Top Carburetor) ...           | 3-21 |
| Cleaning and Inspection .....                         | 3-25 |
| Carburetor Reassembly .....                           | 3-26 |
| Carburetor Installation .....                         | 3-30 |



## Specifications

|                                                    |                                                                                           |
|----------------------------------------------------|-------------------------------------------------------------------------------------------|
| Idle RPM (In Forward Gear)                         | 500-600                                                                                   |
| Float Level<br>Carb Model WMA7B<br>Carb Model WMA9 | 1/4 in $\pm$ 1/64 in. (6.4mm $\pm$ 0.4mm)<br>11/16 in $\pm$ 1/64 in. (16.3mm $\pm$ 0.4mm) |
| Float Drop<br>Carb Model WMA7B<br>Carb Model WMA9  | 1/32 in. to 1/16 in. (0.80mm to 1.6mm)<br>No Adjustment                                   |

## Special Tools

| Description      | Part No. |
|------------------|----------|
| Carburetor Scale | 91-36392 |



# Fuel System (Carburetor)

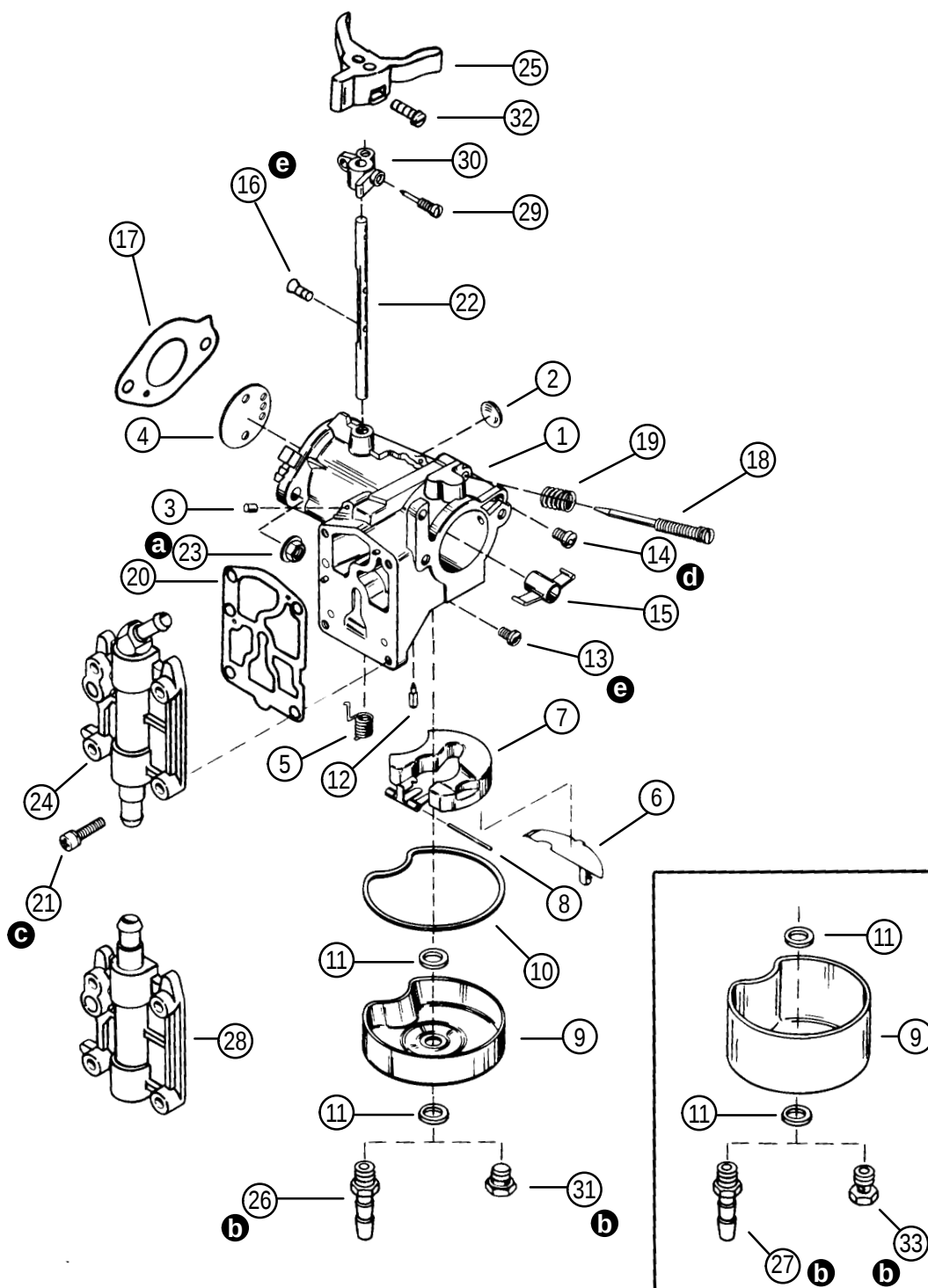
- 1 - Carburetor Body
- 2 - Welch Plug
- 3 - Plug
- 4 - Throttle Shutter
- 5 - Spring
- 6 - Baffle
- 7 - Float
- 8 - Pivot Pin
- 9 - Fuel Bowl
- 10 - Gasket
- 11 - Gasket
- 12 - Needle
- 13 - Main Jet
- 14 - Vent Jet
- 15 - Venturi
- 16 - Screw (2)
- 17 - Gasket
- 18 - Idle Mixture Screw
- 19 - Spring
- 20 - Gasket
- 21 - Screw (4)
- 22 - Throttle Shaft
- 23 - Nut (2)

## Upper Carburetor

- 24 - Cover Plate
- 25 - Throttle Lever
- 26 - Fitting
- 27 - Main Jet - WMA9

## Carburetor

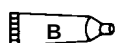
- 28 - Cover Plate
- 29 - Screw
- 30 - Throttle Lever
- 31 - Screw
- 32 - Screw
- 33 - Main Jet - WMA9



## Torque Specifications

- a** 110 lb. in. (12.1 N·m)
- b** 33 lb. in. (3.7 N·m)
- c** 18 lb. in. (2.0 N·m)
- d** 14 lb. in. (1.6 N·m)
- e** 6 lb. in. (.07 N·m)

## Quicksilver Lubrication/Sealant Application Points



Loctite 271 (92-32609-1)



- 
- This diagram illustrates the assembly of a fuel pump system. The main assembly is shown in an exploded view, with parts numbered 1 through 37. Key components include the electric black fuel pump body (1), various gaskets and seals (2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18), and connecting hoses (19, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37). The diagram is divided into sections by dashed lines, indicating the flow of fuel from the pump to the carburetor and then to the fuel pump and oil pump. The 'To Fuel Connector' section shows the pump body (1) connected to the fuel pump (35) and the oil pump (36). The 'To Fuel Pump' section shows the pump body (1) connected to the fuel pump (35). The 'To Oil Pump' section shows the pump body (1) connected to the oil pump (36). The 'To Carburetor' section shows the pump body (1) connected to the carburetor (37). The 'Electric Black Fuel Pump Body' section shows the pump body (1) connected to the electric black fuel pump body (1).

## Torque Specifications

**a** 40 lb. in. (4.5 N·m)



# Fuel Pump

## General Information

### FUEL PUMP DESCRIPTION/OPERATION

The fuel pump is a crankcase-pressure-operated, diaphragm-type pump. Crankcase pulsating pressure (created by the up-and-down movement of piston) is transferred to fuel pump by way of a passage (hole) between crankcase and fuel pump.

When piston is in an upward motion, a vacuum is created in the crankcase, thus pulling in a fuel/air mixture (from carburetor) into crankcase. This vacuum also pulls in on the fuel pump diaphragm, thus the inlet check valve (in fuel pump) is opened and fuel (from fuel tank) is drawn into fuel pump.

Downward motion of the piston forces the fuel/air mixture out of the crankcase into the cylinder. This motion also forces out on the fuel pump diaphragm, which, in turn, closes the inlet check valve (to keep fuel from returning to fuel tank) and opens the outlet check valve, thus forcing fuel to the carburetors.

### CHECKING FOR RESTRICTED FUEL FLOW CAUSED BY ANTI-SIPHON VALVES

While anti-siphon valves may be helpful from a safety stand-point, they clog with debris, they may be too small, or they may have too heavy a spring. The pressure drop across these valves can create operational problems and/or powerhead damage by restricting fuel to the fuel pump and carburetor(s). Some symptoms of restricted (lean) fuel flow, which could be caused by use of an anti-siphon valve are:

1. Loss of fuel pump pressure
2. Loss of power
3. High speed surging
4. Preignition/detonation (piston dome erosion)
5. Outboard cuts out or hesitates upon acceleration
6. Outboard runs rough
7. Outboard quits and cannot be restarted
8. Outboard will not start
9. Vapor lock

Since any type of anti-siphon device must be located between the outboard fuel inlet and fuel tank outlet, a simple method of checking [if such a device (or bad fuel) is a problem source] is to operate the outboard with a separate fuel supply which is known to be good, such as a remote fuel tank.

If, after using a separate fuel supply, it is found that the anti-siphon valve is the cause of the problem, there are 2 solutions to the problem; either 1) remove the anti-siphon valve or 2) replace it with a solenoid-operated fuel shutoff valve.

## Testing

Install clear fuel hose(s) between fuel pump and carburetor(s). Run engine, and inspect fuel passing thru hose(s) for air bubbles. If bubbles are found, see "Air Bubbles in Fuel Line," below. If bubbles are NOT found, see "Lack of Fuel Pump Pressure."

## Troubleshooting Fuel Pump

| Problem: Air Bubbles in Fuel Line |                                                                   |
|-----------------------------------|-------------------------------------------------------------------|
| Possible Cause                    | Corrective Action                                                 |
| Low Fuel in Tank                  | Fill Tank with Fuel                                               |
| Loose Fuel Line Connection        | Check and Tighten All Connections                                 |
| A Hole or Cut in Fuel Line        | Check Condition of all Fuel Lines and Replace any Found to be Bad |
| Fuel Pump Anchor Screw(s) Loose   | Tighten all Screws Evenly and Securely                            |
| Fuel Pump Gasket(s) Worn Out      | Rebuild Fuel Pump                                                 |

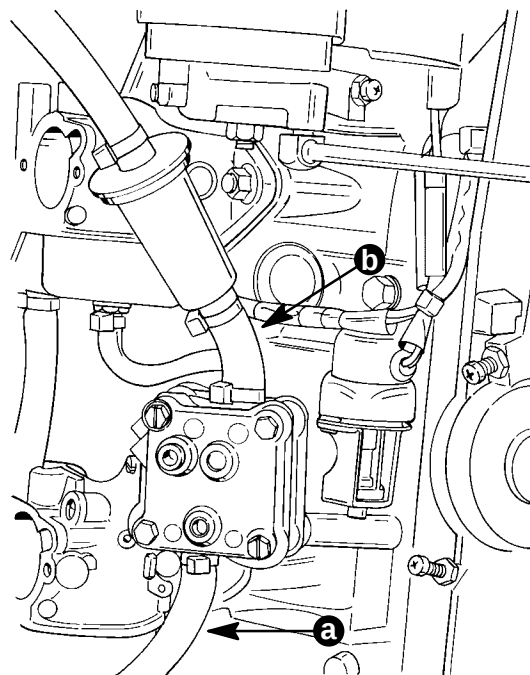


### Problem: Lack of Fuel Pump Pressure

| Possible Cause                                        | Corrective Action                                                                                                                                                    |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| An Anti-siphon Valve                                  | Read "Checking for restricted Fuel Flow Caused by Anti-siphon Valves" Preceding                                                                                      |
| Air in Fuel Line                                      | "Air Bubbles in Fuel Line" Preceding                                                                                                                                 |
| A Dirty or Clogged Fuel Filter                        | Replace Fuel Filter                                                                                                                                                  |
| The Fuel Pickup in Fuel Tank Clogged or Dirty         | Clean or Replace Pickup                                                                                                                                              |
| Worn Out Fuel Pump Diaphragm                          | Rebuild Fuel Pump                                                                                                                                                    |
| Defective (Hole or Crack) Check Valve(s) in Fuel Pump | Rebuild Fuel Pump                                                                                                                                                    |
| Broken Check Valve Retainer                           | Rebuild Fuel Pump                                                                                                                                                    |
| Pulse Hole Plugged                                    | Remove Fuel Pump and Clean Out Hole                                                                                                                                  |
| Loose Pulse Hose                                      | Tighten Connection                                                                                                                                                   |
| Boost Diaphragm Gasket Distorted or Out of Place      | Check Seal Between Mating Surfaces Where "Rib" Divides Pulse Chamber - Gasket Must Align with Rib; Check for Distorted Gasket, Align or Replace Gasket if Necessary. |

## Fuel Pump Removal (Electric Start Model)

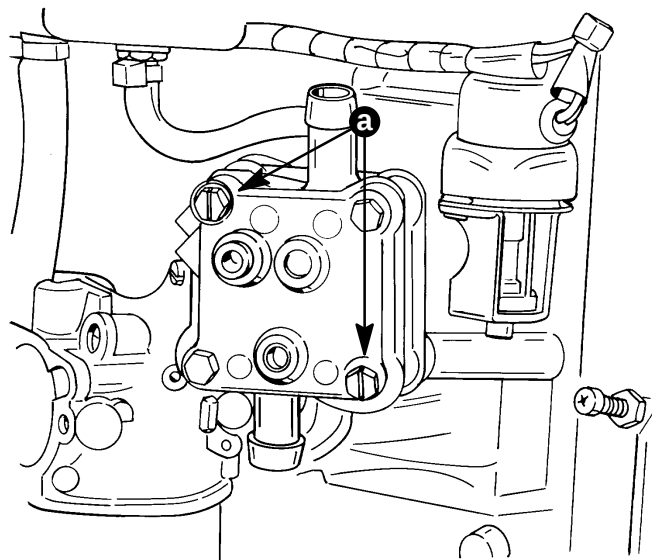
1. Remove oil tank from outboard. Refer to Section 8 "Oil Injection System".
2. Remove fuel "inlet" hose and "outlet" hose.



52014

- a - Inlet Hose  
b - Outlet Hose

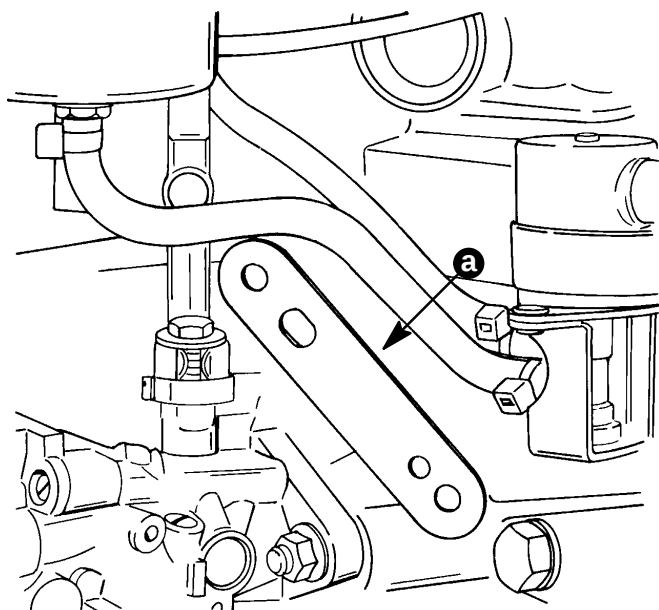
3. Remove 2 screws securing fuel pump to power-head.



52025



4. Remove gasket from powerhead.

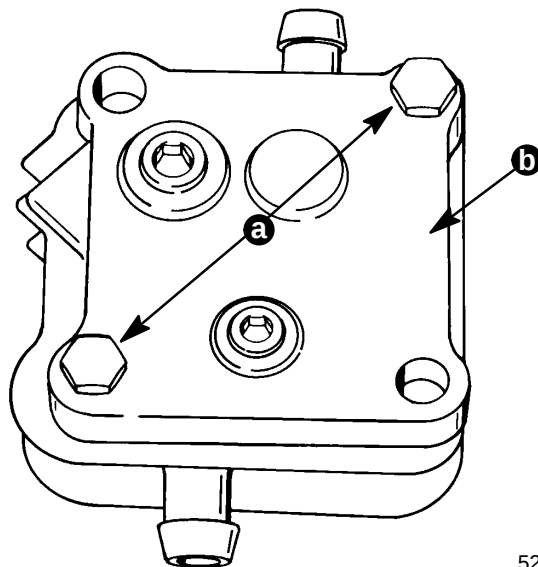


52019

a - Gasket

## Fuel Pump Disassembly

1. Remove bolts and chamber plate.



52019

a - Bolts

b - Chamber Plate

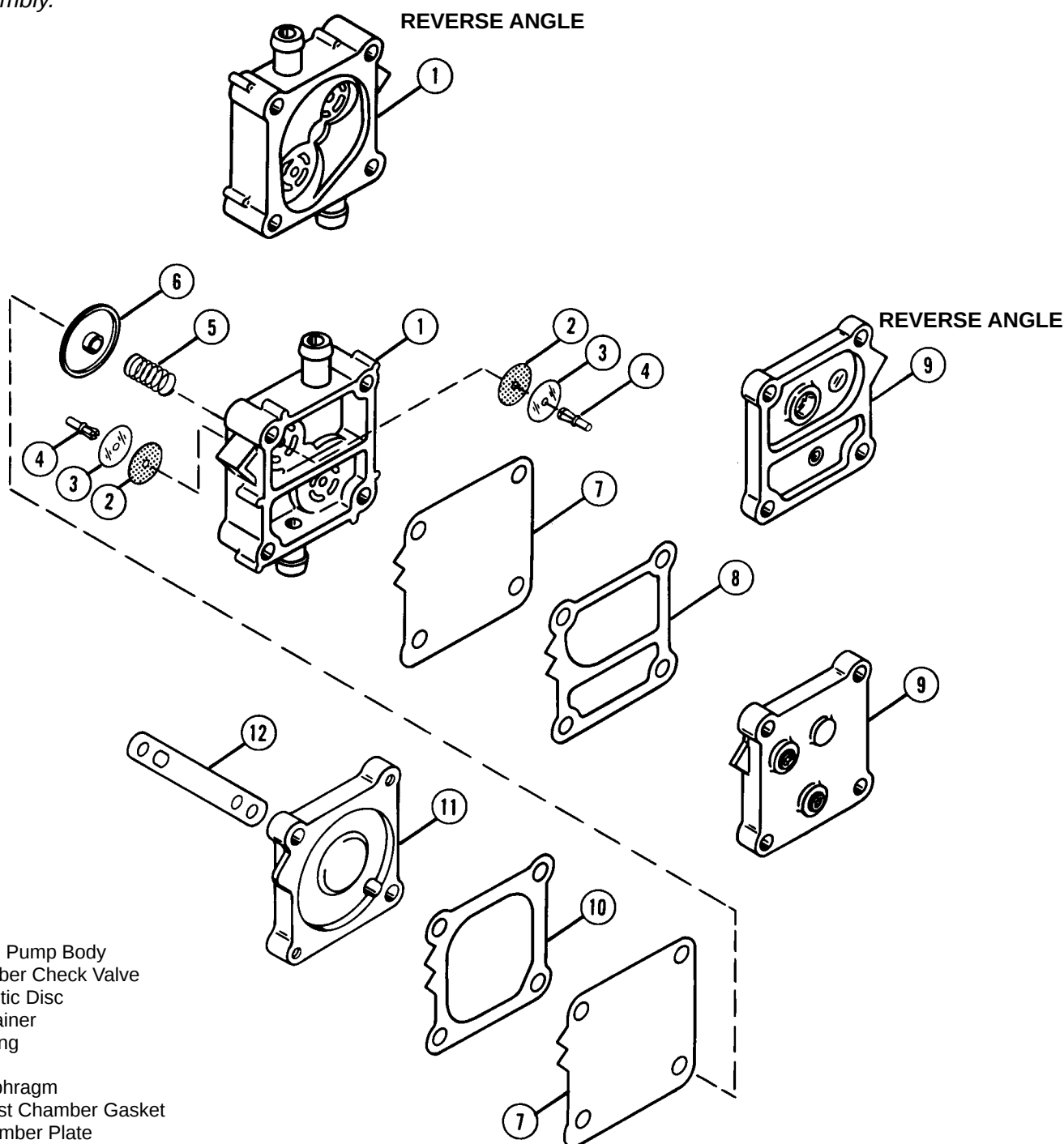
2. Disassemble fuel pump as shown in “**Fuel Pump Exploded View**”.



# Fuel Pump Exploded View (Design 1)

**IMPORTANT:** Align all gasket and diaphragm aligning tabs with fuel pump aligning tabs during reassembly.

**NOTE:** Respective diaphragms go against the mating surfaces of the fuel pump body and respective gaskets are between the diaphragms and end caps. Gaskets should always be replaced on fuel pump reassembly.



50569

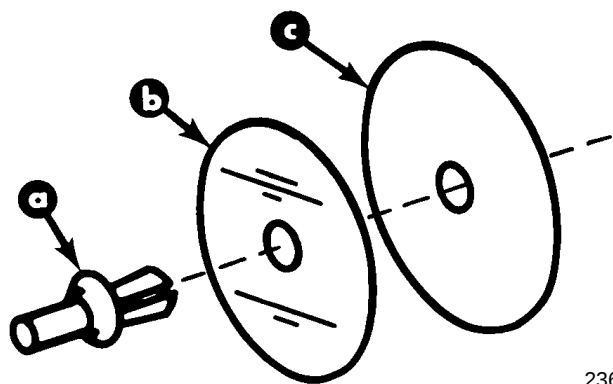


## Cleaning and Inspection

1. Clean fuel pump housing, chamber plate and pump base, then dry with compressed air.
2. Inspect spring coils for damage.
3. Inspect pump body, chamber plate and pump base for cracks or rough gasket surfaces.
4. Inspect hoses for looseness or signs of leakage.
5. Inspect check valve discs for cracks, tears or other damage.

## Check Valve Reassembly (Design 1)

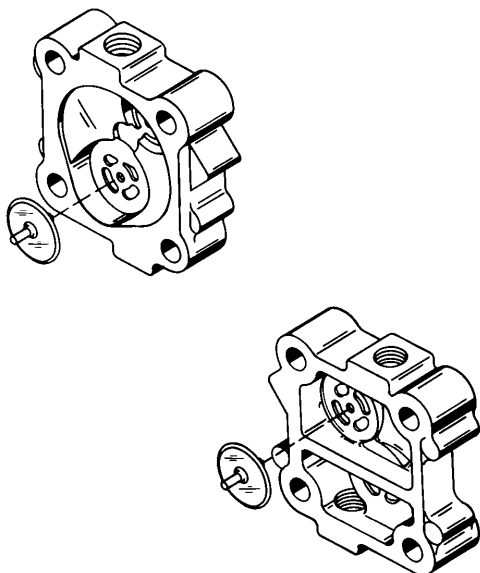
1. Insert retainer thru plastic disc and rubber check valve.



23601

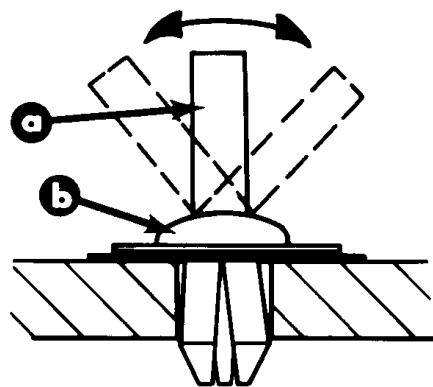
- a - Retainer  
b - Plastic Disc  
c - Rubber Check Valve

2. Install check valves and retainers into fuel pump body.



23601

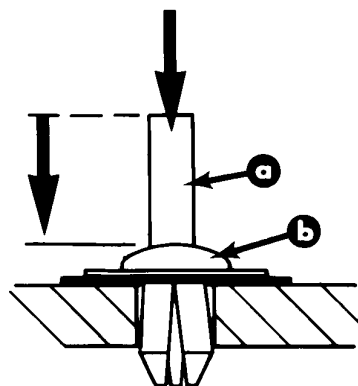
3. With retainer installed in pump body, break retainer rod from retainer by bending sideways.



23601

- a - Retainer Rod  
b - Retainer

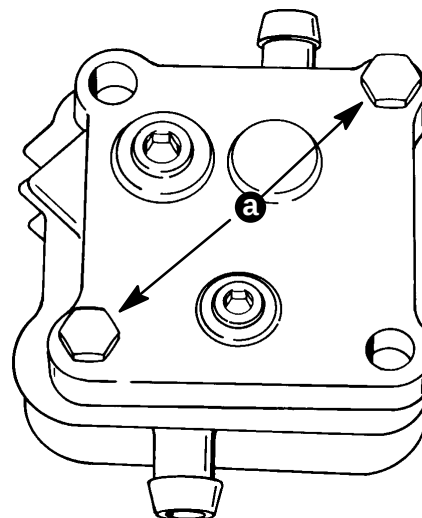
4. Reinstall rod into retainer cap and use a hammer and punch to tap rod down into retainer until flush with top of retainer.



23601

- a - Rod  
b - Retainer Cap

5. Assemble remaining components as shown in "Fuel Pump Exploded View" preceding.
6. Install bolts and torque to 60 lb. in. (6.8 N-m).



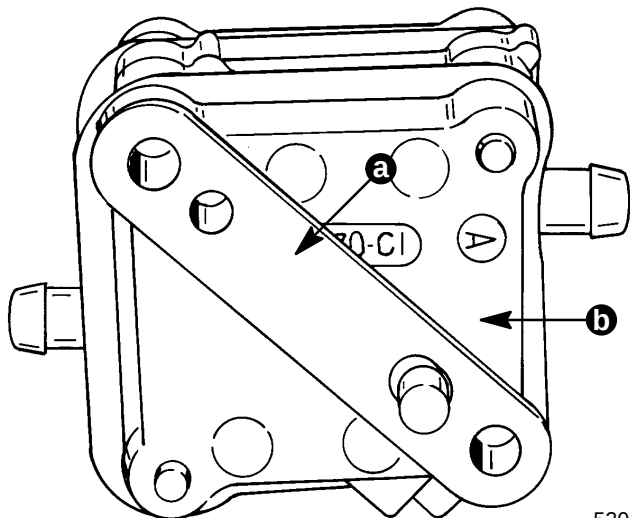
52019

- a - Bolts [Torque to 60 lb. in. (6.8 N-m)]



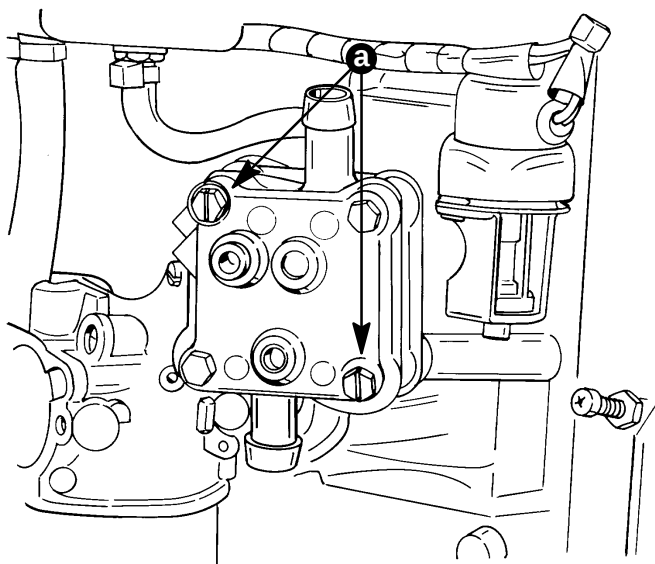
## Fuel Pump Installation (Design 1)

1. Install gasket on fuel pump base.



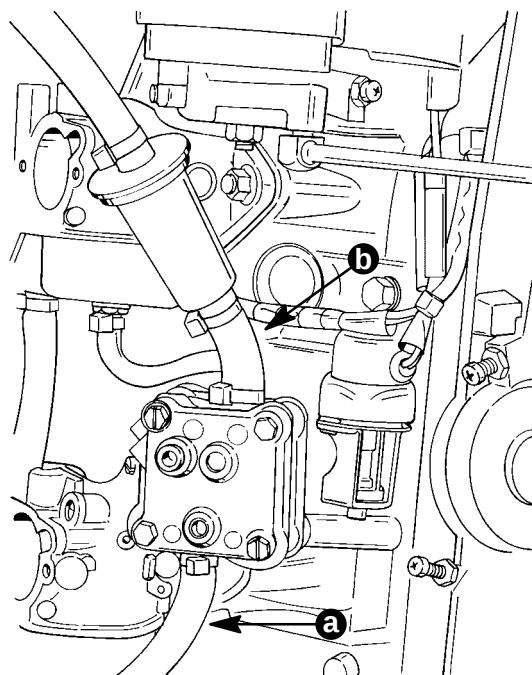
a - Gasket  
b - Base

2. Install pump and secure with screws. Torque screws to 60 lb. in. (6.8 N·m).



a - Screws [Torque to 60 lb. in. (6.8 N·m)]

3. Connect hoses as shown. Secure hoses with straps.



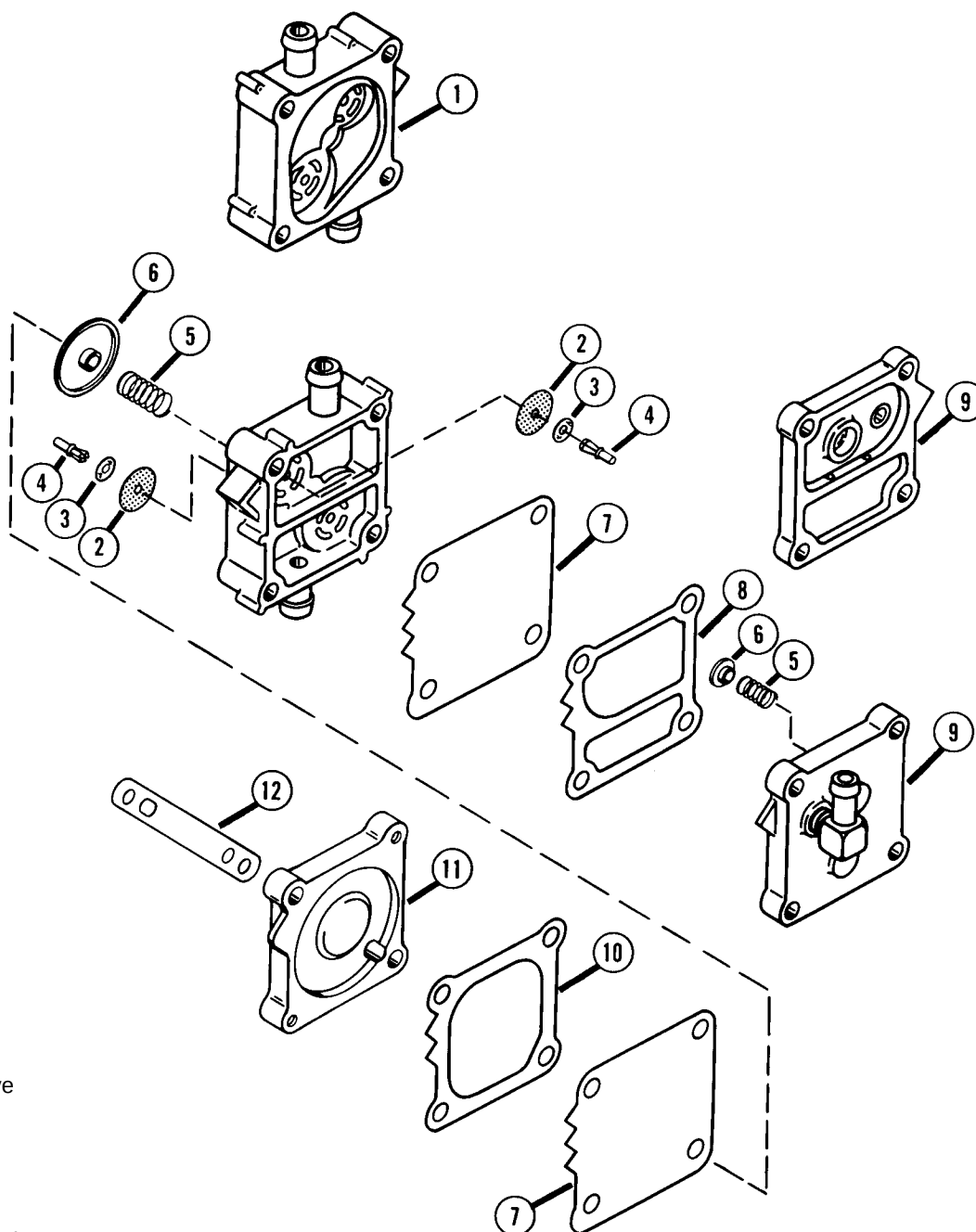
a - Inlet Hose  
b - Outlet Hose



## Fuel Pump Exploded View (Design 2)

**IMPORTANT:** Align all gasket and diaphragm aligning tabs with fuel pump aligning tabs during reassembly.

**NOTE:** Respective diaphragms go against the mating surfaces of the fuel pump body and respective gaskets are between the diaphragms and end caps. Gaskets should always be replaced on fuel pump reassembly.



- 1 - Fuel Pump Body
- 2 - Rubber Check Valve
- 3 - Plastic Disc
- 4 - Retainer
- 5 - Spring
- 6 - Cap
- 7 - Diaphragm
- 8 - Boost Chamber Gasket
- 9 - Chamber Plate
- 10 - Pulse Chamber Gasket
- 11 - Fuel Pump Base
- 12 - Base Gasket

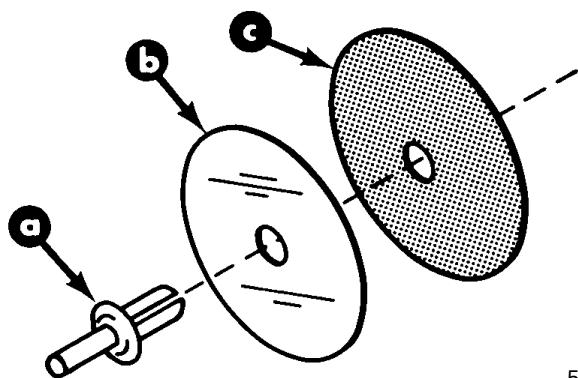


## Cleaning and Inspection

1. Clean fuel pump housing, chamber plate and pump base, then dry with compressed air.
2. Inspect spring coils for damage.
3. Inspect pump body, chamber plate and pump base for cracks or rough gasket surfaces.
4. Inspect hoses for looseness or signs of leakage.
5. Inspect check valve discs for cracks, tears or other damage.

## Check Valve Reassembly (Design 2)

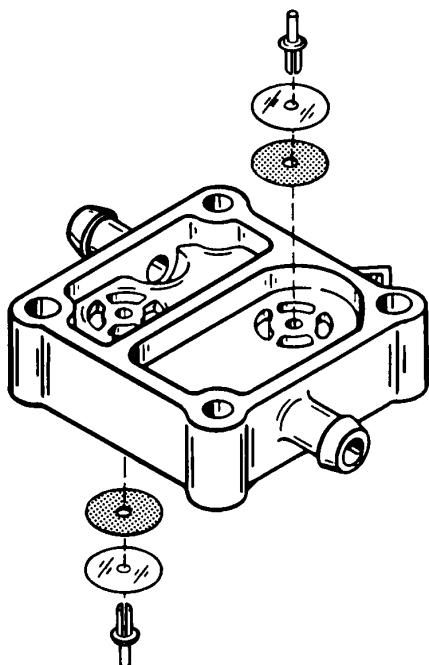
1. Insert retainer thru plastic disc and rubber check valve.



- a - Retainer  
b - Plastic Disc  
c - Check Valve

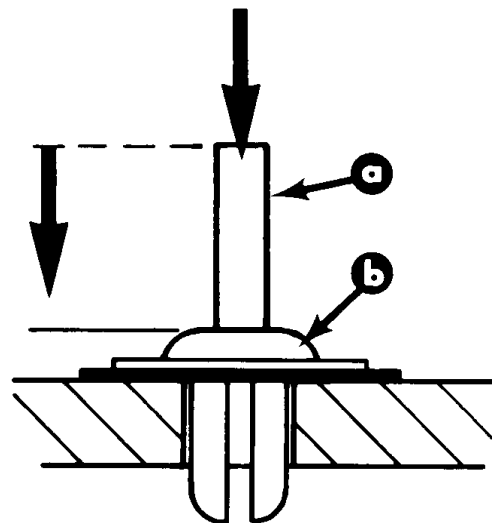
51530

2. Install check valves and retainers into fuel pump body.



51530

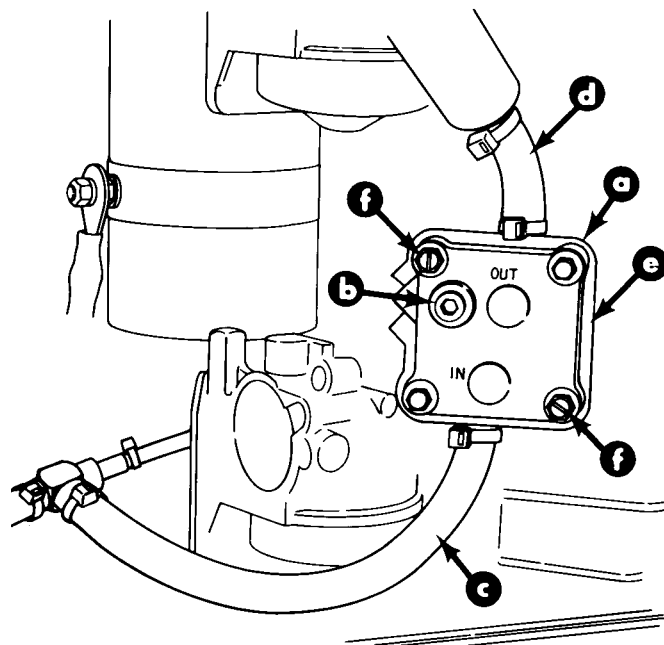
3. Break rod from retainer cap and reinstall rod into cap. Using a hammer and punch, tap rod down into retainer until flush with top of retainer.



- a - Rod  
b - Retainer Cap

51530

## Fuel Pump Installation (Design 2)



- a - Fuel Pump  
b - Plug [Apply PERFECT SEAL (92-34227--1) to threads]  
c - Inlet Hose  
d - Outlet Hose  
e - Gasket (Cylinder Block to Fuel Pump) (HIDDEN)  
f - Screws [Torque to 55 lb. in. (6.2 N·m)]

51518



# Carburetion System

## Fuel System - Troubleshooting

Problems, which sometimes are thought to be caused by the fuel system, may be something completely different. Troubles, that are caused by items 1-thru-5, listed below, also may give the impression that a problem exists in the fuel system.

1. Spark Plugs
2. Ignition Spark Voltage
3. Cylinder Compression
4. Reed Valves
5. Ignition Timing

## Troubleshooting Charts

| Problem: Engine Turns Over But Will Not Start or Starts Hard When Cold                                                                                                                   |                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Possible Cause                                                                                                                                                                           | Corrective Action                                                                     |
| Improper starting procedure.                                                                                                                                                             | Check procedure, as outlined in "Operation and Maintenance Manual".                   |
| Fuel tank empty; improperly mixed fuel; contaminants (water, dirt, etc.) in fuel.                                                                                                        | Check fuel in fuel tank and replace or add.                                           |
| Fuel tank air vent closed or restricted.                                                                                                                                                 | Air vent must be open and free from contaminants.                                     |
| A pinched or restricted fuel line.                                                                                                                                                       | Check, and replace as needed.                                                         |
| Dirty or restricted fuel filter.                                                                                                                                                         | Check, replace or clean.                                                              |
| Enrichener Valve not operating.                                                                                                                                                          | Check enrichener system. (Refer to "Enrichener System" following.)                    |
| An inlet needle (in carburetor) that is stuck open or closed. (A needle stuck open, will cause a flooding condition. A needle stuck closed, will prevent fuel from entering carburetor.) | Remove, clean or replace.                                                             |
| Anti-siphon valve restricting fuel flow.                                                                                                                                                 | Refer to "Checking for restricted Fuel Flow caused by Anti-siphon Valves", following. |

See "Checking for restricted Fuel Flow caused by Anti-Siphon Valves," page 3A-4.

| Problem: Engine Floods                                              |                                              |
|---------------------------------------------------------------------|----------------------------------------------|
| Possible Cause                                                      | Corrective Action                            |
| Dirt or foreign particles are preventing inlet needle from seating. | Flush out inlet seat and clean inlet needle. |
| Worn inlet needle.                                                  | Replace.                                     |
| Punctured float.                                                    | Replace.                                     |
| Incorrect float setting.                                            | Reset float.                                 |

| Problem: Engine Runs Too Lean                             |                                                                                                                      |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Possible Cause                                            | Corrective Action                                                                                                    |
| Carburetor is loose. Air leaks past mixing chamber cover. | Tighten bolts securely. Tighten cover or replace gasket.                                                             |
| Fuel level too low.                                       | Reset float level.                                                                                                   |
| Clogged high speed jet.                                   | Check and clean.                                                                                                     |
| Restricted fuel flow to carburetor.                       | Check fuel lines and filter(s) for restricted flow.                                                                  |
| Incorrect high speed jet.                                 | refer to main jet chart and replace with proper jet.                                                                 |
| Idle mixture set too lean.                                | Adjust to run richer.                                                                                                |
| Air leakage into fuel system.                             | Check fuel line connections, hose clamps, fuel pump, and fuel outlet tube (located in fuel tank) for loose fittings. |
| Anti-siphon valve restricting fuel flow.                  | Refer to "Checking for restricted fuel flow caused by Anti-siphon".                                                  |

| Problem: Engine Runs Too Rich  |                                                       |
|--------------------------------|-------------------------------------------------------|
| Possible Cause                 | Corrective Action                                     |
| Fuel level too high.           | Reset float to correct level.                         |
| Carburetor floods.             | See preceding "Engine Floods".                        |
| Idle nozzle air holes plugged. | Blow out with compressed air.                         |
| Restricted air flow.           | Check cowl air inlet and carburetor for obstructions. |
| Main fuel jet loose.           | Retighten jet.                                        |

**Problem 1: Engine Idles Rough and Stalls****Problem 2: Engine Runs Uneven or Surges****Problem 3: Engine Will Not Accelerate**

| Possible Cause                                                                                                                                                                                                   | Corrective Action                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Fuel tank air vent closed or restricted.                                                                                                                                                                         | Check - Air vent must be open all-the-way and free from restrictions.                    |
| A pinched, cut or re-restricted fuel line; also loose fuel line connection.                                                                                                                                      | Check all fuel lines and replace as needed. Check and tighten all fuel line connections. |
| A dirty or restricted fuel filter.                                                                                                                                                                               | Check, replace, or clean all fuel filters.                                               |
| Restricted filter in fuel tank.                                                                                                                                                                                  | Clean by rinsing in clean lead-free gasoline or kerosene.                                |
| Improperly mixed fuel; contaminants (water, dirt, etc.) in fuel.                                                                                                                                                 | Check fuel and replace, if necessary.                                                    |
| An inlet needle (in carburetor) that is either stuck open or closed. (A needle, that is stuck open, will cause a flooding condition. A needle that is stuck closed, will prevent fuel from entering carburetor). | remove and replace with new inlet needle.                                                |
| Incorrect idle mixture adjustment.                                                                                                                                                                               | Readjust.                                                                                |
| Damaged fuel pump diaphragm.                                                                                                                                                                                     | Replace.                                                                                 |
| Carburetor is loose.                                                                                                                                                                                             | Tighten bolts securely.                                                                  |
| Chamber cover leaking air.                                                                                                                                                                                       | Tighten or replace gasket.                                                               |
| Off idle holes plugged.                                                                                                                                                                                          | Blow out with compressed air.                                                            |
| Main nozzle or idle nozzle air bleed holes plugged.                                                                                                                                                              | Blow out with compressed air.                                                            |
| Improper main jet or restricted jet.                                                                                                                                                                             | Clean or replace with proper jet (refer to "Main Jet Chart").                            |
| Damaged reed(s).                                                                                                                                                                                                 | Inspect reeds as outlined in Section 4A.                                                 |
| A crack in the fuel pickup outlet tube (located in fuel tank).                                                                                                                                                   | Replace.                                                                                 |

**Problem: Fuel Blow-Back Out of Carburetor**

| Possible Cause                     | Corrective Action |
|------------------------------------|-------------------|
| Chipped/broken (reed block) reeds. | Replace reeds.    |

**Problem: Rough Idle**

| Possible Cause                                                  | Corrective Action |
|-----------------------------------------------------------------|-------------------|
| If related to reed-block, indicates excessive preload in reeds. | Replace reeds.    |

**Problem: Can't Reduce Engine RPM to Slow Idle**

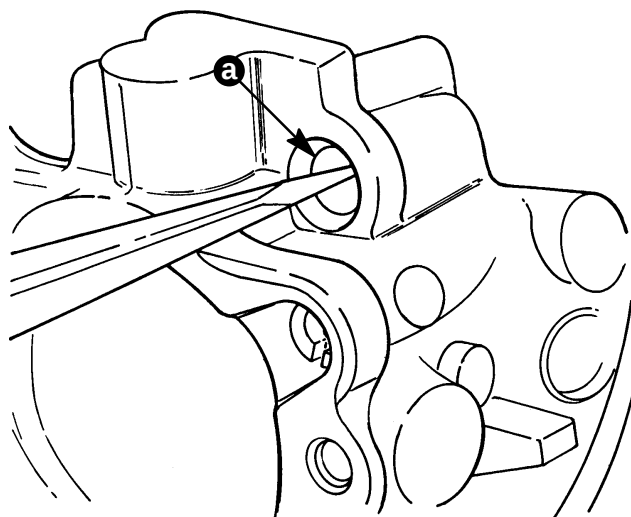
| Possible Cause          | Corrective Action |
|-------------------------|-------------------|
| Multiple chipped reeds. | Replace reeds.    |

**Checking for Restricted Fuel Flow Caused by Anti-Siphon Valves**

Refer to "Fuel Pump – General Information" for troubleshooting procedures, page 3A-4.

**Carburetor Adjustments****Initial Starting Adjustment**

1. After service or replacement of carburetor, turn idle mixture screw adjustment in (clockwise) until it seats LIGHTLY-then back-off (each carburetor) 1-1/4 turns. This will permit engine startup.

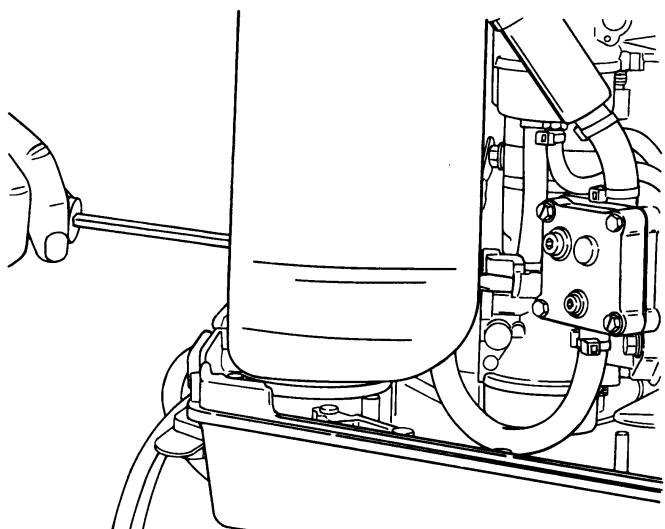
**Idle Speed Adjustment**

1. Adjust engine idle RPM as outlined in Section 2C "Timing/Synchronizing/Adjusting".



## Idle Mixture Screw Adjustment

1. Place outboard in test tank or place boat and outboard in water.
2. Preset carburetor idle mixture screw at 1-1/4 turns out from lightly seated position.



52020

3. Start outboard and allow to warm up to operating temperature.
4. Place outboard in gear with engine running. Slowly turn idle mixture screw counter clockwise until the corresponding cylinders start to load up or fire unevenly due to an over-rich condition.
5. Slowly turn idle mixture screw clockwise until the cylinders fire evenly and engine picks up speed.
6. Continue turning screw clockwise until too lean a mixture is obtained (engine slows down and misfires).
7. Set idle mixture screw at a point midway between TOO RICH and TOO LEAN. When in doubt, set slightly RICH rather than TOO LEAN.
8. Do not adjust leaner than necessary to attain reasonable smooth idling. Too lean a setting is a major cause of hard starting.

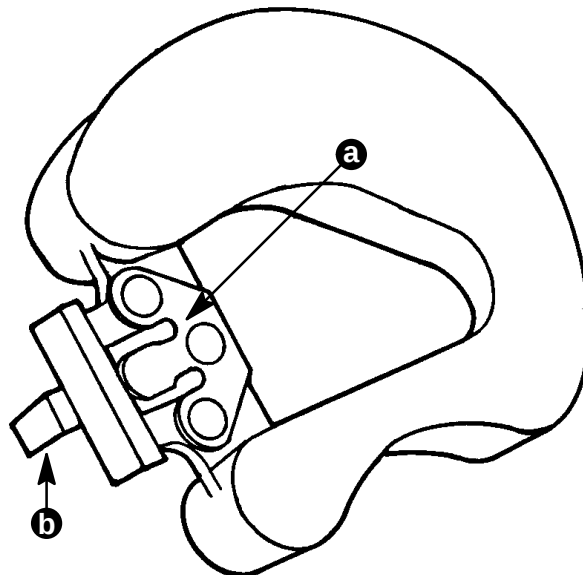
## Float Adjustment

1. Remove carburetor as outlined in “**Carburetor Removal**”, following.
2. Remove float bowl and check float level and float drop.

## FLOAT LEVEL AND FLOAT DROP ADJUSTMENT

Metal tab controls float level. Plastic tab limits float drop. Bending tab (a) towards needle (when float is installed) decreases float level.

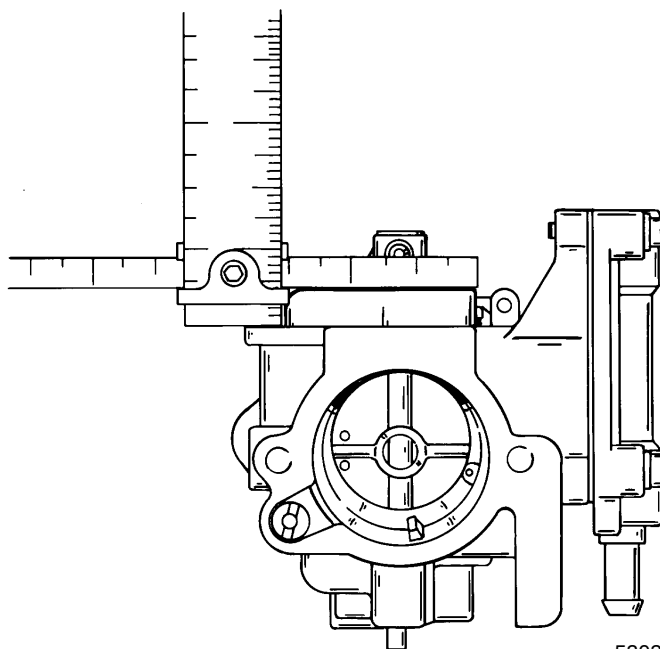
**NOTE:** Float must be replaced if float drop is out of adjustment.



a - Metal Tab  
b - Plastic Tab

## FLOAT LEVEL (WMA7B CARBURETOR)

1. On **WMA7B** carburetors, adjust float level to 1/4 in. (6.4mm) from float bottom to casting as shown.

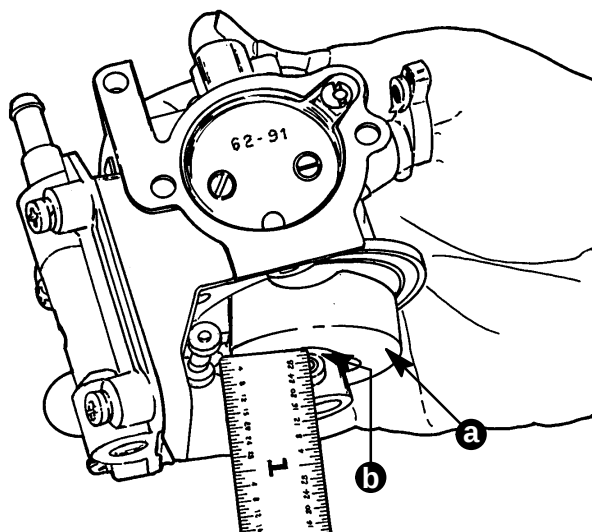


52038



## FLOAT DROP (WMA7B CARBURETOR ONLY)

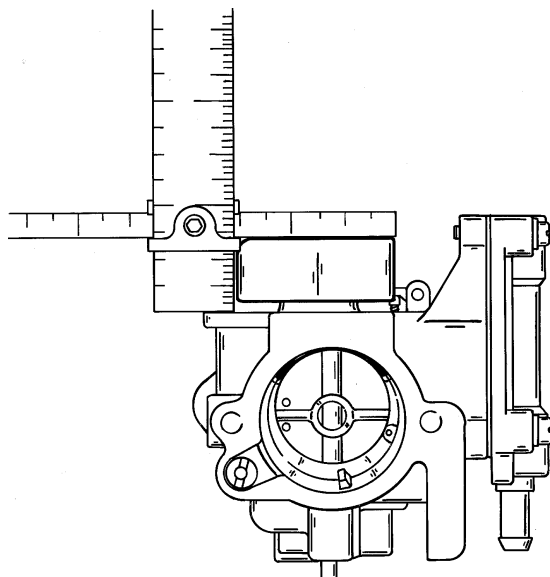
1. Float drop measurement of 1/32 in. (0.793mm) to 1/16 in. (1.587mm) from bottom of float and top of fixed jet as shown. Replace float if measurement is not obtained.



- a - Float Bottom
- b - Fixed Jet

## FLOAT LEVEL (WMA9 CARBURETOR)

1. On **WMA9** carburetors, adjust float level to 11/16 in. (17.46mm) from float bottom to casting.



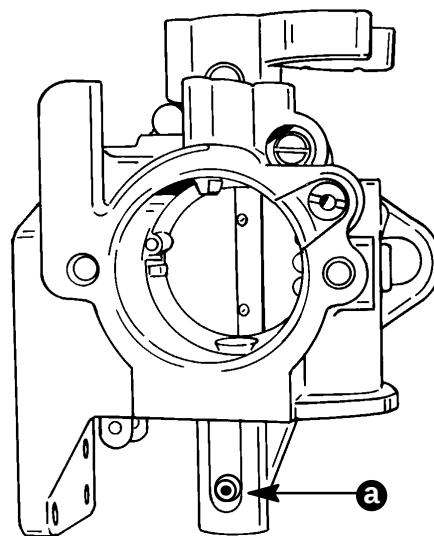
## FLOAT DROP (WMA9 CARBURETOR ONLY)

Float drop is not adjustable on **WMA9** carburetors.

## Main (High Speed) Jet Adjustment

The carburetor is equipped with a fixed high speed jet and normally no adjustment is required. However, extreme changes in weather (temperature and humidity) and/or elevation may result in a too lean or rich fuel mixture at wide-open-throttle, which may require a change in the high speed jet. A smaller size main jet will lean the fuel mixture, and a larger size jet will richen the fuel mixture.

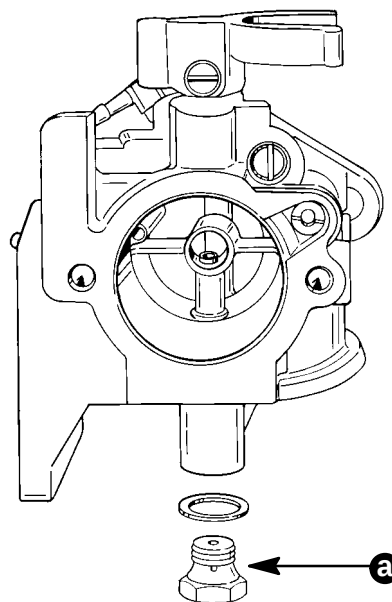
### WMA7B Carburetor



- a - Main Jet

52015

### WMA9 Carburetor



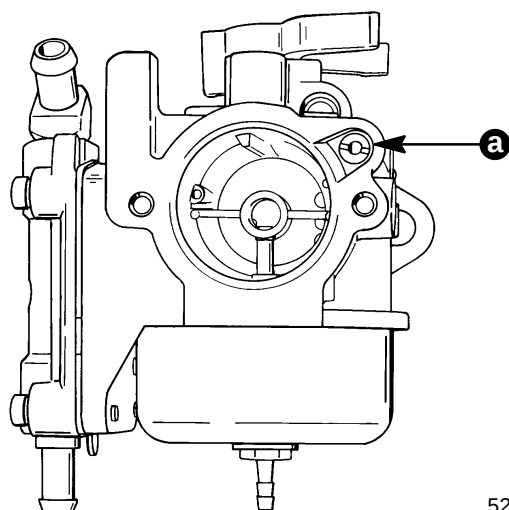
- a - Main Jet

52026



## Vent Jet

The vent jet supplies less than atmosphere pressure to the fuel bowl at mid-range, which results in improved fuel economy. If a jet with a larger orifice is installed (or jet is removed), the mid-range fuel/air ratio will be richer.



52019

a - Vent Jet

## High Altitude Jetting

The carburetor jets installed at the manufacturer is for outboard operation at sea level through an elevation of 2500 feet (762m) above sea level. If the outboard is to be operated at an altitude higher than 2500 feet, it will be necessary to rejet (remove the carburetor jet and install jet with a different orifice size) the carburetor. Each time the engine is to be operated at a different elevation, refer to the “**Carburetor Jet Chart**”, following and rejet carburetor for elevation outboard will be operated at.

### Carburetor Jet Orifice Sizes WMA7B

| Model             | Jet Type | Standard Jet up to 2500' |           | 2500' – 5000' |           | 5000' – 7500' |           | 7500' and Up |           |
|-------------------|----------|--------------------------|-----------|---------------|-----------|---------------|-----------|--------------|-----------|
|                   |          | Size                     | Part No.  | Size          | Part No.  | Size          | Part No.  | Size         | Part No.  |
| 40 HP<br>(4 Cyl.) | Main^    | .057                     | 1399-1457 | .055          | 1399-1655 | .053          | 1399-1653 | .051         | 1399-1651 |
|                   | Vent*    | .098                     | 1399-7335 | .096          | 1399-6249 | .094          | 1395-8423 | .092         | 1395-5733 |

^8 – 32 Thread

\*10 – 32 Thread

### Carburetor Jet Orifice Sizes WMA9

| Model             | Jet Type | Standard Jet up to 2500' |             | 2500' – 5000' |                | 5000' – 7500' |                | 7500' and Up |                |
|-------------------|----------|--------------------------|-------------|---------------|----------------|---------------|----------------|--------------|----------------|
|                   |          | Size                     | Part No.    | Size          | Part No.       | Size          | Part No.       | Size         | Part No.       |
| 40 HP<br>(4 Cyl.) | Main-Top | .050                     | 1395-823621 | .048          | 1395-823621--3 | .046          | 1395-823621--2 | .044         | 1395-823621--1 |
|                   | Main-Bot | .050                     | 1395-823622 | .048          | 1395-823622--3 | .046          | 1395-823622--2 | .044         | 1395-823622--1 |
|                   | Vent*    | .098                     | 1399-7335   | .096          | 1399-6249      | .094          | 1395-8423      | .092         | 1395-5733      |

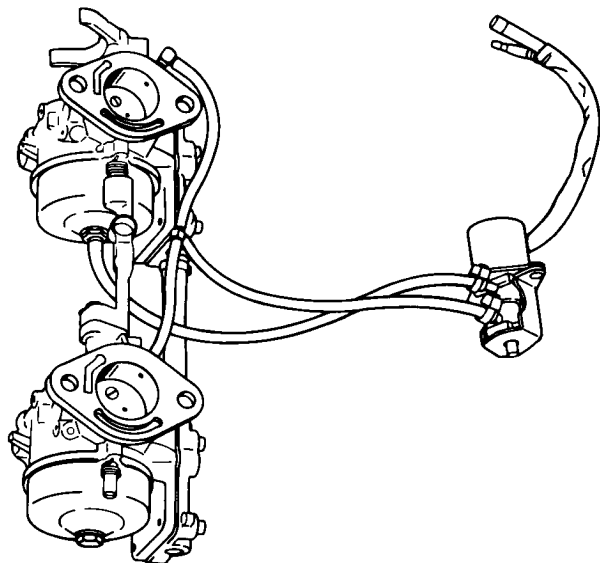
\*10 – 32 Thread



## Enrichment System (Electric Start Models)

The enrichener system (electric start models) provides the engine with a rich fuel charge (supplied from the float bowl of the top carburetor) for starting ease of a cold engine.

### Enrichener Hose Routed to Carburetor Flanges

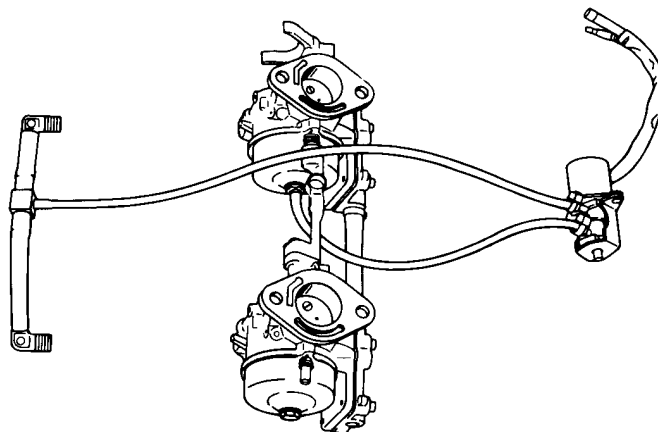


50571

#### Description:

The enrichener system consists of an electrically actuated valve. With the key in the "RUN" position and pushed in (and held in) the valve is opened allowing gravity fed fuel to be delivered to the engine thru a fitting on the bottom carburetor flange. With the key in the "START" position (and held in) the valve is opened allowing not only fuel to be gravity fed but also drawn into the engine thru both top and bottom carburetor flanges during each engine revolution. When the key is released (from the pushed in position) the valve will return closed. The valve can be operated manually if valve fails to operate electrically; refer to "**Manual Operation of Enrichener Valve**" following.

### Enrichener Hose Routed to Balance Tube



50571

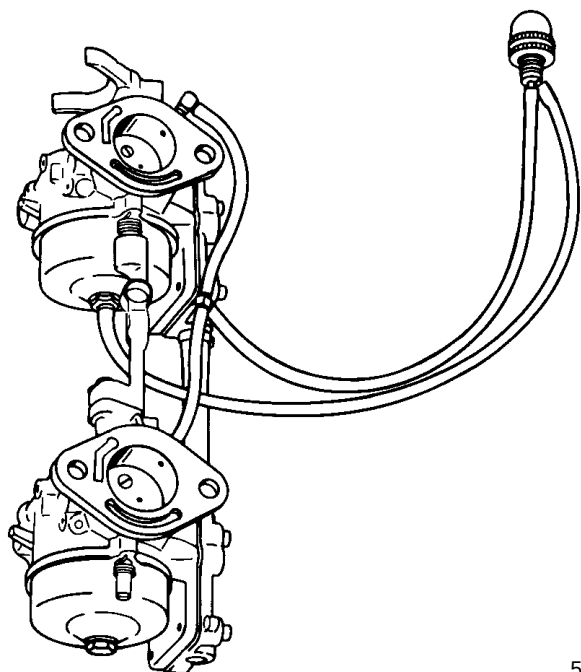
#### Description:

The enrichener system using enrichener hose routed to balance tube is similar to the system using the enrichener hose routed to the carburetors in that each uses the same electrically actuated valve that can be used manually. Although, with the key in the "RUN" position and pushed in (and held in) the fuel is gravity fed from the top carburetor float bowl directly to the crankcase (fuel is dispensed thru internal passages to the bottom two cylinders) thru the balance tube located on the starboard side of the outboard. With the key in the "START" position fuel is not only gravity fed to the crankcase (bottom two cylinders) but also drawn into the crankcase (top two cylinders) during each engine revolution.



## Primer System

### Hose Installation



50571

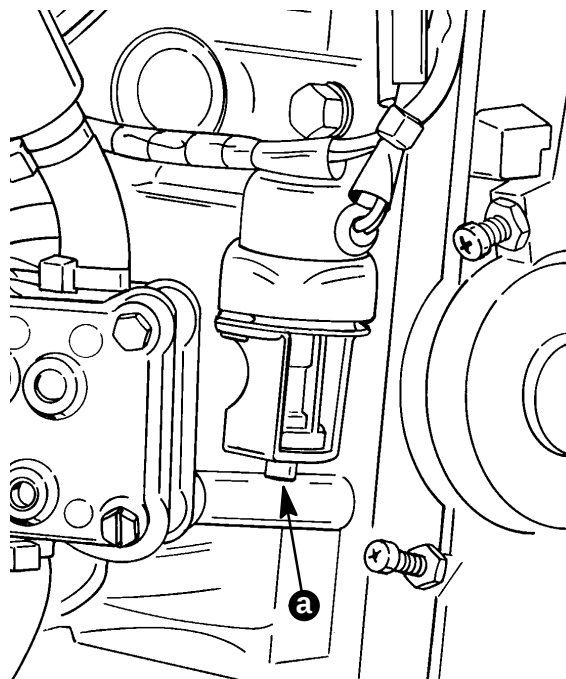
#### Description:

The primer system consists of a primer bulb that pulls fuel directly from the top carburetor float bowl and delivers fuel to the engine thru fittings located on each carburetor flange. Equal fuel amounts are delivered while depressing primer bulb with engine stopped or running.

## Enrichener Valve (Manual Operation)

**IMPORTANT:** Use of enrichener if motor is warm could result in engine flooding.

Squeeze primer bulb until bulb is firm. Press button in on enrichener valve and hold approximately 5 seconds. Release button. Start outboard.

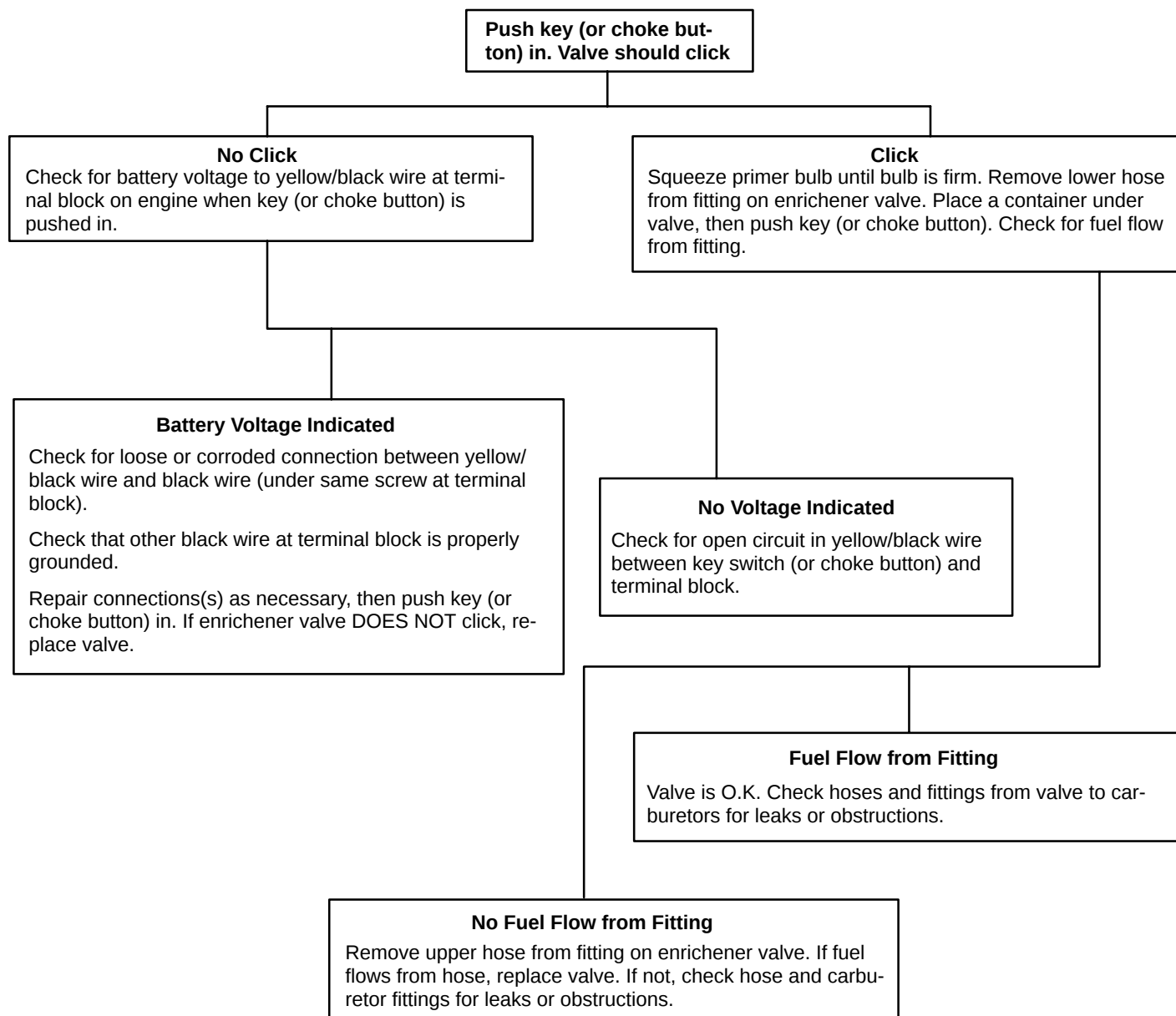


52014

a - Button



## Enrichment Valve Test

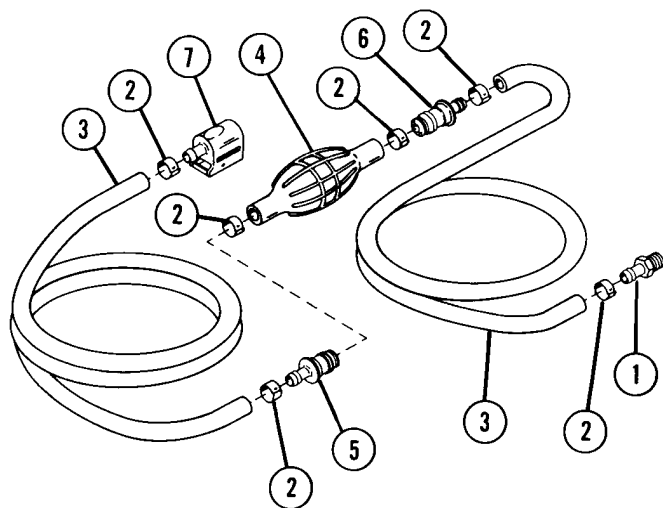


## Enrichener Valve Replacement

1. Disconnect enrichener valve leads at bullet connectors.
2. Disconnect hoses from valve.
3. Remove bolt that secures valve mounting bracket to engine, then lift from engine
4. Reinstall hoses to valve. Refer to "Hose Installation," following.
5. Apply a drop of Loctite 271 (92-32609-1) to threads of mounting bracket retaining bolt, then secure valve to engine with bracket and bolt.
6. Connect enrichener valves leads at bullet connectors.



## Fuel Line and Primer Bulb Assembly



50165

- 1 - Fitting
- 2 - Clamp
- 3 - Fuel Line
- 4 - Primer Bulb
- 5 - Check Valve (BLACK)
- 6 - Check Valve (WHITE)
- 7 - Fuel Line Connector (Engine End)

## Maintenance

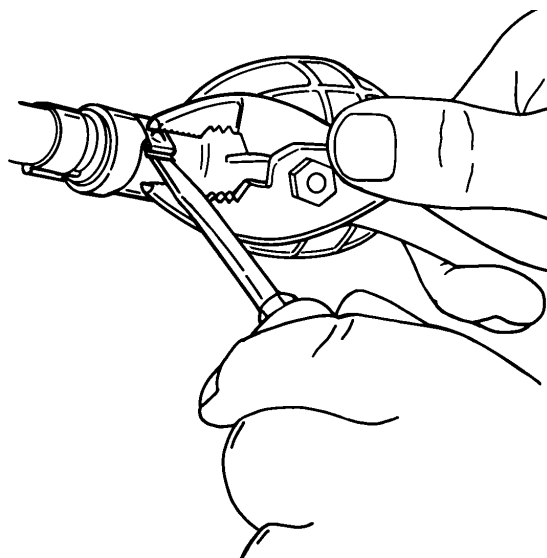
Periodically check fuel line and primer bulb for cracks, breaks, restrictions or chafing. Check all fuel line connections for tightness. All fuel line connections must be clamped securely.

Primer bulb assembly has 2 check valves: Fuel inlet (toward tank) and a fuel outlet (toward engine).

The fuel inlet valve allows fuel to fill primer bulb but closes to prevent fuel from returning to tank when bulb is squeezed. The fuel outlet valve opens when primer bulb is squeezed to allow fuel flow to carburetor, but closes as bulb is released to prevent fuel from returning to primer bulb.

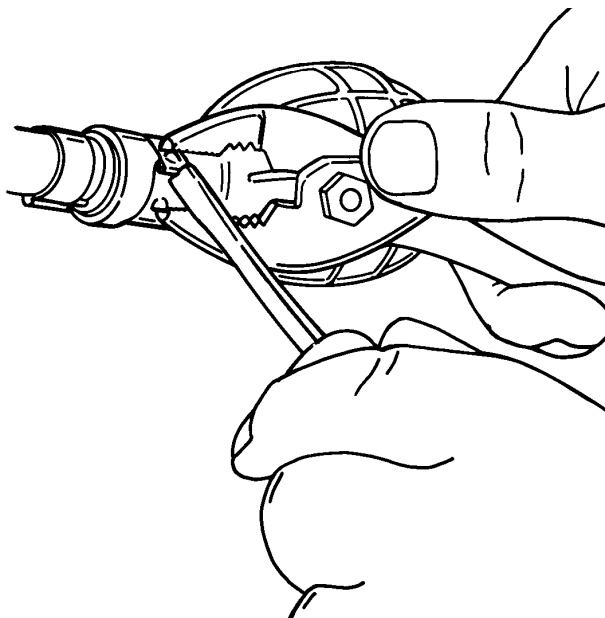
## Fuel Line Clamp Removal and Installation

1. To remove fuel line clamps, grip clamp with pliers and bend overlapping hook backward.



51115

2. To install fuel line clamps, grip hose clamp with pliers and push down on hook with screwdriver until hooks interlock.



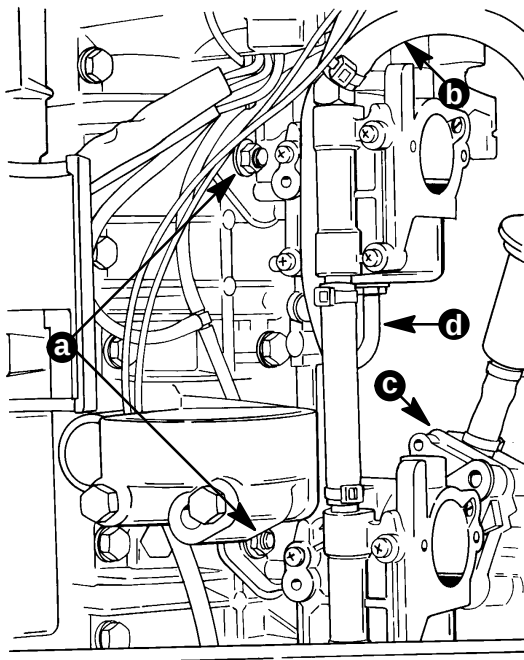
51115



## Carburetor Removal (Manual Start Model)

**NOTE:** Fuel pump can be removed from engine block to aid in carburetor removal.

1. Remove 4 nuts securing carburetors to power-head. Disconnect fuel hose from fuel pump and primer hose.

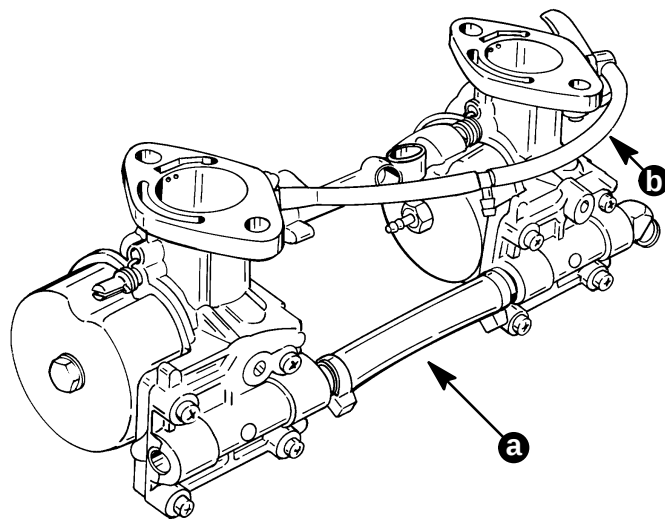


52022

- a - Nuts
- b - Fuel Hose
- c - Fuel Pump
- d - Primer Hose

## Carburetor Disassembly (Top Carburetor)

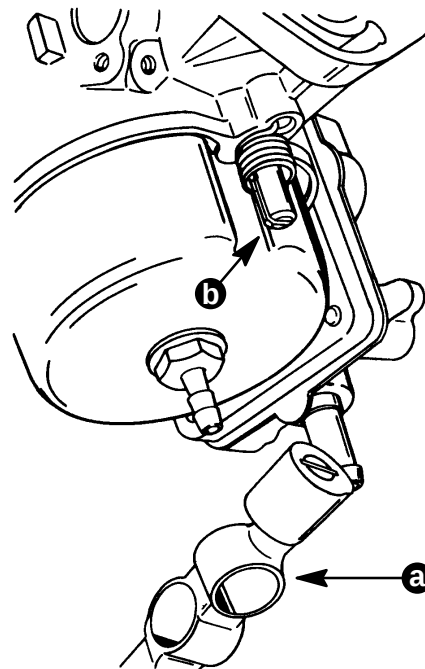
1. Disconnect fuel hose and primer hose from carburetor.



52012

- a - Fuel Hose
- b - Primer Hose

2. Disconnect throttle linkage from throttle shaft.

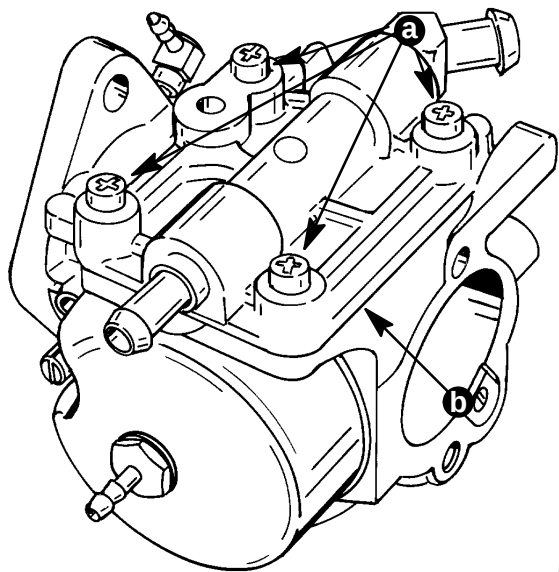


52020

- a - Throttle Linkage
- b - Throttle Shaft



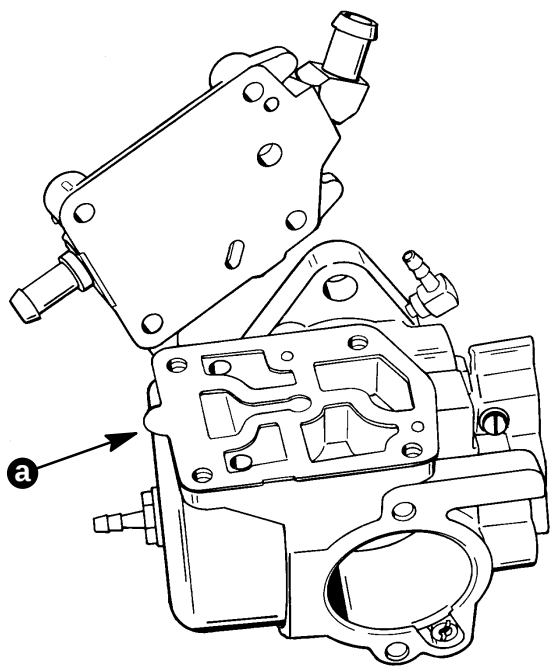
3. Remove 4 screws securing cover plate to carburetor.



52012

- a - Screws  
b - Cover Plate

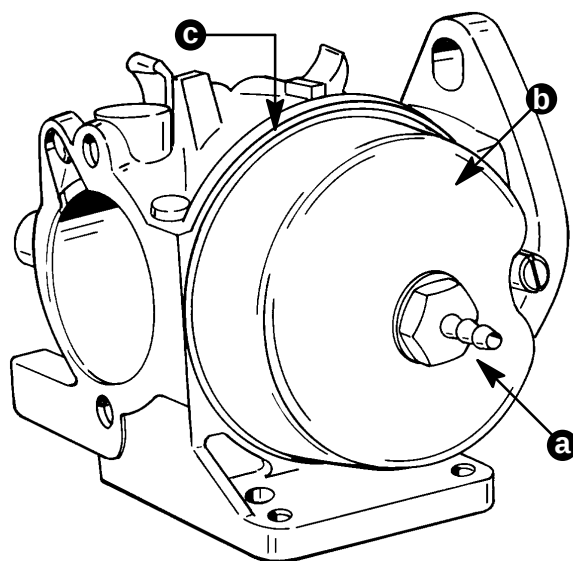
4. Remove cover plate and gasket.



52018

- a - Gasket

5. Remove primer fitting, bowl and bowl gasket from carburetor.

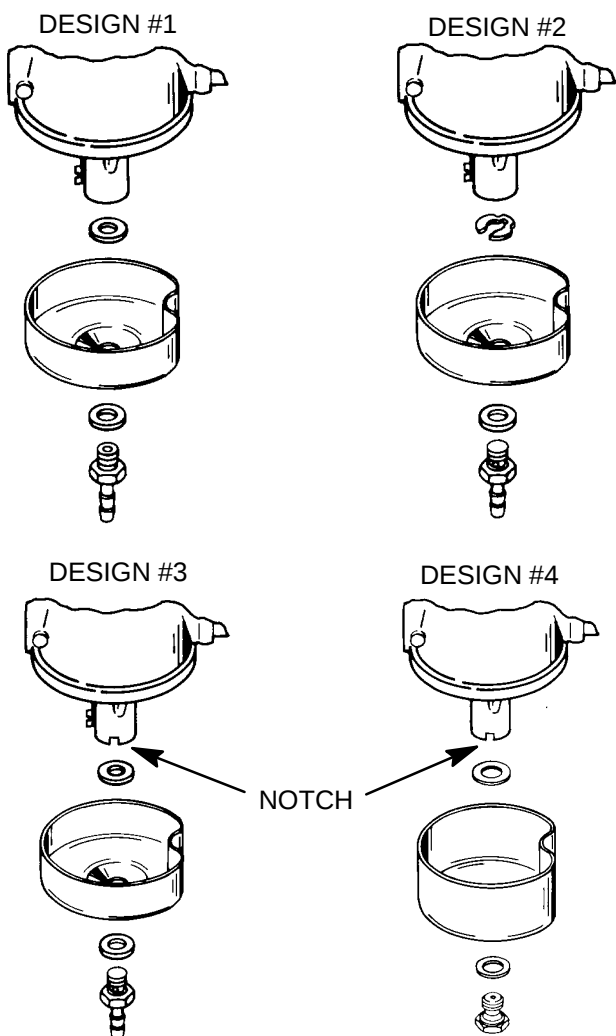


52012

- a - Primer Fitting  
b - Bowl  
c - Gasket

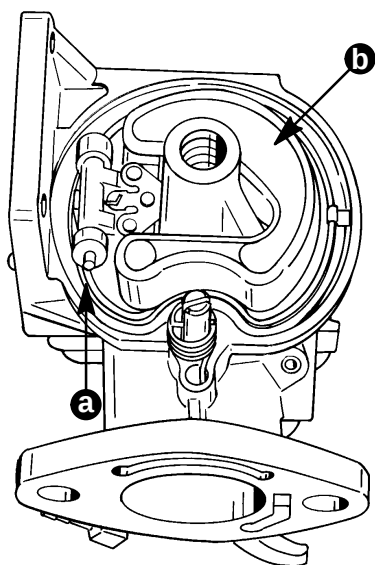


**NOTE:** Carburetor float bowl primer fitting design can be identified below.



52027

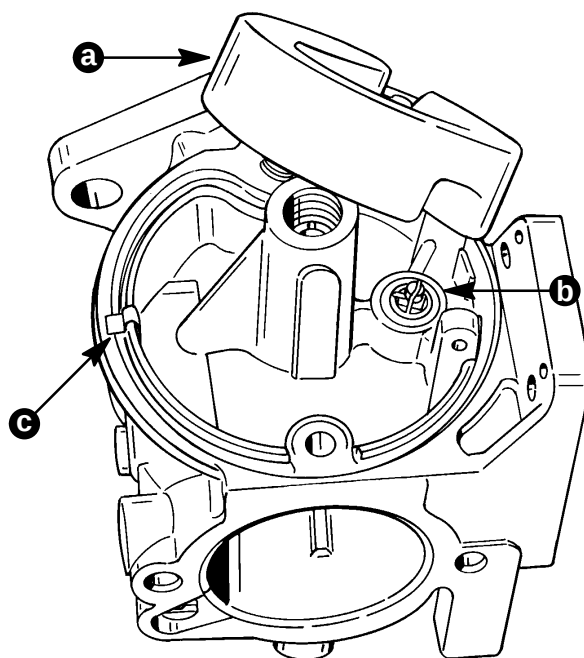
6. Remove pivot pin securing float to carburetor.



52013

a - Pivot Pin  
b - Float

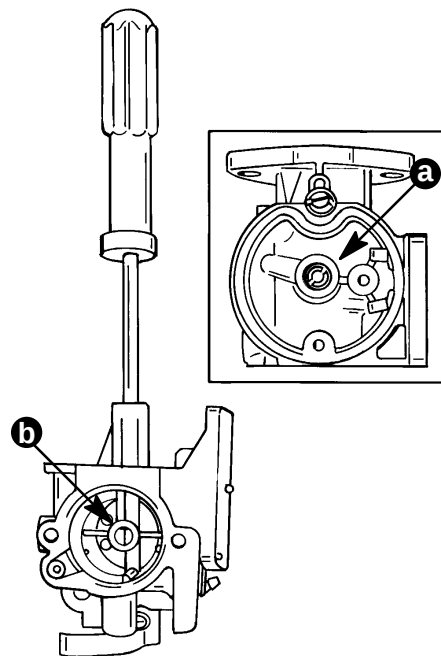
7. Remove float, needle and baffle from carburetor.



52013

a - Float  
b - Needle  
c - Baffle

8. Remove main nozzle and venturi from carburetor.



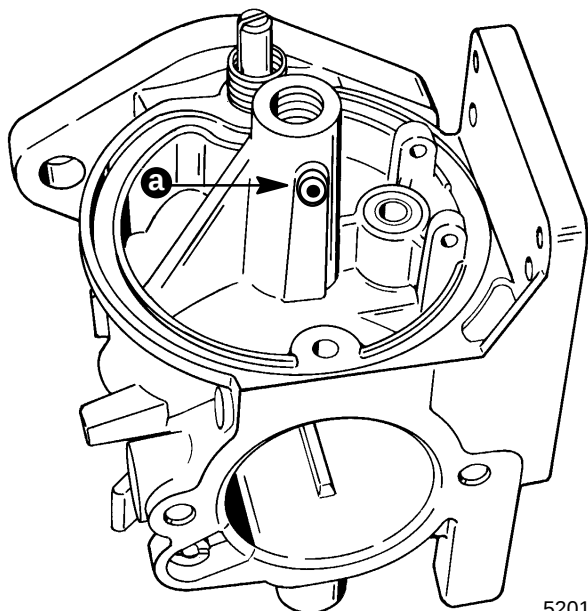
52015

a - Main Nozzle  
b - Venturi



9. Remove main jet from carburetor.

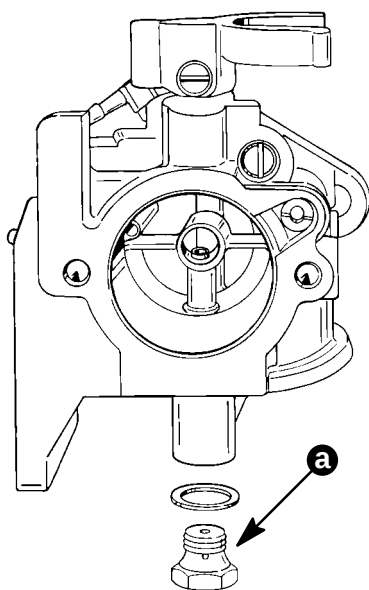
### WMA7B CARB



52016

a - Main Jet

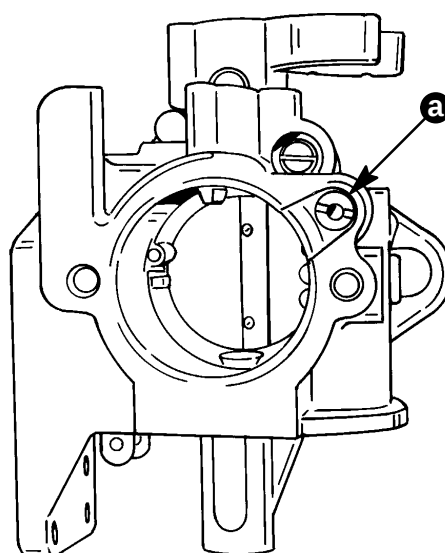
### WMA9 CARB



52026

a - Main Jet

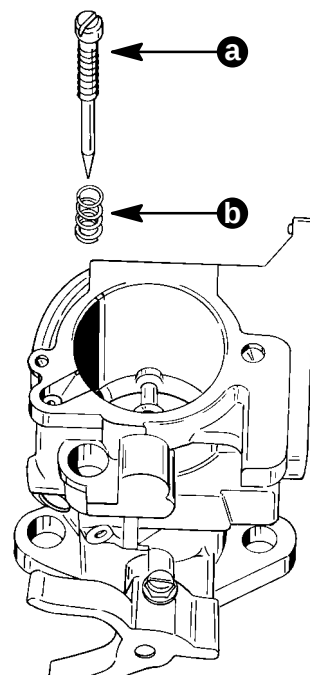
10. Remove vent jet from carburetor.



52015

a - Vent Jet

11. Remove idle mixture screw and spring from carburetor.

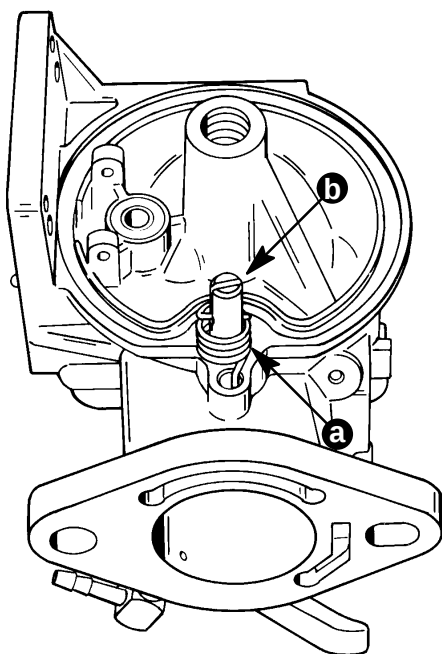


52015

a - Idle Mixture Screw  
b - Spring



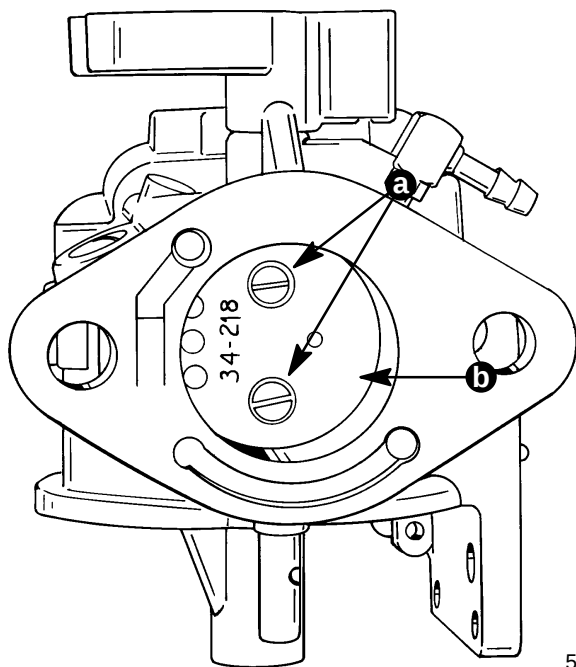
12. Remove throttle return spring from throttle shaft.



a - Throttle Return Spring  
b - Throttle Shaft

52016

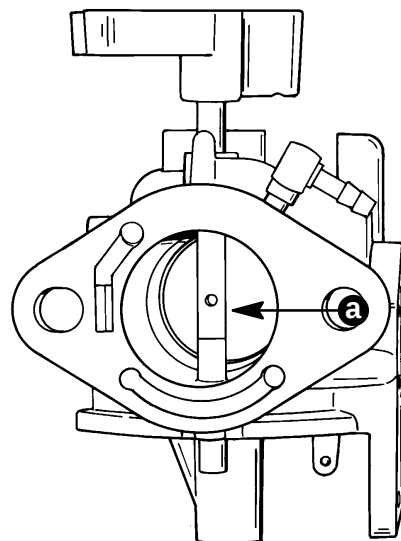
13. Remove screws securing throttle plate to throttle shaft.



a - Screws  
b - Throttle Shaft

52023

14. Remove throttle shaft from carburetor.



a - Throttle Shaft

52021

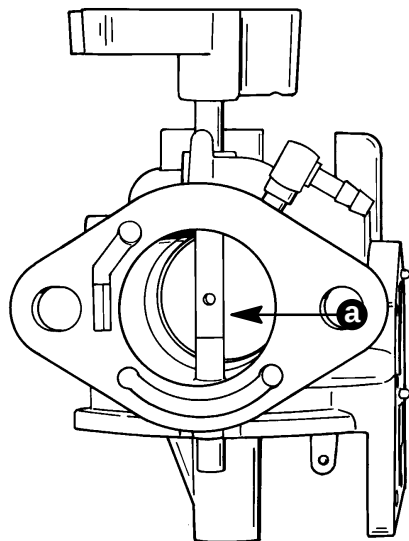
## Cleaning and Inspection

1. Carefully inspect carburetor body and fuel bowl for cracks, stripped threads, plugged or restricted passages and passage plugs that show signs of leakage.
2. Thoroughly clean all carburetor parts with a mild cleaning solution (that will not damage rubber or plastic) to remove dirt, gum and varnish that may have accumulated.
3. After washing parts, blow parts dry with compressed air. Be sure to blow air thru all passages, orifices and nozzles.
4. Check float hinge in the float pin area for wear and check float for leaks. Replace parts as necessary.
5. Examine inlet needle for wear. If worn, replace with new inlet needle.



# Carburetor Reassembly

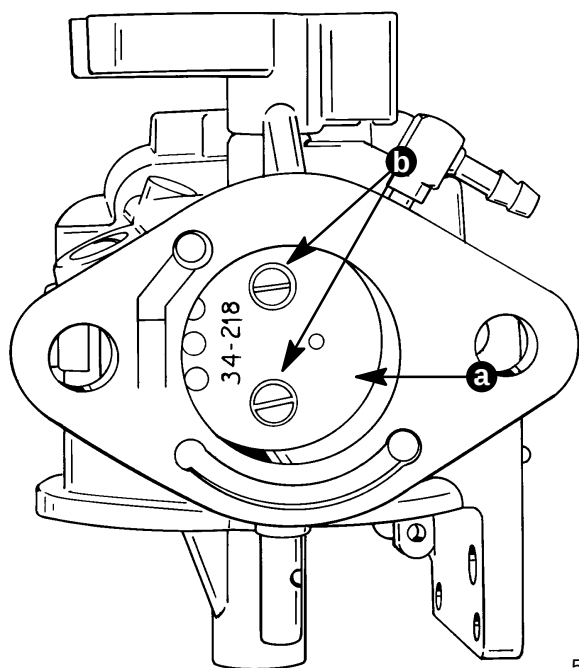
1. Install throttle shaft to carburetor.



52021

a - Throttle Shaft

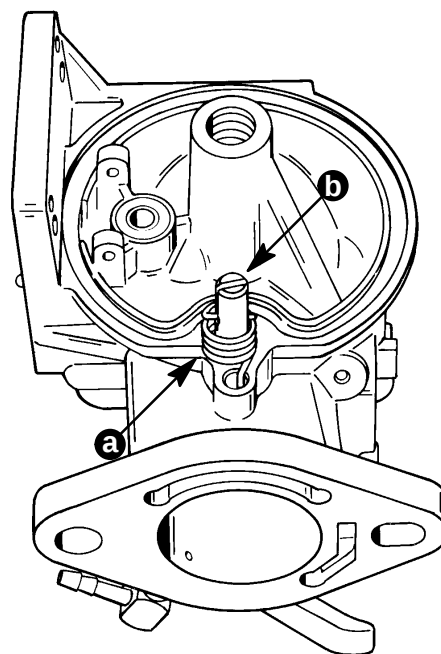
2. Install throttle shaft plate to throttle shaft. Apply Loctite 271 to threads of screws. Tighten securely.



52023

a - Throttle Shaft Plate  
b - Screws

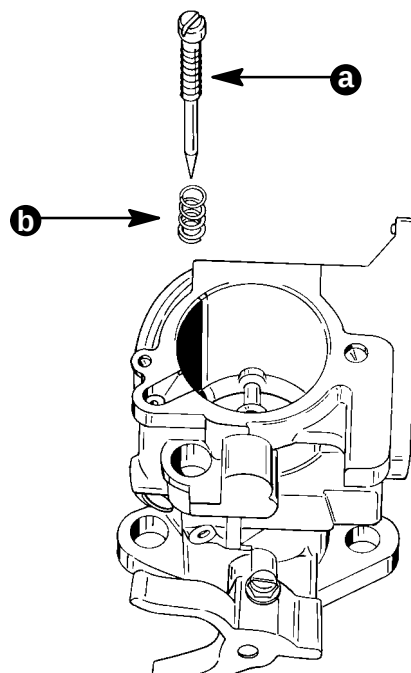
3. Install throttle return spring to throttle shaft.



52016

a - Throttle Return Spring  
b - Throttle Shaft

4. Install idle mixture screw and spring in carburetor. Refer to "Idle Mixture Screw Adjustment" preceding.

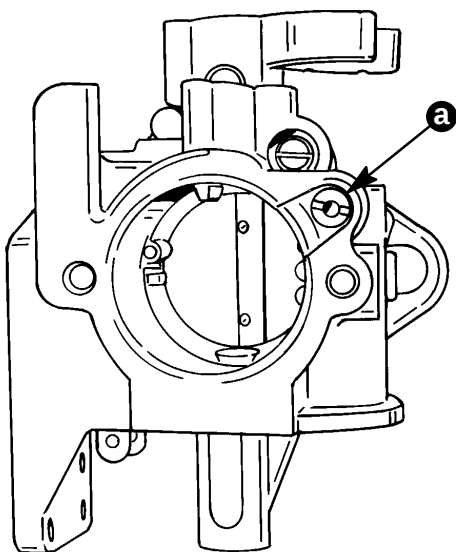


52015

a - Idle Mixture Screw  
b - Spring



5. Install vent jet. Torque to 14 lb. in. (1.6 N·m).

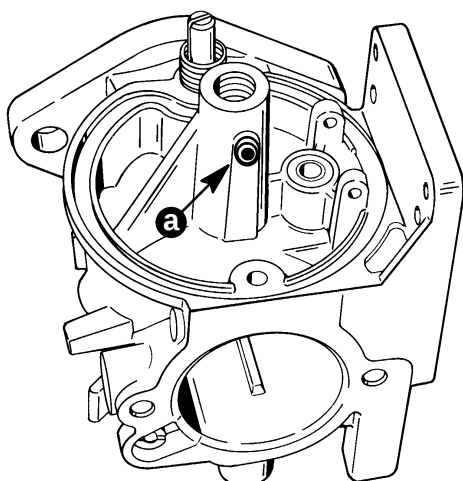


52015

a - Vent Jet [Torque to 14 lb. in. (1.6 N·m)]

6. Install main jet. Torque to 6 lb. in. (0.7 N·m).

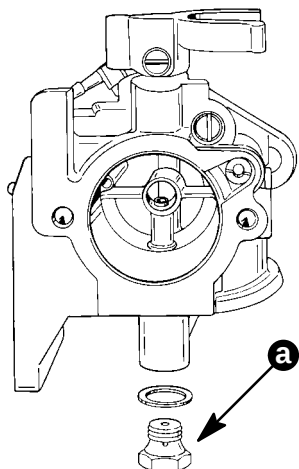
#### WMA7B CARB



52016

a - Main Jet [Torque to 6 lb. in. (0.7 N·m)]

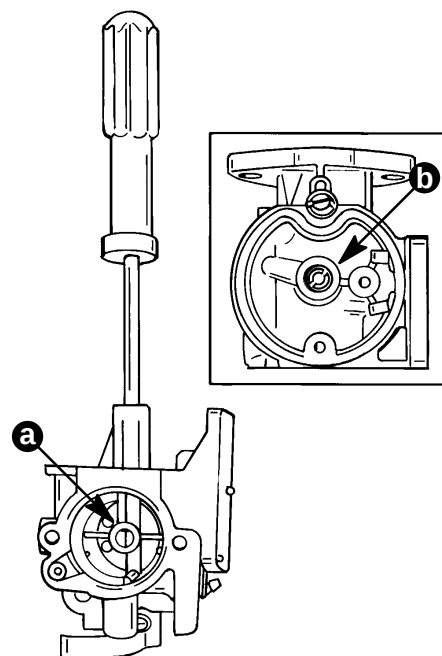
#### WMA9 CARB



52026

a - Main Jet [Torque to 35 lb. in. (3.9 N·m)]

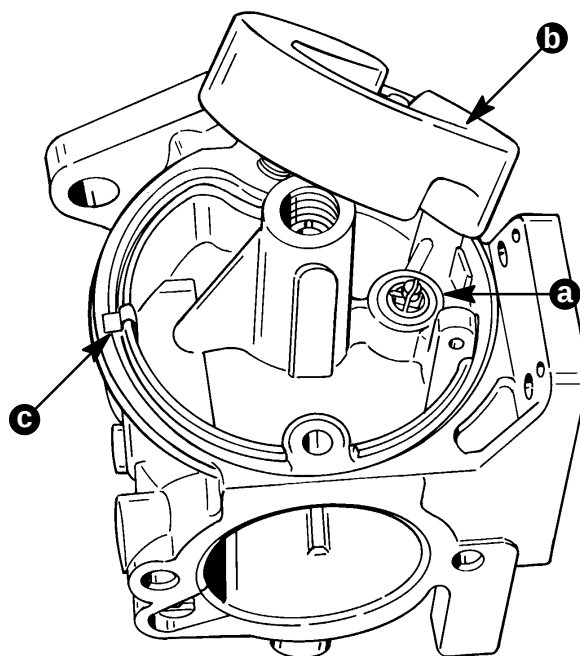
7. Install venturi into carburetor. Install main nozzle into carburetor. Tighten securely.



52015

a - Venturi  
b - Main Nozzle

8. Install float needle, float and baffle plate. Secure needle to float using retaining wire on float needle.

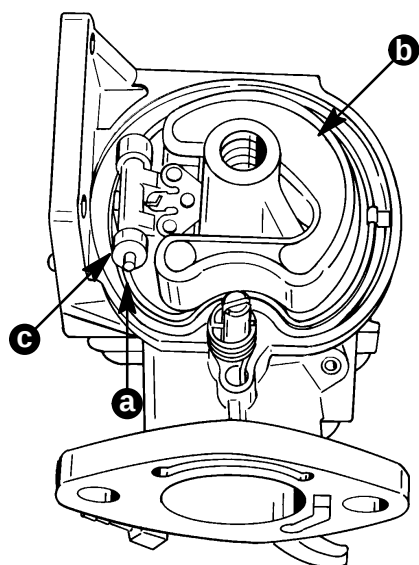


52013

a - Float Needle  
b - Float  
c - Baffle Plate



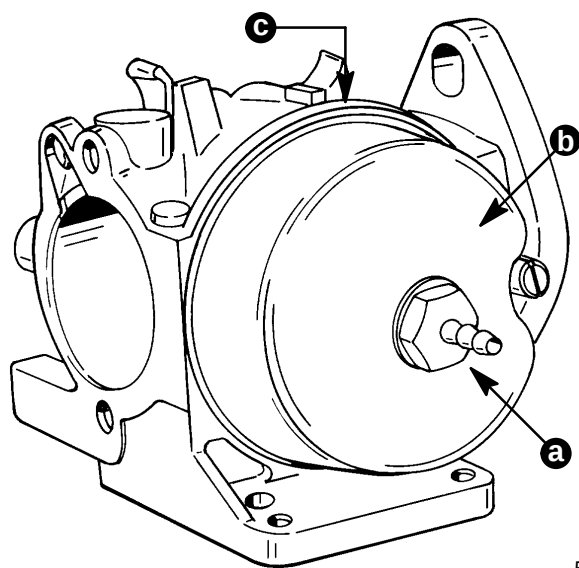
9. Install pivot pin securing float to carburetor.
10. Seat splined portion of pivot pin into carburetor post.



52013

- a - Pivot Pin  
b - Float  
c - Post

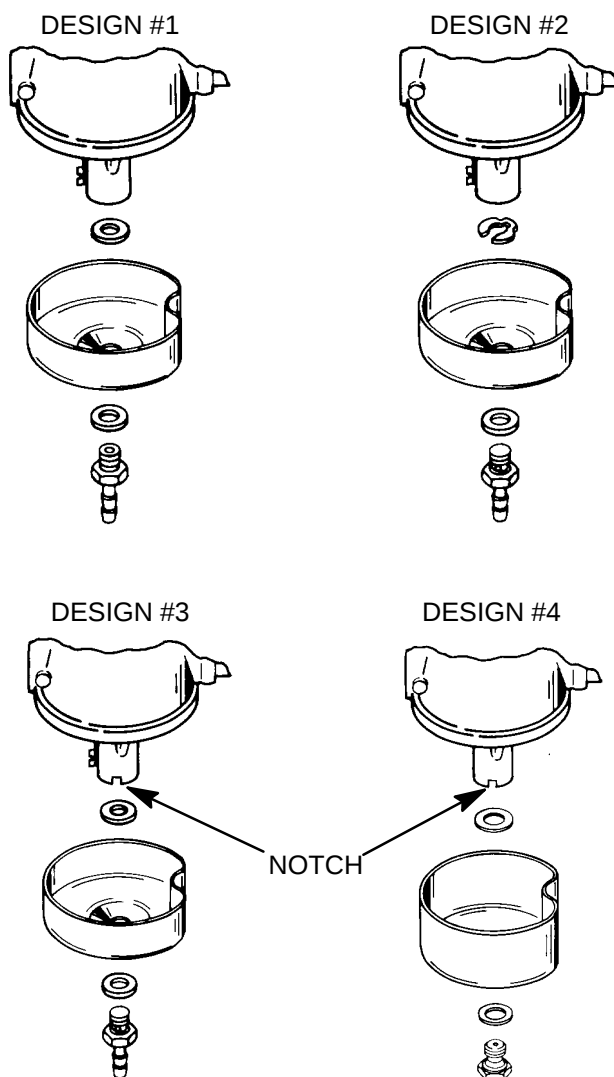
11. Install float bowl using new bowl gasket and secure to carburetor body using primer fitting. Torque fitting to 33 lb. in. (3.7 N·m). See float bowl Primer Fitting Designs following.



52012

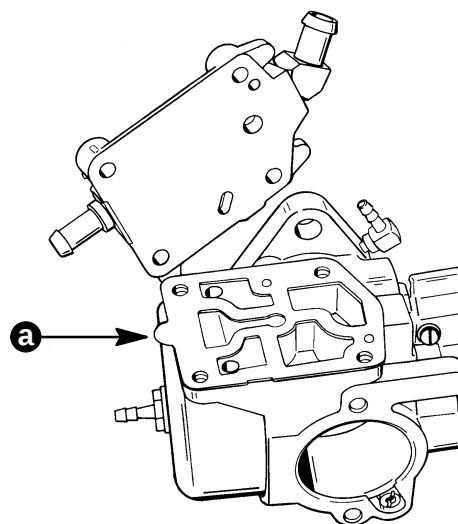
- a - Primer Fitting  
b - Bowl  
c - Gasket

## PRIMER FITTING DESIGNS



52027

12. Install gasket and cover to carburetor.

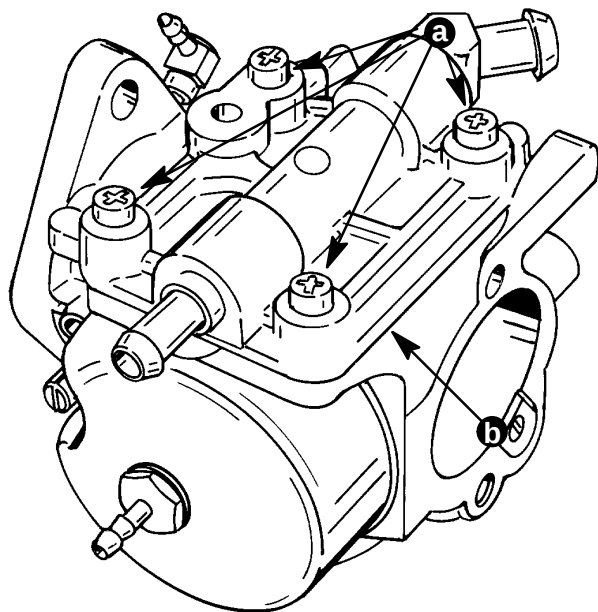


52018

- a - Gasket



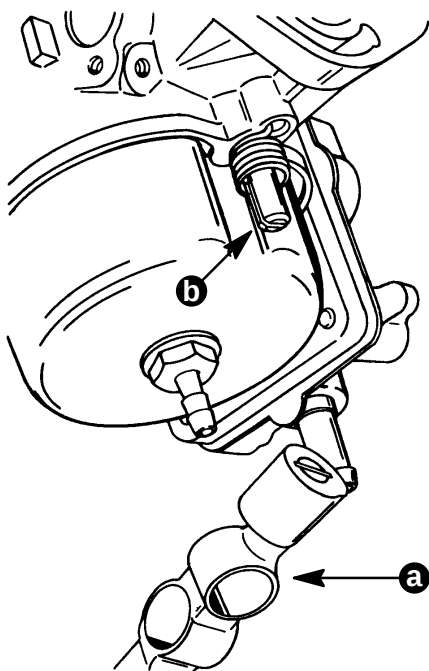
13. Torque screws to 18 lb. in. (2.0 N·m).



52012

a - Screws

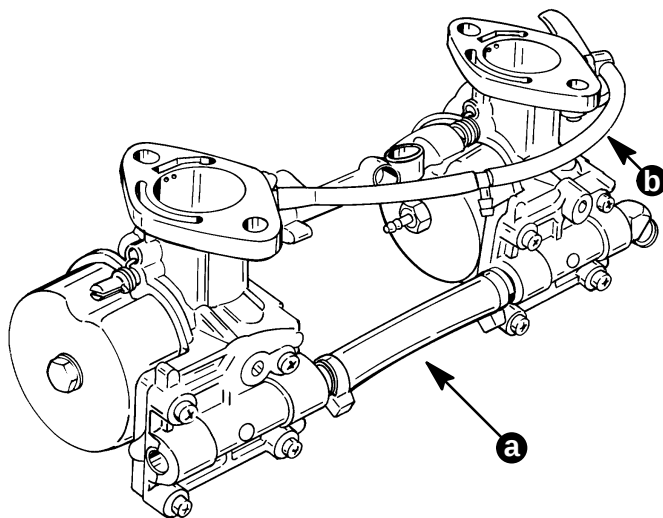
14. Connect throttle linkage to carburetor throttle shaft.



52020

a - Throttle Linkage  
b - Throttle Shaft

15. Connect fuel hose and primer hose to carburetor. Secure fuel hose using sta-strap.



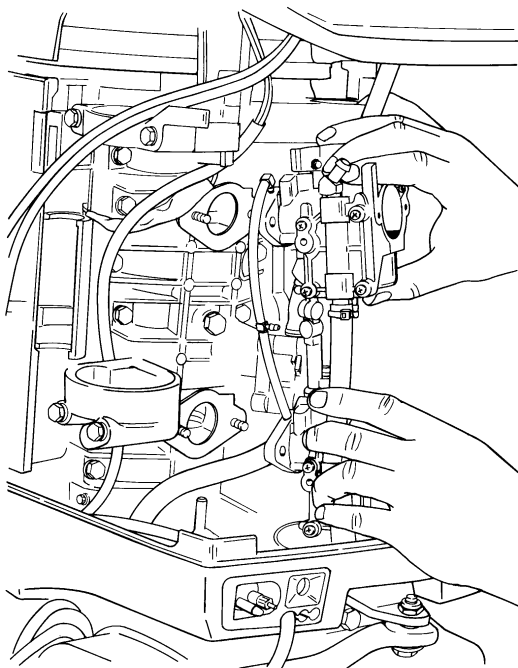
52012

a - Fuel Hose  
b - Primer Hose



## Carburetor Installation

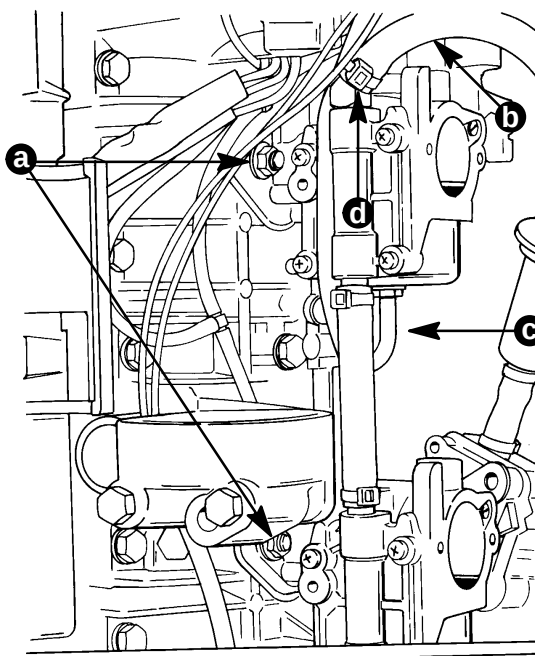
1. Install carburetors to powerhead using new gas-kets.



52021

2. Secure carburetors to engine using 4 nuts. Torque nuts to 110 lb. in. (12.4 N·m).

3. Connect fuel line and primer line. Secure fuel line using sta-strap.



52022

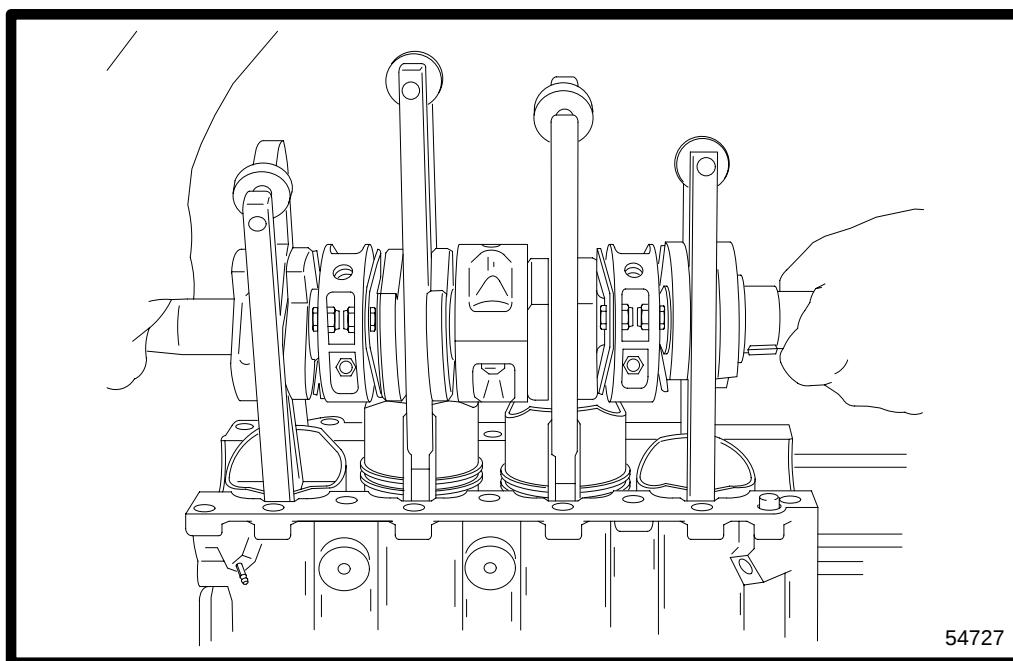
- a - Nuts [Torque to 110 lb. in. (12.4 N·m)]
- b - Fuel Line
- c - Primer Line
- d - Sta-strap

Reinstall oil tank. Refer to Section 8 “Oil Injection System”.



# POWERHEAD

4





# Table of Contents

|                                                              | Page |
|--------------------------------------------------------------|------|
| Specifications .....                                         | 4-1  |
| Special Tools .....                                          | 4-1  |
| General Information .....                                    | 4-1  |
| Throttle Control Linkage .....                               | 4-2  |
| Cylinder Block and Crankcase Assembly .....                  | 4-4  |
| End Caps and Exhaust Cover .....                             | 4-6  |
| Crankshaft, Pistons and Connecting Rods .....                | 4-8  |
| Powerhead Torque Sequence and<br>Torque Specifications ..... | 4-10 |
| Powerhead Removal from Driveshaft<br>Housing .....           | 4-11 |
| Electric Start Model .....                                   | 4-11 |
| Manual Start Model .....                                     | 4-14 |
| Powerhead Disassembly .....                                  | 4-16 |
| End Cap Disassembly .....                                    | 4-21 |
| Crankshaft Disassembly .....                                 | 4-22 |
| Cleaning and Inspection .....                                | 4-25 |
| Cylinder Block and Crankcase Cover .....                     | 4-25 |
| Cylinder Bore (Cleaning and<br>Inspection) .....             | 4-25 |
| Honing Procedure .....                                       | 4-25 |
| Cylinder Bore Size .....                                     | 4-26 |
| Pistons .....                                                | 4-26 |
| Measuring Piston Roundness .....                             | 4-27 |
| Reed Blocks .....                                            | 4-27 |
| Connecting Rods .....                                        | 4-28 |
| Cleaning Connecting Rods .....                               | 4-30 |
| Crankshaft .....                                             | 4-30 |
| Ball Bearing .....                                           | 4-31 |
| Powerhead Reassembly .....                                   | 4-31 |
| General .....                                                | 4-31 |
| Crankshaft Reassembly .....                                  | 4-32 |
| Piston Installation .....                                    | 4-35 |
| Crankshaft Seal Installation .....                           | 4-37 |
| End Cap Reassembly .....                                     | 4-38 |
| Lower End Cap .....                                          | 4-38 |
| Upper End Cap .....                                          | 4-39 |
| Cylinder Block Reassembly .....                              | 4-39 |
| Installing Powerhead on Driveshaft<br>Housing .....          | 4-48 |



## Specifications

### Block

Type ..... 4 Cylinder, 2 Cycle  
Displacement ..... 44.0 cu in. (721 cc)

### Cylinder Bore

Dia. Standard ..... 2.565 in. (65.15 mm)  
Dia. .015 in. Oversize ... 2.580 in. (65.32 mm)  
Dia. .030 in. Oversize ... 2.595 in. (65.91 mm)  
Out of Round (Max.) .... 0.004 in. (0.10 mm)  
Taper (Max.) ..... 0.004 in. (0.10 mm)

### Piston

Dia. Standard ..... 2.558 in. (64.97 mm)  
Dia. .015 in. Oversize ... 2.573 in. (65.35 mm)  
Dia. .030 in. Oversize ... 2.588 in. (65.73 mm)

Piston Clearance ..... 0.007 in. to 0.011 in.  
(0.17 mm to 0.27 mm)

Piston Ring End Gap ... 0.0015 in. to 0.014 in.  
(0.038 mm to 0.35 mm)

### Reed Block

Reed Stop Opening (Max.) 0.020 in. (0.50 mm)

### Crankshaft

Runout (Max.) ..... 0.003 in. (0.08 mm)  
Taper (Max.) ..... 0.003 in. (0.08 mm)

Firing Order ..... 1-3-2-4

## Special Tools

| Description                   | Part Number |
|-------------------------------|-------------|
| Flywheel Holder               | 91-52344    |
| Flywheel Holder Strap Wrench  | 91-24937A1  |
| Protector Cap                 | 91-24161    |
| Flywheel Puller               | 91-73687A1  |
| Lifting Eye                   | 91-90455    |
| Piston Ring Expander          | 91-24697    |
| Piston Pin Tool               | 91-76160A2  |
| Piston Ring Compressor        | 91-31461A2  |
| Bearing Puller                | 91-24100A1  |
| Powerhead Stand               | 91-25821A1  |
| Torque Wrench (0-200 lb. ft.) | *91-32610   |
| Torque Wrench (0-150 lb. in.) | *91-66274   |
| Compression Tester            | 91-29287    |

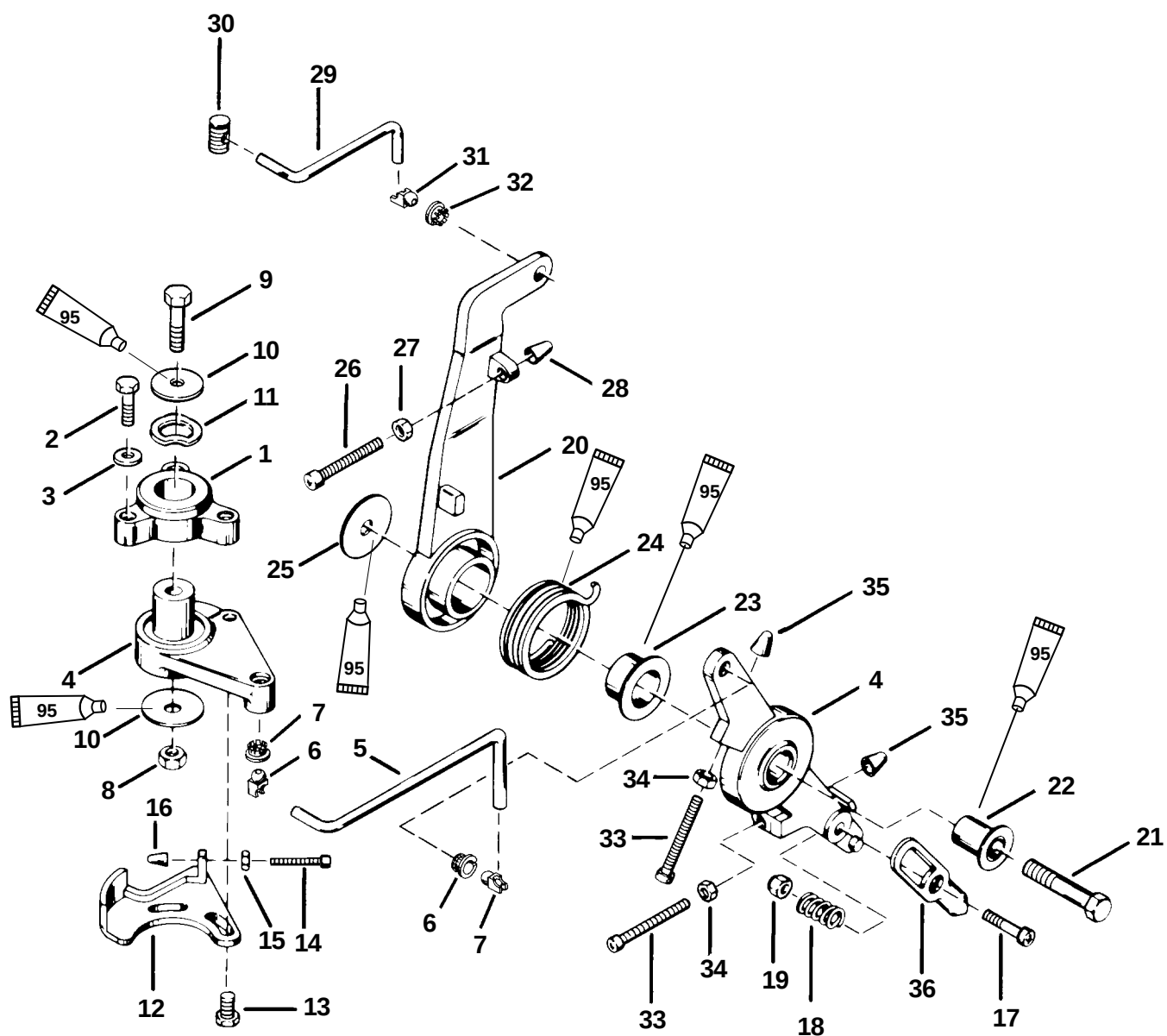
\*May be Obtained Locally

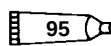
## General Information

Powerhead "Disassembly" and "Reassembly" instructions are printed in a sequence that should be followed to assure best results when removing or replacing powerhead components. If complete disassembly is not necessary, start reassembly at point where disassembly was stopped. (Refer to "Table of Contents," preceding.) Usually, complete disassembly of powerhead will be required. If major powerhead repairs are to be performed, remove powerhead from drive shaft housing. Removal of powerhead is not required for minor repairs on components, such as ignition system, carburetors, etc.



# Throttle Control Linkage



 95 2-4-C With Teflon (92-825407A12)

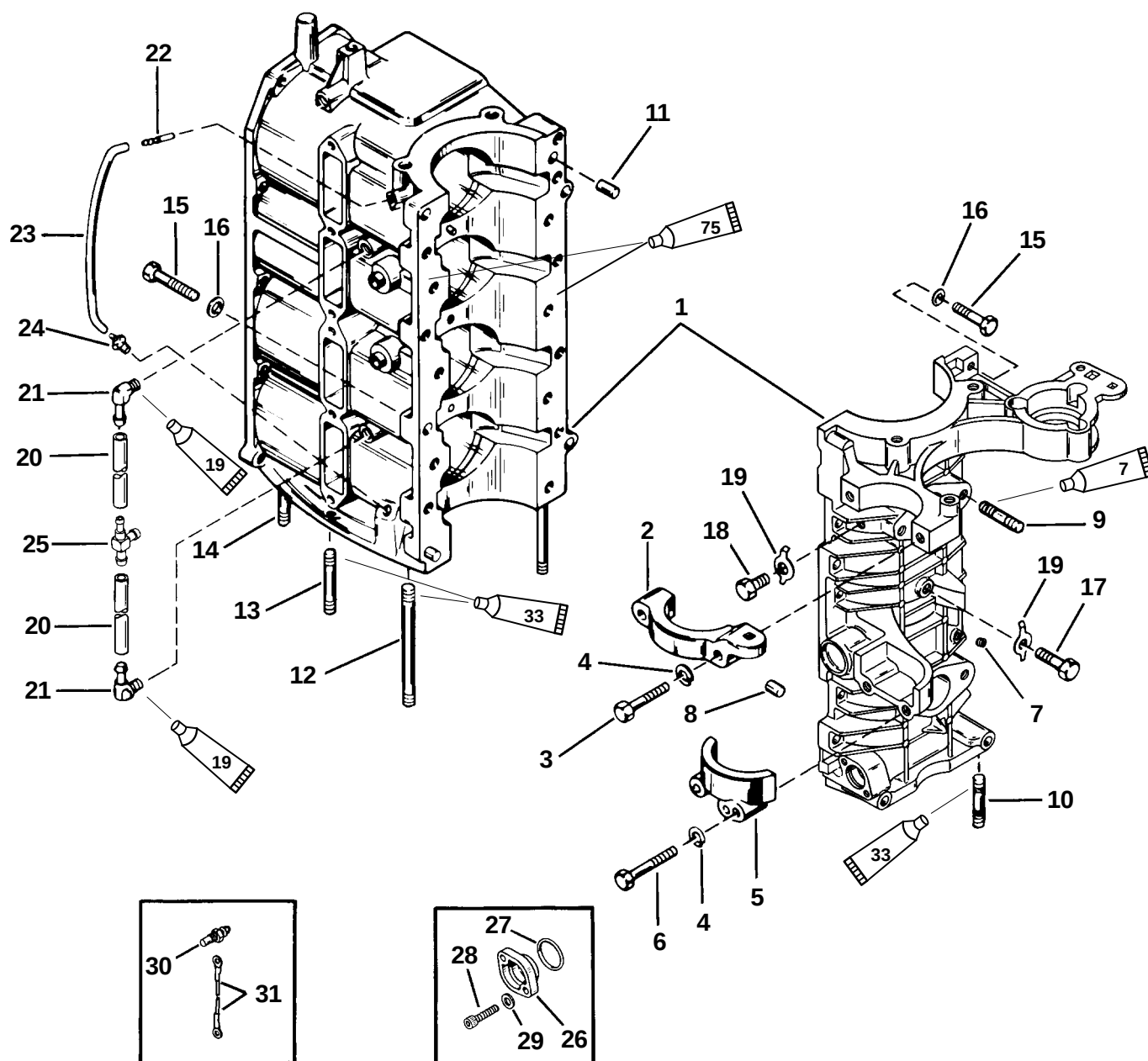


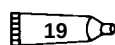
## Throttle Control Linkage

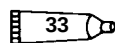
| REF. NO. | QTY. | DESCRIPTION         | TORQUE                                          |         |      |
|----------|------|---------------------|-------------------------------------------------|---------|------|
|          |      |                     | lb. in.                                         | lb. ft. | N·m  |
| 1        | 1    | BRACKET             |                                                 |         |      |
| 2        | 3    | SCREW (1-1/8 IN.)   | 150                                             |         | 17.0 |
| 3        | 3    | LOCKWASHER          |                                                 |         |      |
| 4        | 1    | THROTTLE ACTUATOR   |                                                 |         |      |
| 5        | 1    | LINK ROD            |                                                 |         |      |
| 6        | 2    | SWIVEL BALL         |                                                 |         |      |
| 7        | 2    | SWIVEL BASE         |                                                 |         |      |
| 8        | 1    | NUT                 |                                                 |         |      |
| 9        | 1    | SCREW (2 IN.)       | Drive Tight; but actuator must be free to pivot |         |      |
| 10       | 2    | WASHER              |                                                 |         |      |
| 11       | 1    | WAVE WASHER         |                                                 |         |      |
| 12       | 1    | PLATE               |                                                 |         |      |
| 13       | 2    | SCREW (1/2 IN.)     |                                                 |         |      |
| 14       | 1    | SCREW (1 IN.)       |                                                 |         |      |
| 15       | 1    | NUT                 |                                                 |         |      |
| 16       | 1    | CAP                 |                                                 |         |      |
| 17       | 1    | SCREW (7/8 IN.)     |                                                 |         |      |
| 18       | 1    | SPRING              |                                                 |         |      |
| 19       | 1    | NUT                 |                                                 |         |      |
| 20       | 1    | SPARK ADVANCE LEVER |                                                 |         |      |
| 21       | 1    | SCREW (1-3/4 IN.)   | Drive Tight                                     |         |      |
| 22       | 1    | BUSHING             |                                                 |         |      |
| 23       | 1    | BUSHING             |                                                 |         |      |
| 24       | 1    | SPRING              |                                                 |         |      |
| 25       | 1    | WASHER              |                                                 |         |      |
| 26       | 1    | SCREW (1-3/4 IN.)   |                                                 |         |      |
| 27       | 1    | NUT                 |                                                 |         |      |
| 28       | 1    | CAP                 |                                                 |         |      |
| 29       | 1    | LINK ROD            |                                                 |         |      |
| 30       | 1    | PIVOT               |                                                 |         |      |
| 31       | 1    | SWIVEL BALL         |                                                 |         |      |
| 32       | 1    | SWIVEL BASE         |                                                 |         |      |
| 33       | 1    | SCREW (2-1/4 IN.)   |                                                 |         |      |
| 33       | 1    | SCREW (1-3/4 IN.)   |                                                 |         |      |
| 34       | 2    | NUT                 |                                                 |         |      |
| 35       | 2    | CAP                 |                                                 |         |      |
| 36       | 1    | LATCH               |                                                 |         |      |

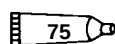


# Cylinder Block and Crankcase Assembly



 19 Perfect Seal (92-34227-1)

 33 Loctite 680 (Obtain Locally)

 75 Loctite Master Gasket (92-12564-1)

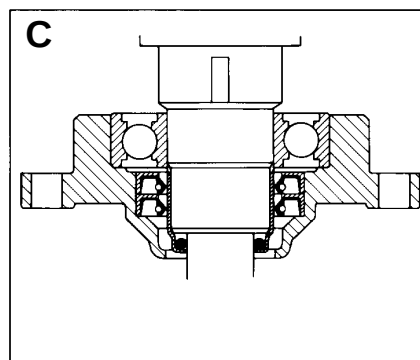
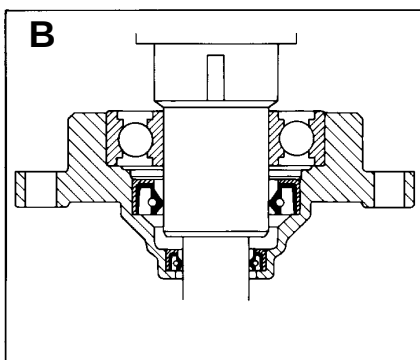
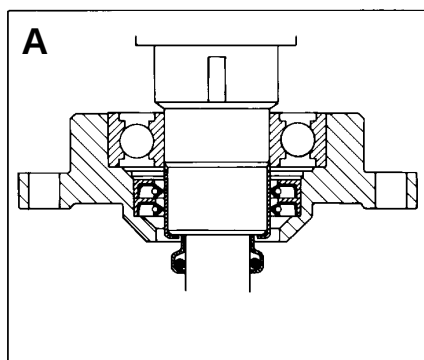
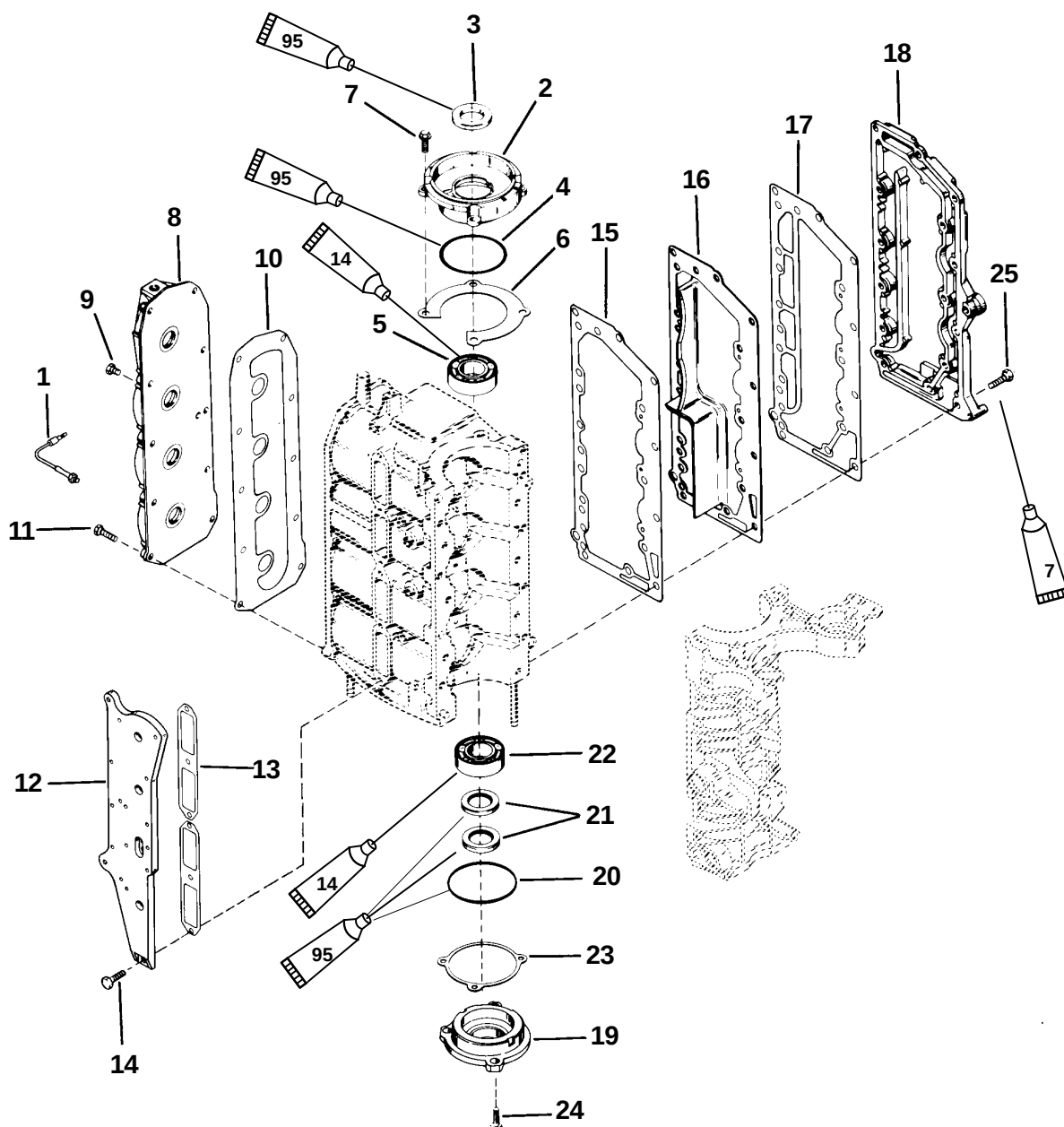


# Cylinder Block and Crankcase Assembly

| REF. NO. | QTY. | DESCRIPTION                                    | TORQUE  |         |      |
|----------|------|------------------------------------------------|---------|---------|------|
|          |      |                                                | lb. in. | lb. ft. | N·m  |
| 1        | 1    | CYLINDER BLOCK/CRANKCASE ASSEMBLY              |         |         |      |
| 2        | 1    | BRACKET–starter motor (UPPER)                  |         |         |      |
| 3        | 2    | SCREW–bracket to crankcase (1-7/8")            | 180     | 15      | 20.3 |
| 4        | 4    | LOCKWASHER–bracket screw                       |         |         |      |
| 5        | 1    | COVER–starter motor (LOWER)                    |         |         |      |
| 6        | 2    | SCREW–cover to crankcase (1-7/8")              | 180     | 15      | 20.3 |
| 7        | 1    | PLUG                                           |         |         |      |
| 8        | 2    | DOWEL PIN                                      |         |         |      |
| 9        | 4    | STUD–carburetor (1-1/4")                       |         |         |      |
| 10       | 2    | STUD–crankcase to drive shaft housing (1-5/8") |         |         |      |
| 11       | 2    | DOWEL PIN–crankcase to cylinder block          |         |         |      |
| 12       | 2    | STUD (4")                                      |         |         |      |
| 13       | 2    | STUD (2-1/8")                                  |         |         |      |
| 14       | 2    | STUD (2-1/2")                                  |         |         |      |
| 15       | 13   | SCREW–crankcase to cylinder block (1-1/2")     | 210     | 17.5    | 23.7 |
| 15       | 3    | SCREW–crankcase to cylinder block (1-3/8")     | 210     | 17.5    | 23.7 |
| 15       | 2    | SCREW–crankcase to cylinder block (2-7/8")     | 210     | 17.5    | 23.7 |
| 16       | 17   | WASHER–crankcase screw                         |         |         |      |
| 17       | 1    | SCREW–center main bearing locking (1")         | 75      |         | 8.5  |
| 18       | 2    | SCREW (3/4") <b>DESIGN II</b>                  | 75      |         | 8.5  |
| 19       | 3    | LOCKWASHER <b>w/LOCKWASHER</b>                 |         |         |      |
| 18       | 2    | SCREW (5/8") <b>DESIGN I</b>                   | 75      |         | 8.5  |
| 19       | 3    | TAB WASHER <b>w/TAB WASHER</b>                 |         |         |      |
| 20       | 1    | TUBE–balance–main bearing                      |         |         |      |
| 21       | 2    | ELBOW–balance tube to cylinder block           |         |         |      |
| 22       | 1    | CONNECTOR–bleed hose (UPPER)                   |         |         |      |
| 23       | 1    | HOSE–cylinder bleed (11")                      |         |         |      |
| 24       | 1    | CHECK VALVE–bleed hose (LOWER)                 |         |         |      |
| 25       | 1    | PRIMER TEE (OLD DESIGN)                        |         |         |      |
| 26       | 1    | COVER                                          |         |         |      |
| 27       | 1    | O-RING <b>NON OIL</b>                          |         |         |      |
| 28       | 2    | SCREW                                          |         |         |      |
| 29       | 2    | WASHER                                         |         |         |      |
| 30       | 1    | TEMPERATURE SENDER <b>POWERBOAT</b>            |         |         |      |
| 31       | 1    | CABLE ASSEMBLY                                 |         |         |      |



# End Caps and Exhaust Cover



7 Loctite 271 (Obtain Locally)

14 2 Cycle Outboard Oil (92-13249A24)

95 2-4-C With Teflon (92-825407A12)

A=DESIGN I B=DESIGN II C=DESIGN III



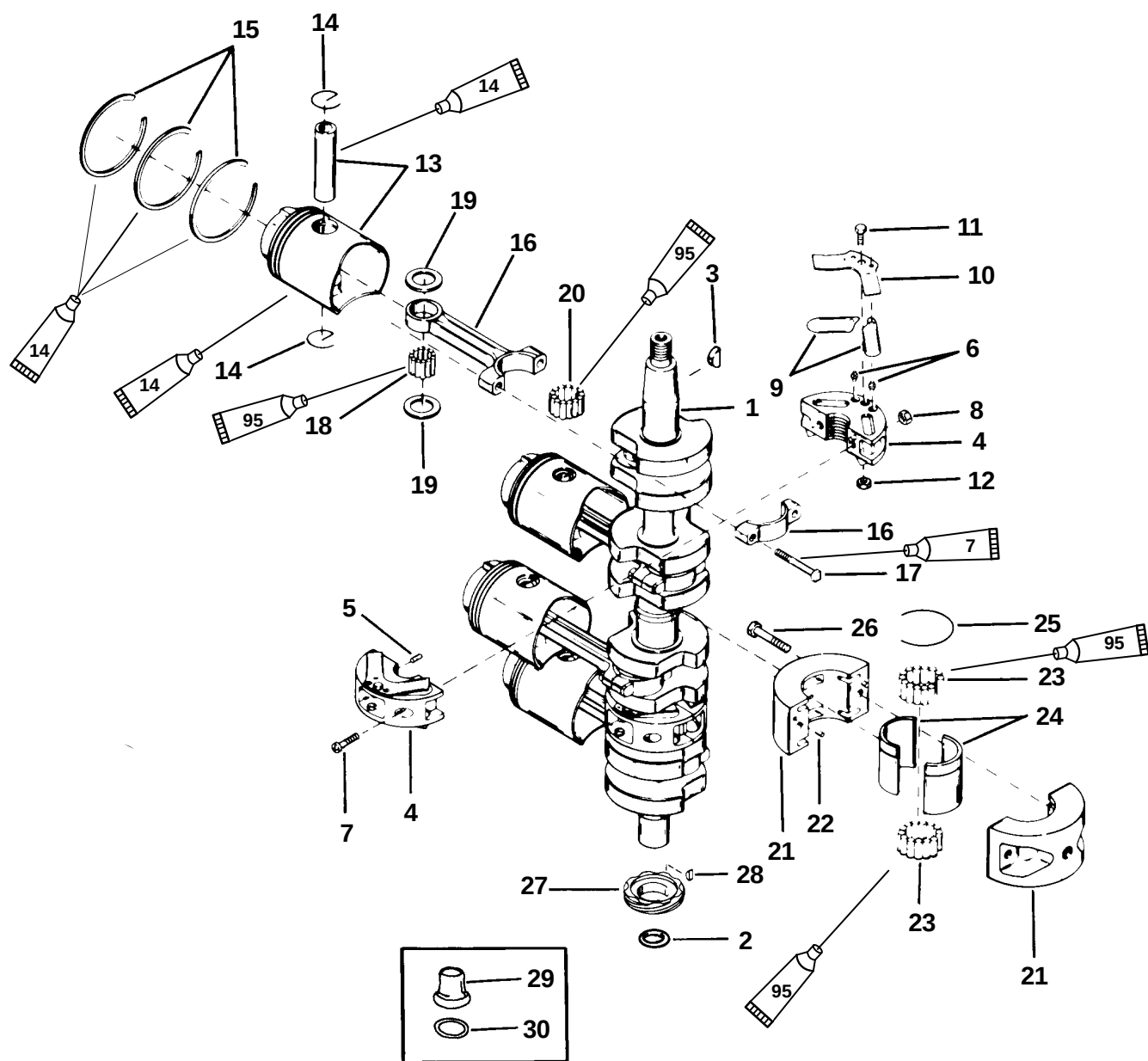
## End Caps and Exhaust Cover

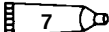
| REF. NO. | QTY. | DESCRIPTION                                          | TORQUE  |         |      |
|----------|------|------------------------------------------------------|---------|---------|------|
|          |      |                                                      | lb. in. | lb. ft. | N·m  |
| 1        | 1    | TEMPERATURE SWITCH (ELECTRIC)                        |         |         |      |
| 2        | 1    | END CAP ASSEMBLY–upper                               |         |         |      |
| 3        | 1    | OIL SEAL–upper end cap                               |         |         |      |
| 4        | 1    | O-RING–upper end cap                                 |         |         |      |
| 5        | 1    | BALL BEARING–upper end cap                           |         |         |      |
| 6        | AR   | SHIM–upper end cap (.005-10)                         |         |         |      |
| 7        | 4    | SCREW–upper end cap (3/4")                           | 200     | 16.6    | 22.5 |
| 8        | 1    | COVER ASSEMBLY–cylinder block                        |         |         |      |
| 9        | 1    | PIPE PLUG–cylinder block cover                       |         |         |      |
| 10       | 1    | GASKET–cylinder block cover                          |         |         |      |
| 11       | 10   | SCREW–cylinder block cover (1")                      | 100     |         | 11.3 |
| 12       | 1    | COVER ASSEMBLY–transfer port                         |         |         |      |
| 13       | 2    | GASKET–transfer port cover                           |         |         |      |
| 14       | 6    | SCREW–transfer port cover (5/8")                     | 65      |         | 7.3  |
| 15       | 1    | GASKET–cylinder block to baffle plate                |         |         |      |
| 16       | 1    | PLATE–baffle–exhaust manifold                        |         |         |      |
| 17       | 1    | GASKET–baffle plate to exhaust cover                 |         |         |      |
| 18       | 1    | COVER–exhaust manifold                               |         |         |      |
| 19       | 1    | END CAP ASSEMBLY–lower <b>DESIGN I/II</b>            |         |         |      |
| 20       | 1    | O-RING–lower end cap <b>END CAP</b>                  |         |         |      |
| 21       | 2    | OIL SEAL ( <b>Design I End Cap</b> ) <b>SEE</b>      |         |         |      |
| 21       | 1    | OIL SEAL ( <b>Design II End Cap</b> ) <b>BELOW</b>   |         |         |      |
| 21       | 1    | OIL SEAL ( <b>Design II End Cap</b> ) <b>FOR S/N</b> |         |         |      |
| 22       | 1    | BALL BEARING–lower end cap                           |         |         |      |
| 19       | 1    | END CAP ASSEMBLY–lower <b>DESIGN III</b>             |         |         |      |
| 20       | 1    | O-RING–lower end cap <b>END CAP</b>                  |         |         |      |
| 21       | 2    | OIL SEAL <b>SEE BELOW</b>                            |         |         |      |
| 22       | 1    | BALL BEARING–lower end cap <b>FOR S/N</b>            |         |         |      |
| 23       | AR   | SHIM–lower end cap (.005-10)                         |         |         |      |
| 24       | 3    | SCREW–lower end cap                                  | 200     | 16.6    | 22.5 |
| 25       | 15   | SCREW–manifold cover to cylinder block (1")          | 200     | 16.6    | 22.5 |

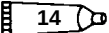
**DESIGN I/II – S/N USA-D279349 & BELOW BEL-9793444 & BELOW**  
**DESIGN III – S/N USA-D279350 & UP BEL-9793445 & UP**

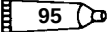


# Crankshaft, Pistons, and Connecting Rods



 Loctite 271 (Obtain Locally)

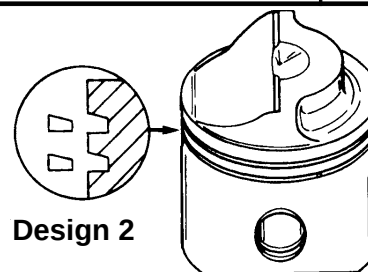
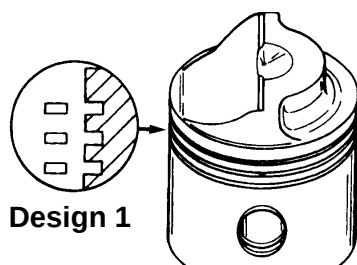
 2 Cycle Outboard Oil (92-13249A24)

 2-4-C With Teflon (92-825407A12)



# Crankshaft, Pistons and Connecting Rods

| REF. NO. | QTY. | DESCRIPTION                             | TORQUE  |         |      |
|----------|------|-----------------------------------------|---------|---------|------|
|          |      |                                         | lb. in. | lb. ft. | N·m  |
| 1        | 1    | CRANKSHAFT                              |         |         |      |
| 2        | 1    | O-RING                                  |         |         |      |
| 3        | 1    | KEY–crankshaft                          |         |         |      |
| 4        | 2    | MAIN BEARING ASSEMBLY (VALVE TYPE)      |         |         |      |
| 5        | 4    | DOWEL PIN–main bearing                  |         |         |      |
| 6        | 16   | DOWEL PIN–reed locating                 |         |         |      |
| 7        | 4    | SCREW–main bearing                      | 55      |         | 6.2  |
| 8        | 4    | NUT–main bearing screw                  |         |         |      |
| 9        | 2    | REED SET–matched                        |         |         |      |
| 10       | 8    | REED STOP                               |         |         |      |
| 11       | 8    | SCREW–reed stop (9/16")                 | 40      |         | 4.5  |
| 12       | 8    | NUT–reed stop screw                     |         |         |      |
| 13       | 4    | PISTON/PISTON PIN (STANDARD)            |         |         |      |
| 13       | AR   | PISTON/PISTON PIN (.015 O.S.) DESIGN II |         |         |      |
| 13       | AR   | PISTON/PISTON PIN (.030 O.S.)           |         |         |      |
| 13       | 4    | PISTON/PISTON PIN (STANDARD)            |         |         |      |
| 13       | AR   | PISTON/PISTON PIN (.015 O.S.) DESIGN I  |         |         |      |
| 13       | AR   | PISTON/PISTON PIN (.030 O.S.)           |         |         |      |
| 14       | 8    | LOCK RING–piston pin                    |         |         |      |
| 15       | 1    | PISTON RING (STANDARD)                  |         |         |      |
| 15       | AR   | PISTON RING (.015 O.S.) DESIGN II       |         |         |      |
| 15       | AR   | PISTON RING (.030 O.S.)                 |         |         |      |
| 15       | 1    | PISTON RING (STANDARD)                  |         |         |      |
| 15       | 1    | PISTON RING (.015 O.S.) DESIGN I        |         |         |      |
| 15       | 1    | PISTON RING (.030 O.S.)                 |         |         |      |
| 16       | 4    | CONNECTING ROD AND CAP ASSEMBLY         |         |         |      |
| 17       | 8    | SCREW–cap to rod                        | 200     | 16.6    | 22.5 |
| 18       | 108  | NEEDLE BEARING–piston pin               |         |         |      |
| 19       | 8    | WASHER–needle locating                  |         |         |      |
| 20       | 1    | NEEDLE BEARING–crank pin                |         |         |      |
| 21       | 1    | CENTER MAIN BEARING ASSEMBLY            |         |         |      |
| 22       | 2    | DOWEL PIN–center main bearing           |         |         |      |
| 23       | 56   | NEEDLE BEARING                          |         |         |      |
| 24       | 1    | RACE–outer                              |         |         |      |
| 25       | 1    | SNAP RING–outer race                    |         |         |      |
| 26       | 2    | SCREW–center main bearing (1")          | 80      |         | 9.0  |
| 27       | 1    | DRIVER GEAR                             |         |         |      |
| 28       | 1    | KEY–driver gear                         |         |         |      |
| 29       | 1    | CARRIER ASSEMBLY DESIGN I/II            |         |         |      |
| 30       | 1    | SEAL                                    |         |         |      |

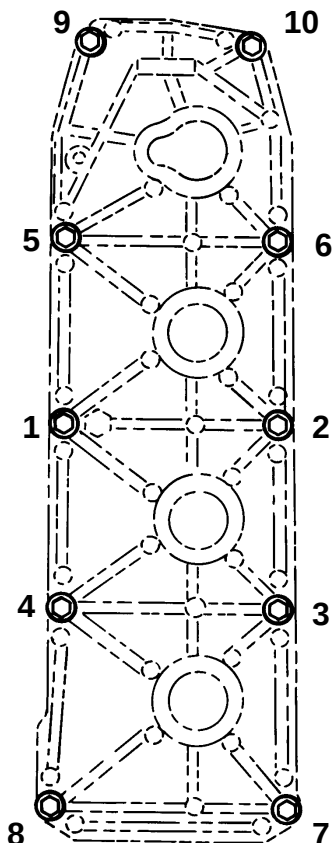




# Powerhead Torque Sequence and Torque Spec- ifications

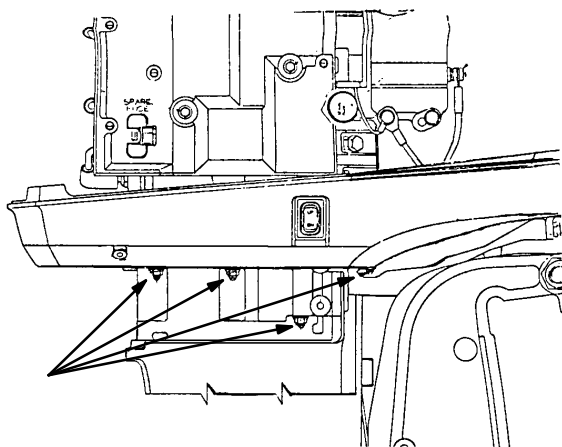
## CYLINDER BLOCK COVER BOLTS

100 lb. in. (11.5 N·m)



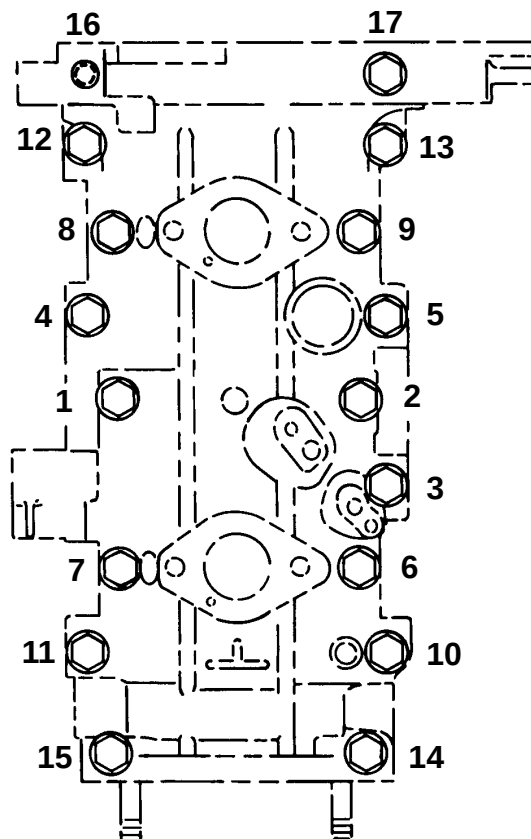
## POWERHEAD TO DRIVESHAFT HOUSING

12.5 lb. ft. (17.0 N·m)



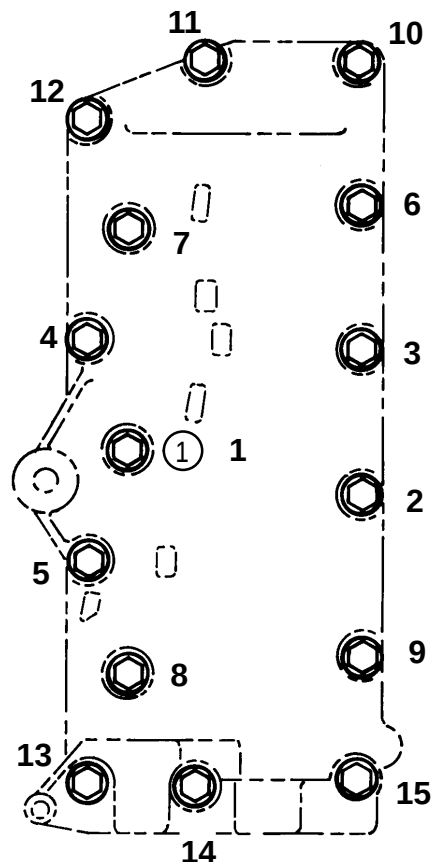
## CRANKCASE COVER BOLTS

17.5 lb. ft. (23.5 N·m)



## EXHAUST COVER

16.5 lb. ft. (22.5 N·m)



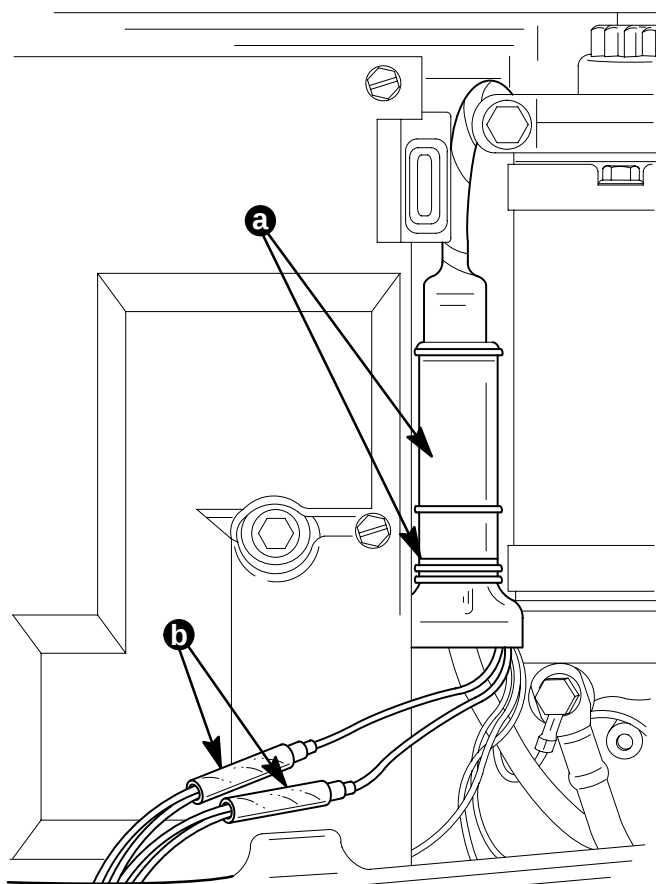


# Powerhead Removal from Driveshaft Housing

## Electric Start Model

1. Disconnect powerhead battery cables from battery.
2. Remove top cowling.
3. Remove Spark Plug leads from spark plugs.
4. Disconnect powerhead and remote control electrical harness connector.

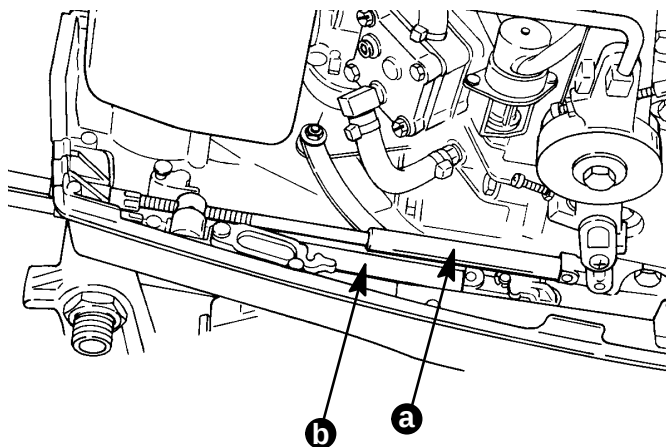
Disconnect remote control trim control leads (BLUE/WHITE and GREEN/WHITE), if applicable.



26835

- a - Harness Connector  
b - Trim Control Leads

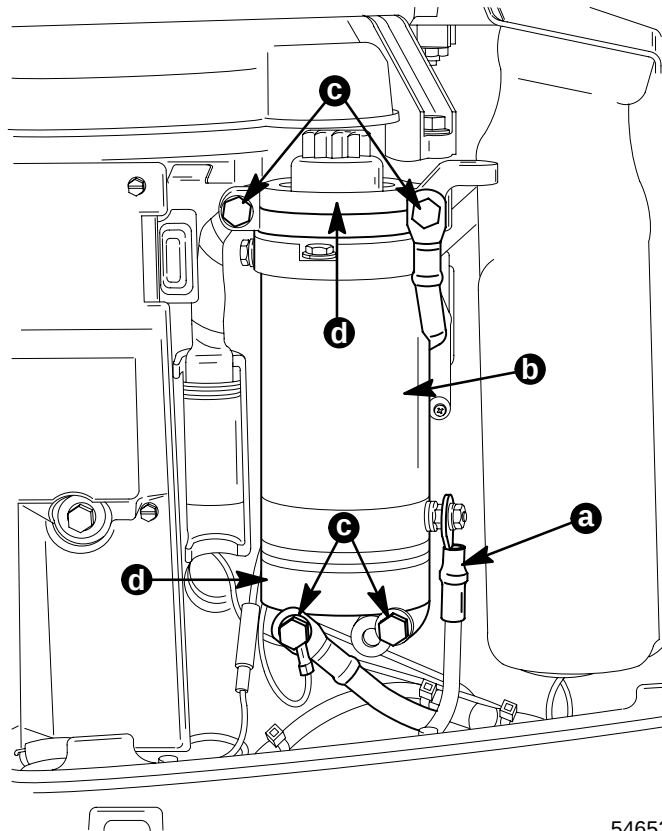
5. Remove shift and throttle cables from engine.



50564C

- a - Throttle Cable  
b - Shift Cable

6. Remove POSITIVE LEAD from starter motor.
7. Remove four bolts securing starter motor and remove retaining clamps and starter motor from powerhead.

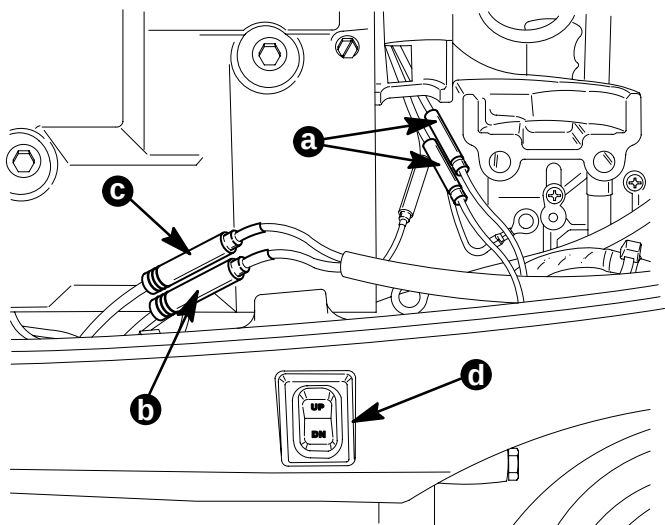


54652

- a - Positive Lead  
b - Starter Motor  
c - Bolts  
d - Retaining Clamps



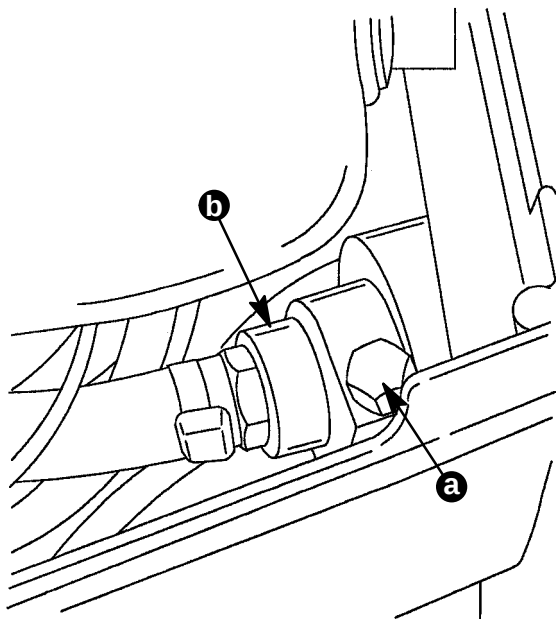
8. Disconnect two blue low oil level leads at their bullet connectors.
9. Disconnect blue/white and green/white power trim switch leads at their bullet connectors.



54668

- a - Blue Leads
- b - Blue/White Lead
- c - Green/White Lead
- d - Trim Switch

10. Remove bolt securing fuel line connector to bottom cowl.

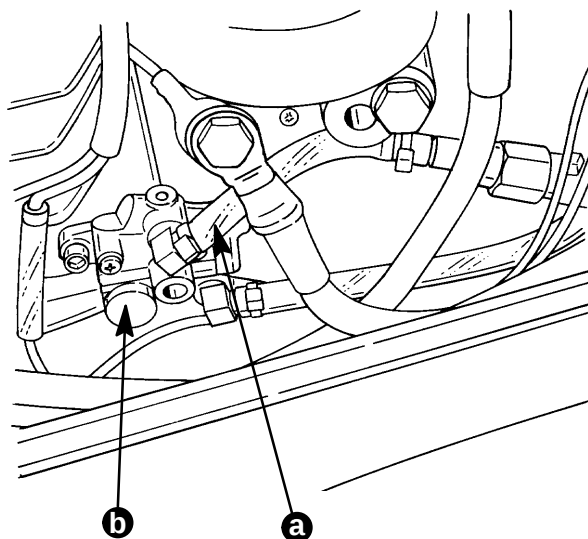


54669

- a - Bolt
- b - Fuel Line Connector

11. Remove inlet hose from oil pump.

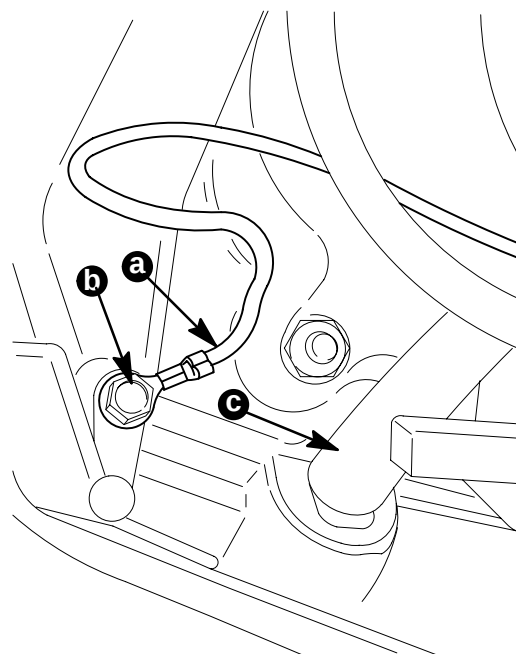
**NOTE:** If oil tank contains oil, inlet hose to oil pump must be plugged when disconnected to prevent oil leakage.



53119

- a - Inlet Hose
- b - Oil Pump

12. Remove black lead from grounding bolt at aft starboard corner of bottom cowl.
13. Remove tell-tale hose from bottom cowl.



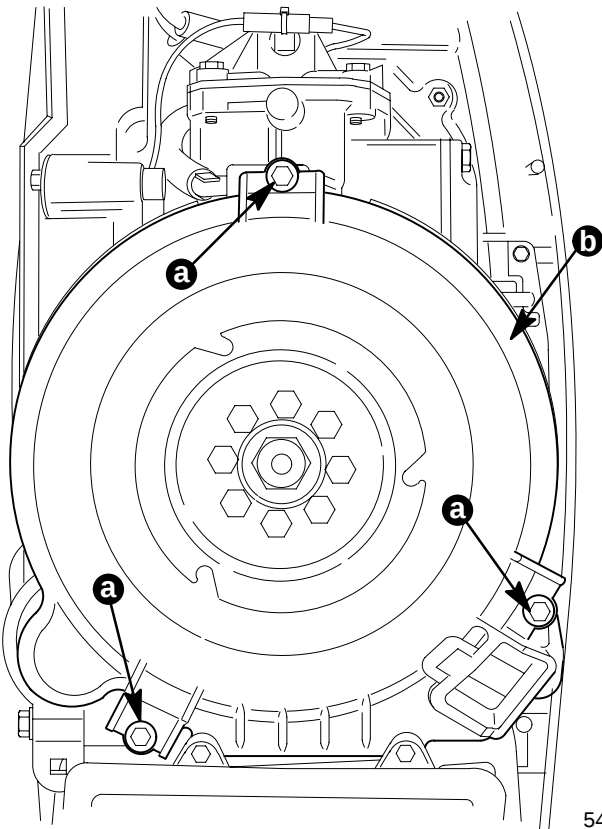
54670

- a - Black Lead
- b - Grounding Bolt
- c - Tell-Tale Hose



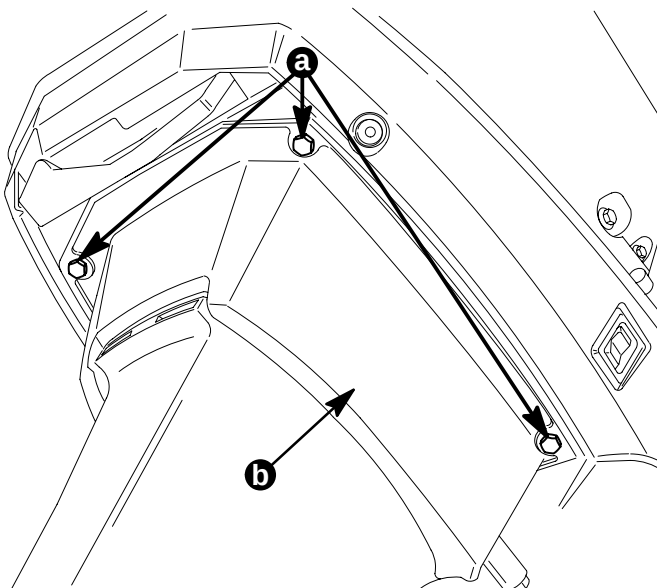
14. Remove three bolts securing flywheel cover to powerhead and remove cover and oil tank assembly.

**NOTE:** Hold oil tank securely when removing from powerhead as oil tank may detach from flywheel cover assembly.



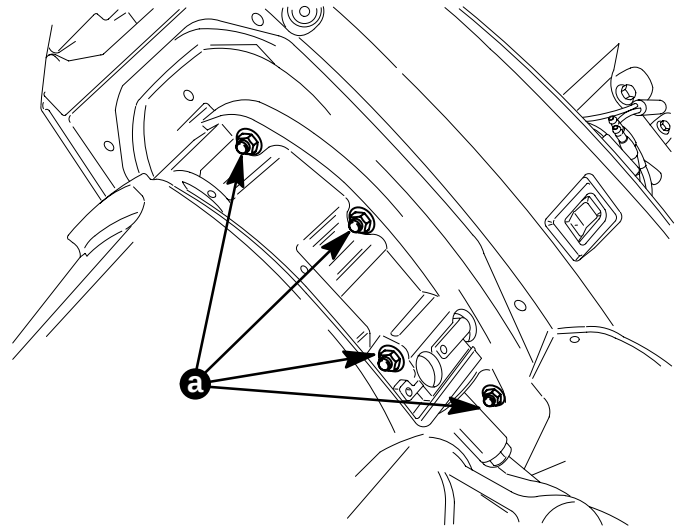
- a - Bolts  
b - Flywheel Cover

15. Remove four bolts securing trim cover to bottom cowl and remove cover.



- a - Bolts (2 Each Side)  
b - Trim Cover

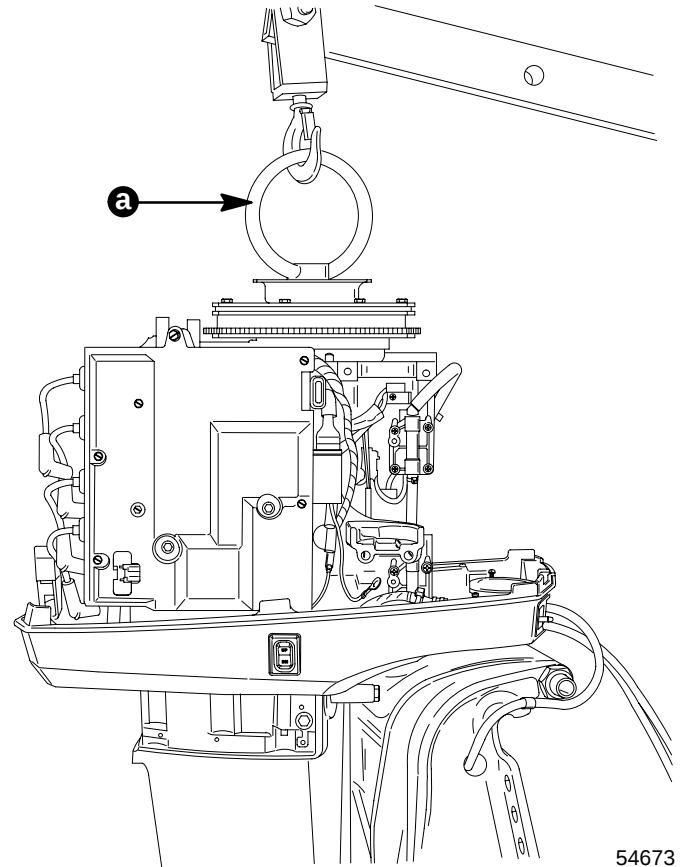
16. Remove eight nuts securing powerhead to drive shaft housing.



54672

- a - Nuts (4 Each Side)

17. Remove plastic cap from center of flywheel and thread Lifting Eye (91-75132) into flywheel. Using hoist, lift powerhead from driveshaft housing and install on Powerhead Stand (91-25821A1) or work bench.



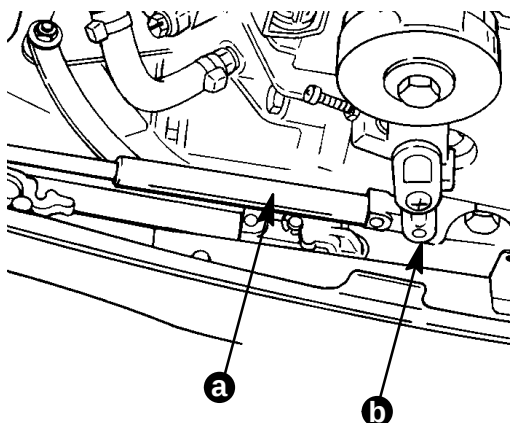
54673

- a - Lifting Eye (91-75132)



## Manual Start Model

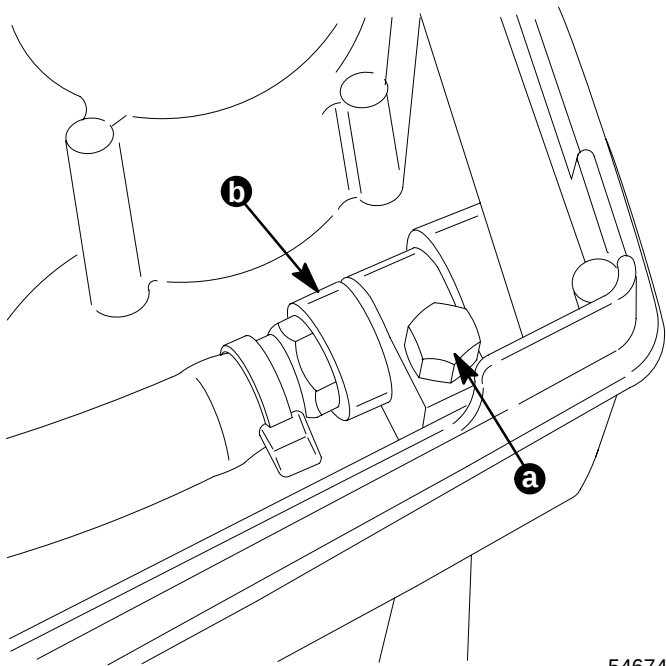
1. Disconnect any alternator charging leads from battery.
2. Remove top cowl.
3. Remove spark plug leads from spark plugs.
4. Unlatch cable retainer and remove throttle cable from throttle/spark arm and shift cable from shift bracket.



26830

- a - Throttle Cable  
b - Throttle Cable Latch

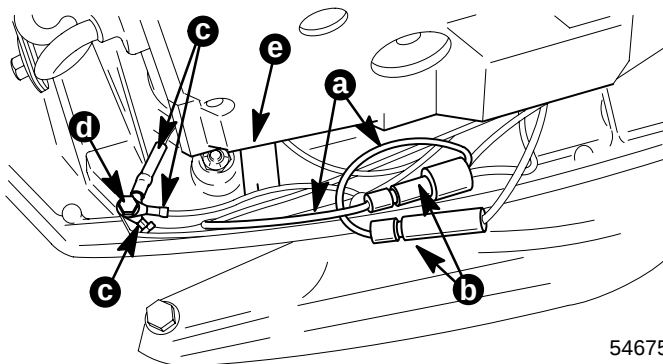
5. Remove bolt securing fuel connector to bottom cowl.



54674

- a - Bolt  
b - Fuel Connector

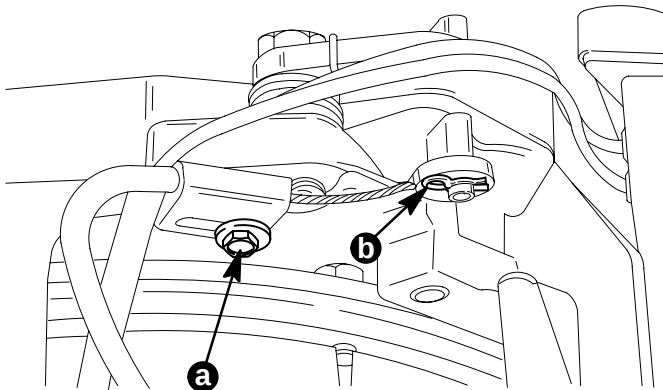
6. Disconnect BLACK/YELLOW stop leads at both bullet connectors.
7. Remove three black leads from grounding bolt at aft starboard corner of bottom cowl.
8. Remove tell-tale hose from bottom cowl.



54675

- a - Black/Yellow Leads  
b - Bullet Connectors  
c - Black Leads  
d - Bolt  
e - Tell-Tale Hose

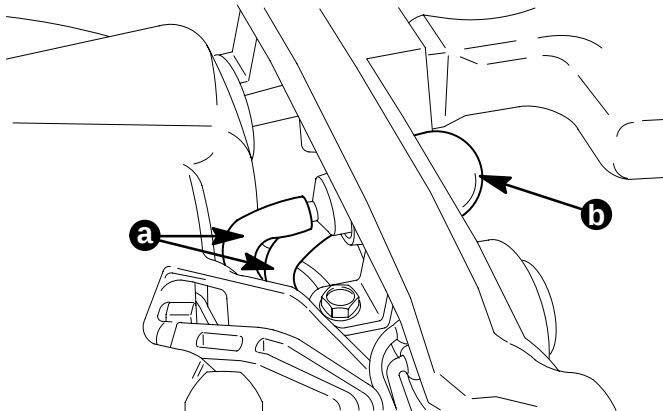
9. Remove bolt and retaining clip from anti-start-in-gear linkage.



54676

- a - Bolt  
b - Retaining Clip

10. Remove two fuel hoses from enricher valve.

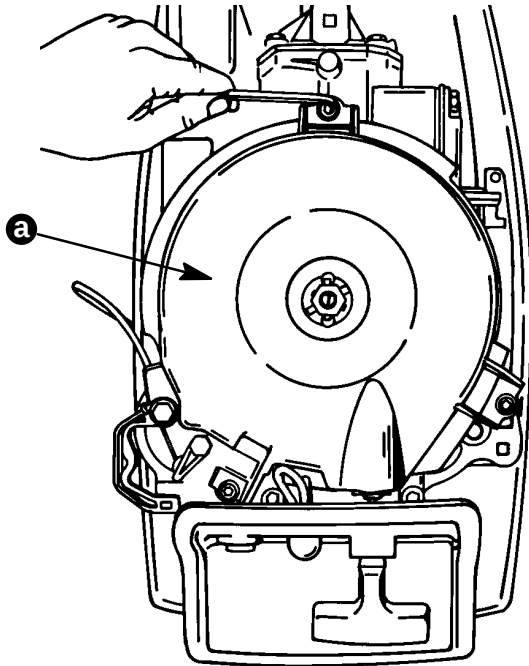


54677

- a - Fuel Hoses  
b - Enricher Valve



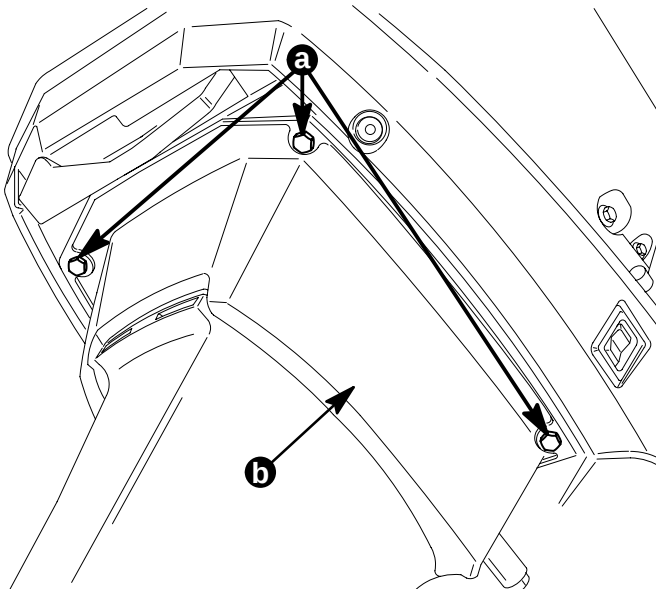
11. Remove three bolts securing recoil starter to powerhead and remove recoil assembly.



26817

a - Recoil Starter

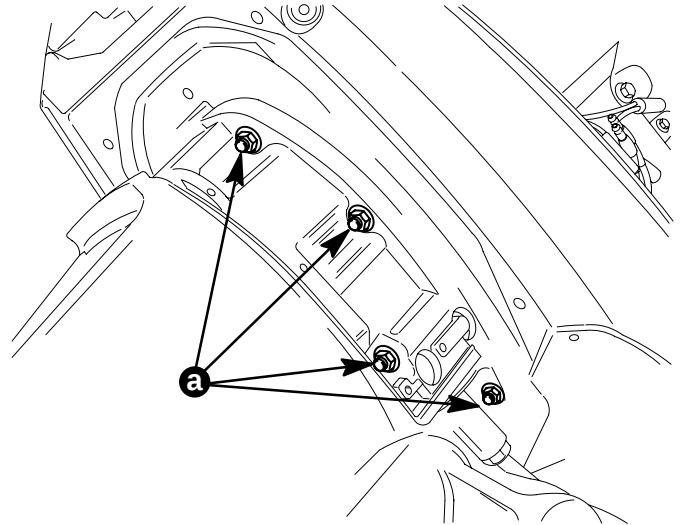
12. Remove four bolts securing trim cover to bottom cowl and remove cover.



54671

a - Bolts (2 Each Side)  
b - Trim Cover

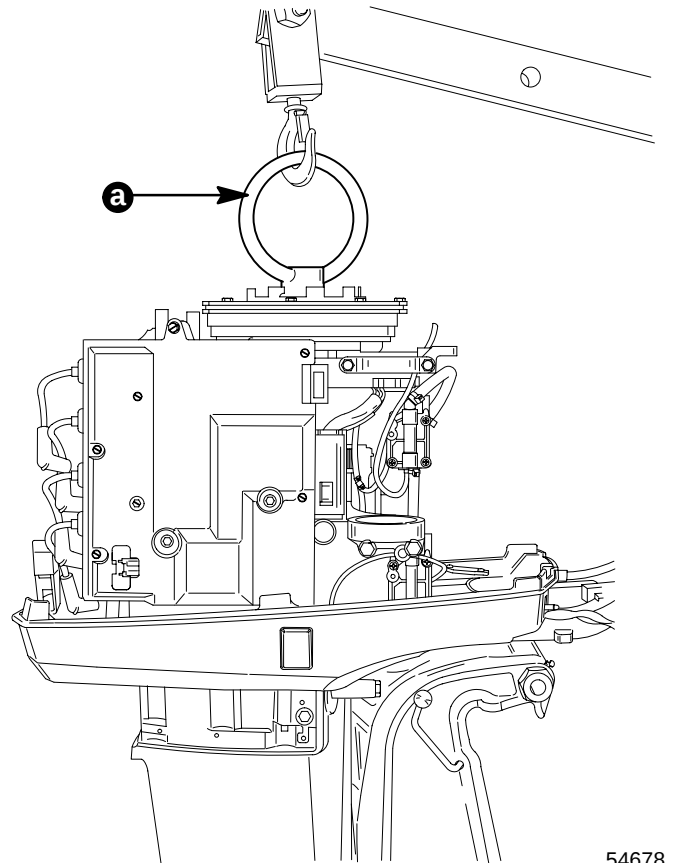
13. Remove eight nuts securing powerhead to drive-shaft housing.



26815

a - Nuts (4 Each Side)

14. Remove plastic cap from center of flywheel and thread lifting eye (91-75132) into flywheel. Using hoist, lift powerhead from driveshaft housing and install on powerhead stand (91-25821A1) or work bench.



54678

a - Lifting Eye (91-75132)



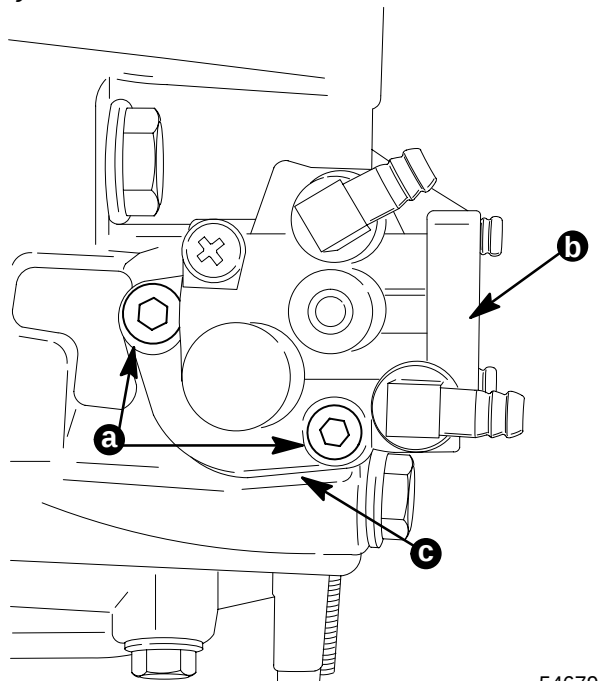
## Powerhead Disassembly

1. Remove the following components/assemblies referring to the listed service manual sections.

| Component/Assembly                               | Section |
|--------------------------------------------------|---------|
| Rewind Starter                                   | 2A      |
| Flywheel                                         | 2A      |
| Ignition Components                              | 2A      |
| Starter Motor                                    | 2B      |
| Carburetors, Fuel Pump and Fuel Enrichment Valve | 3A      |

2. Remove two allen screws securing oil pump to crankcase cover. Remove oil pump and driven gear.

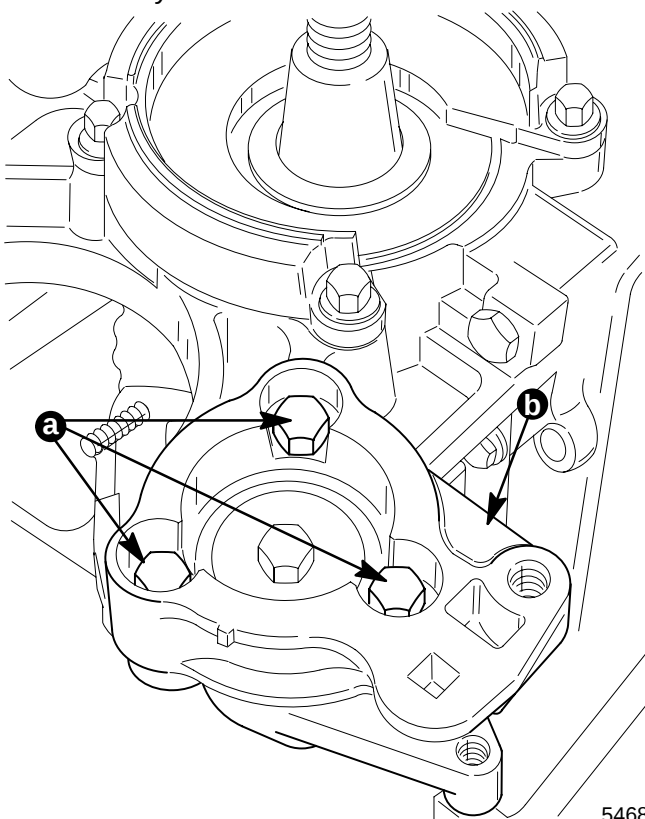
**NOTE:** If driven gear remains in crankcase cover, it can be removed when crankcase cover is removed from cylinder block.



54679

- a - Allen Screws
- b - Oil Pump
- c - Driven Gear (Hidden)

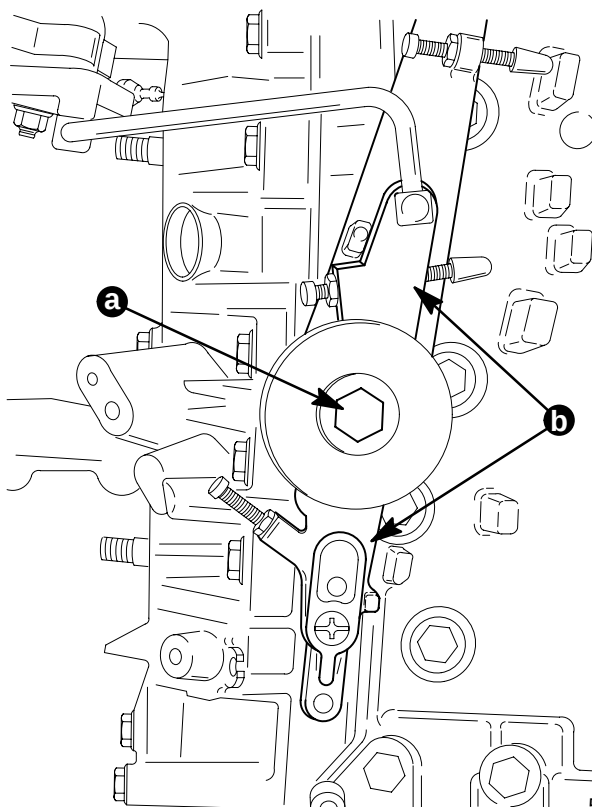
3. Remove three bolts attaching throttle actuator assembly to crankcase cover.



54680

- a - Bolts
- b - Throttle Actuator Assembly

4. Remove bolt securing throttle/spark arm to exhaust manifold cover and remove arm assembly.

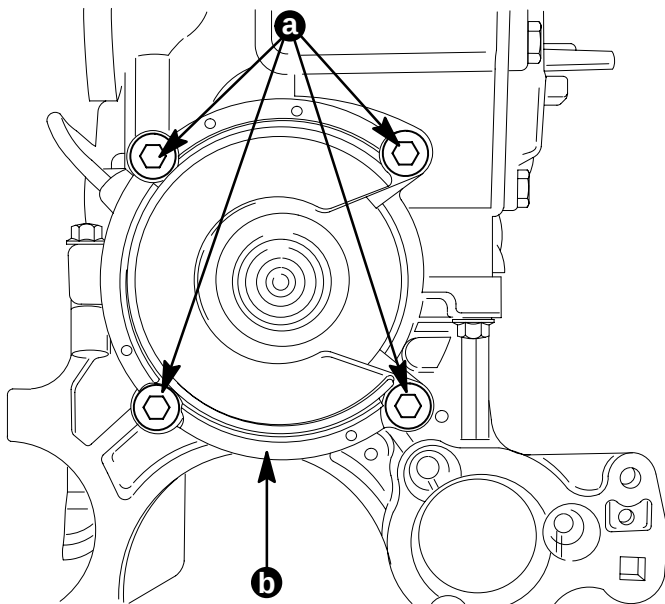


54681

- a - Bolt
- b - Throttle/Spark Arm

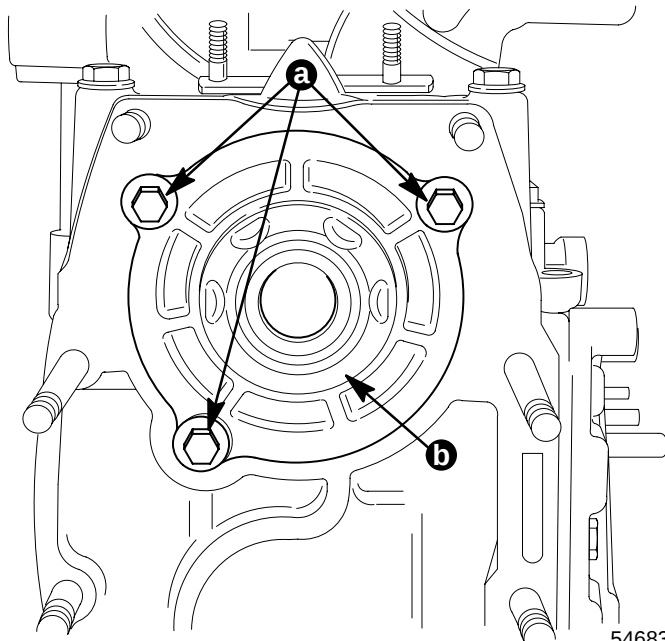


5. Remove bolts securing upper and lower end caps to cylinder block and crankcase cover.



54682

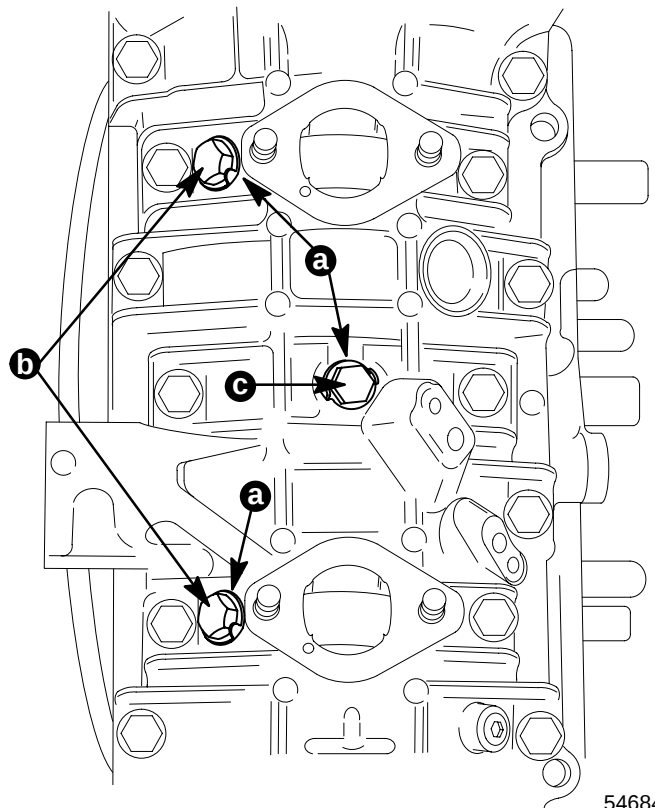
- a - Bolts  
b - Upper End Cap



54683

- a - Bolts  
b - Lower End Cap

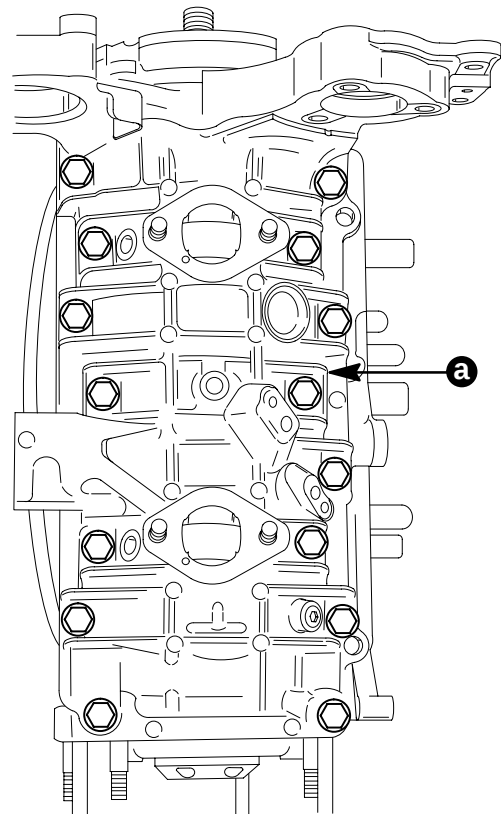
6. Bend back lock tabs on reed cage bolts and center main bolt.



54684

- a - Locking Tab Washer  
b - Reed Cage Bolt  
c - Center Main Bolt

7. Remove 17 bolts securing crankcase cover to block.

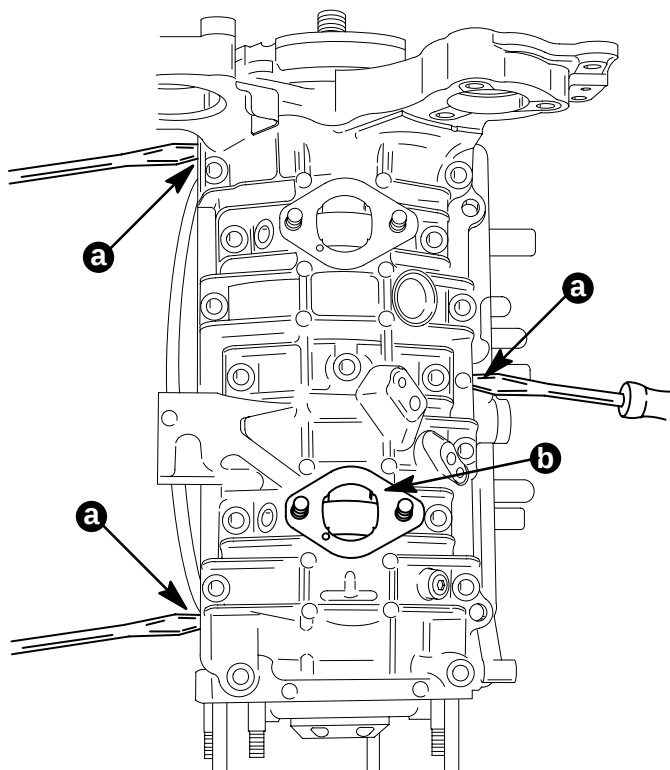


54685

- a - Crankcase Cover



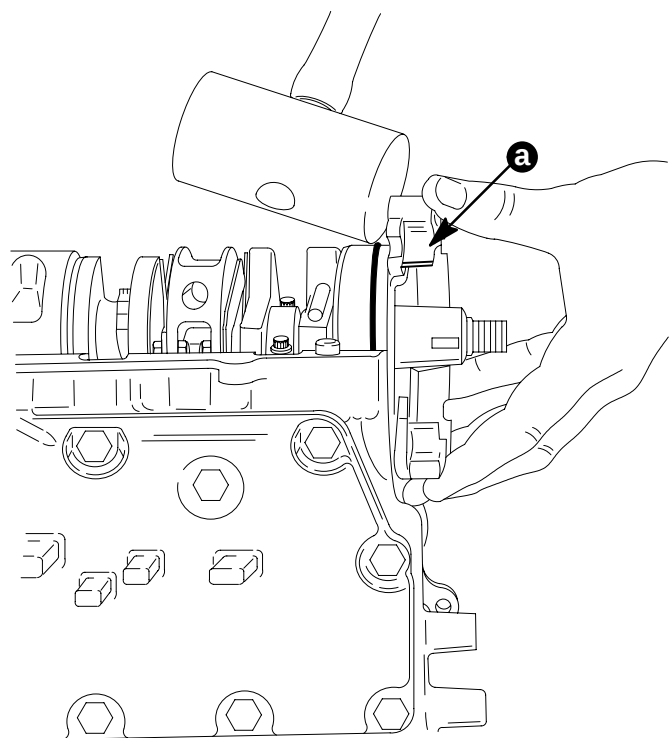
8. Using pry points to aid in removal, lift crankcase cover from cylinder block.



54686

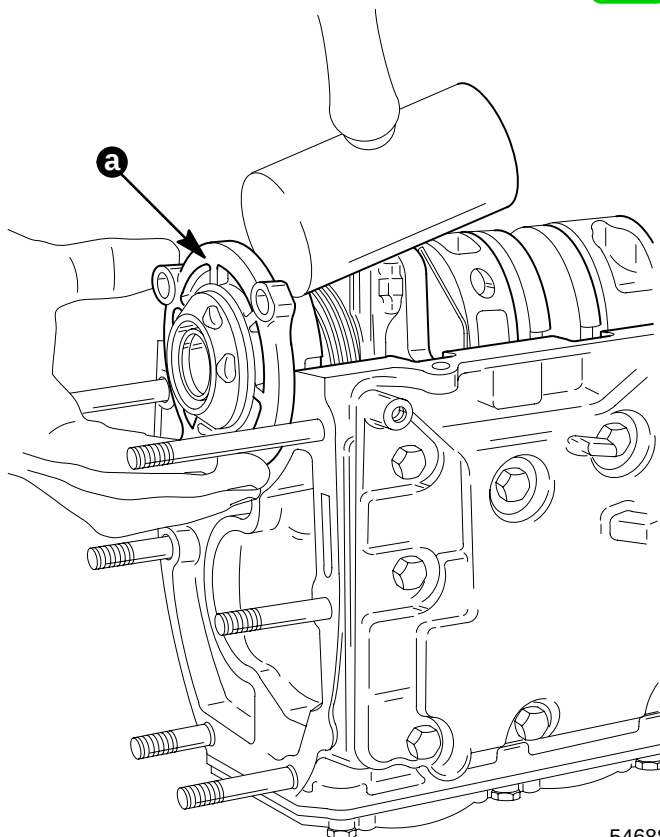
a - Pry Points  
b - Crankcase Cover

9. Gently tap upper and lower end caps from crankshaft with rawhide mallet.



54687

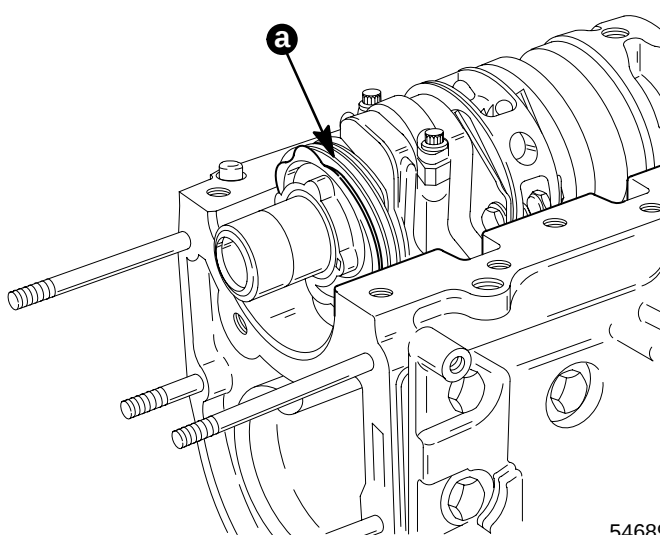
a - Upper End Cap



54688

a - Lower End Cap

10. Remove oil pump drive gear (electric start models only) from crankshaft. Gear slides off crankshaft.

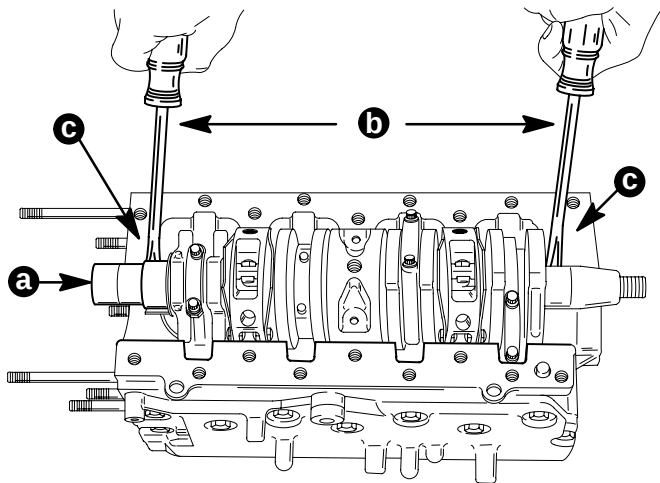


54689

a - Oil Pump Drive Gear



11. Remove crankshaft assembly from cylinder block. If pry bar is used to aid in removal of crankshaft assembly, pad surface of block where pry bar contacts.

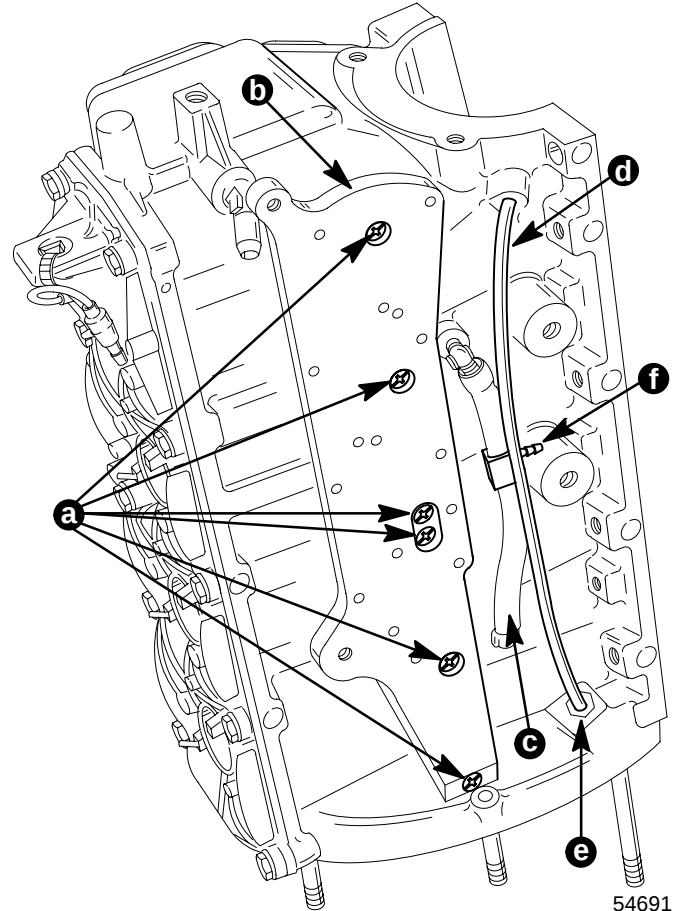


54690

- a - Crankshaft Assembly  
b - Pry Bar  
c - Pad

12. Remove 6 screws securing transfer cover to cylinder block and remove cover.  
13. Remove balance tube and fittings from cylinder block.  
14. Remove bleed hose and bleed check valve from cylinder block.  
15. Remove tell-tale hose and fitting from cylinder block.

**NOTE:** Manual Start Models and some early Electric Start Models have fuel enrichment fitting in the balance tube.

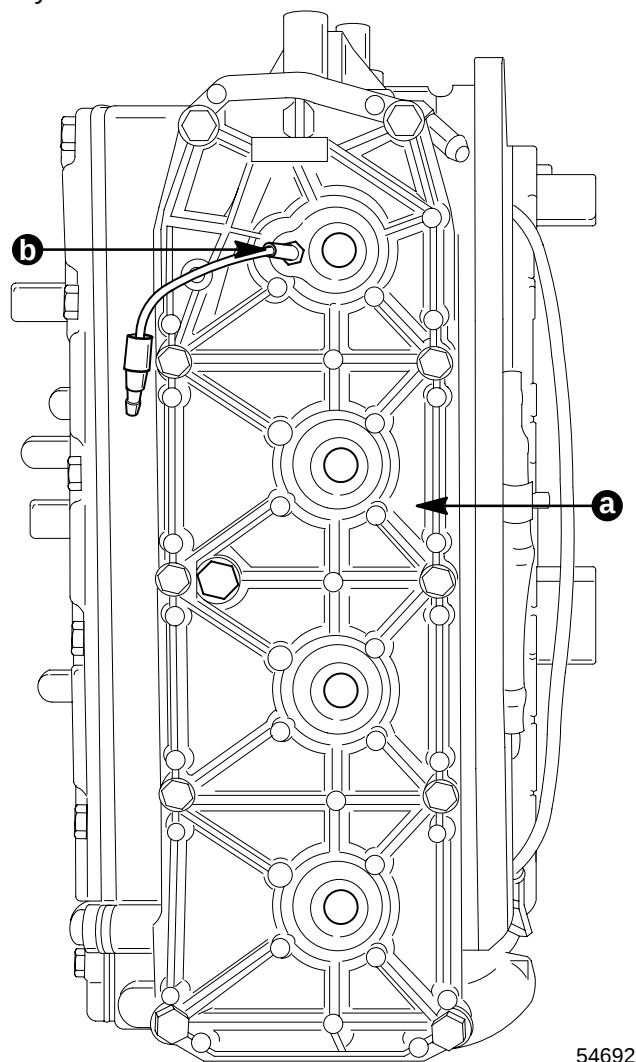


54691

- a - Screws  
b - Transfer Cover  
c - Balance Tube  
d - Bleed Hose  
e - Bleed Check Valve  
f - T-Fitting (Fuel Enrichment)

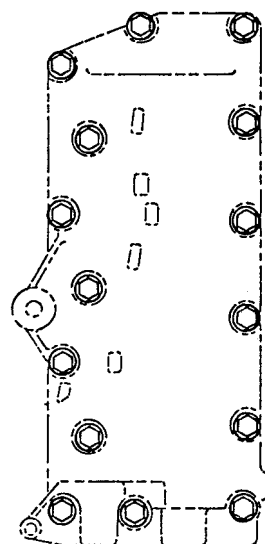


16. Remove 10 bolts from cylinder block cover and remove cover. Remove temperature switch from cylinder block.



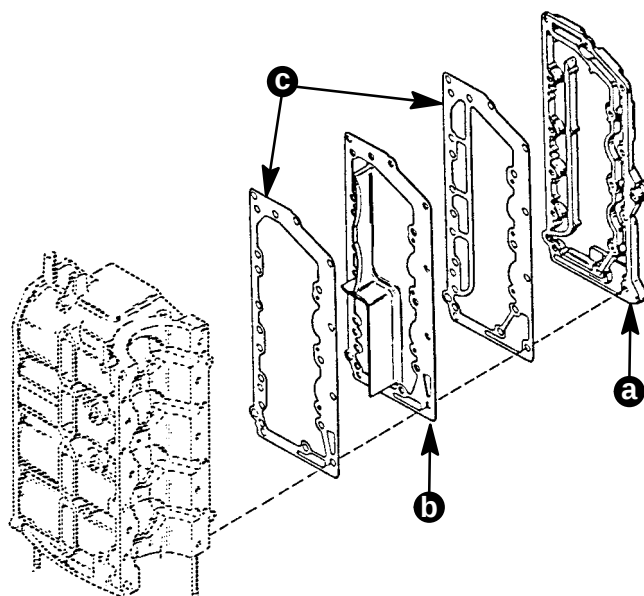
a - Cylinder Block Cover  
b - Temperature Switch

17. Remove 15 bolts from exhaust manifold cover and remove manifold cover and baffle plate from cylinder block.



Exhaust Manifold Cover

50532



a - Exhaust Manifold Cover  
b - Baffle Plate  
c - Gaskets

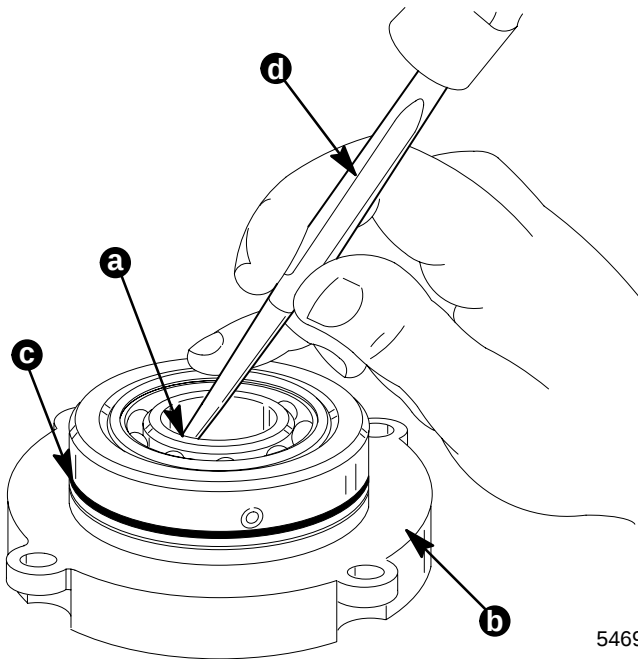


## End Cap Disassembly

**IMPORTANT:** It is recommended that new oil seals be installed in end caps, regardless of appearance, to ensure lasting repair.

### UPPER END CAP

1. Drive oil seal from end cap with a suitable punch.  
Discard oil seal.
2. Remove and discard O-ring from end cap.



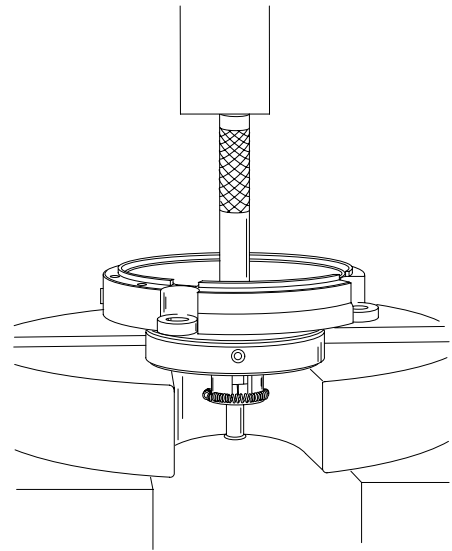
- a - Seal (Hidden)
- b - Upper End Cap
- c - O-Ring
- d - Punch

3. Inspect ball bearing located in the end cap as outlined in "Cleaning and Inspection," following.

**IMPORTANT:** DO NOT remove ball bearing from end cap unless replacement is required.

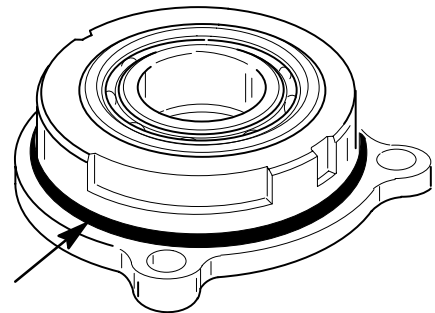
**IMPORTANT:** It is recommended that heat be applied carefully to end cap housing to aid in removal of ball bearing.

4. If inspection determines that replacement of ball bearing is required, use Ball Bearing Puller (91-24100A1) and press ball bearing from end cap.



### LOWER END CAP

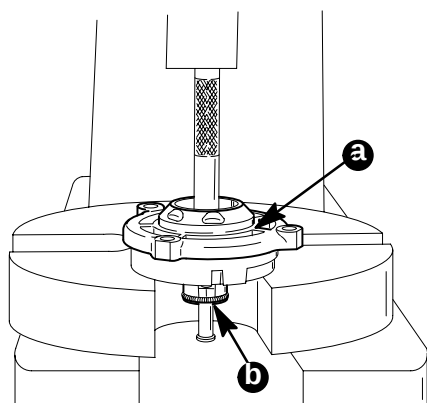
1. Remove and discard O-ring from end cap.





2. Use Ball Bearing Puller (91-24100A1) and press ball bearing from end cap. Inspect ball bearing as outlined in "Cleaning and Inspection," following.

**IMPORTANT:** It is recommended that heat be applied carefully to end cap housing to aid in removal of ball bearing.

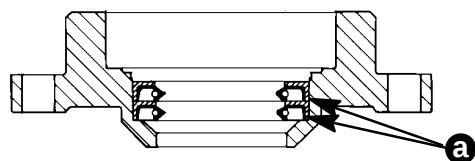


54695

- a - Lower End Cap  
b - Ball Bearing Puller (91-24100A1)

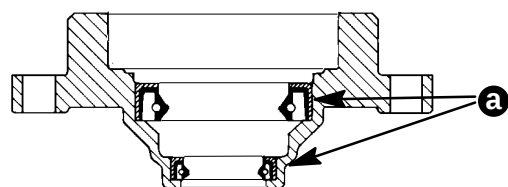
3. Drive oil seals from end cap with a suitable punch. Discard oil seals.

#### Design 1 End Cap



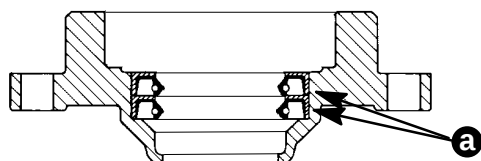
- a - Oil Seals

#### Design 2 End Cap



- a - Oil Seals

#### Design 3 End Cap



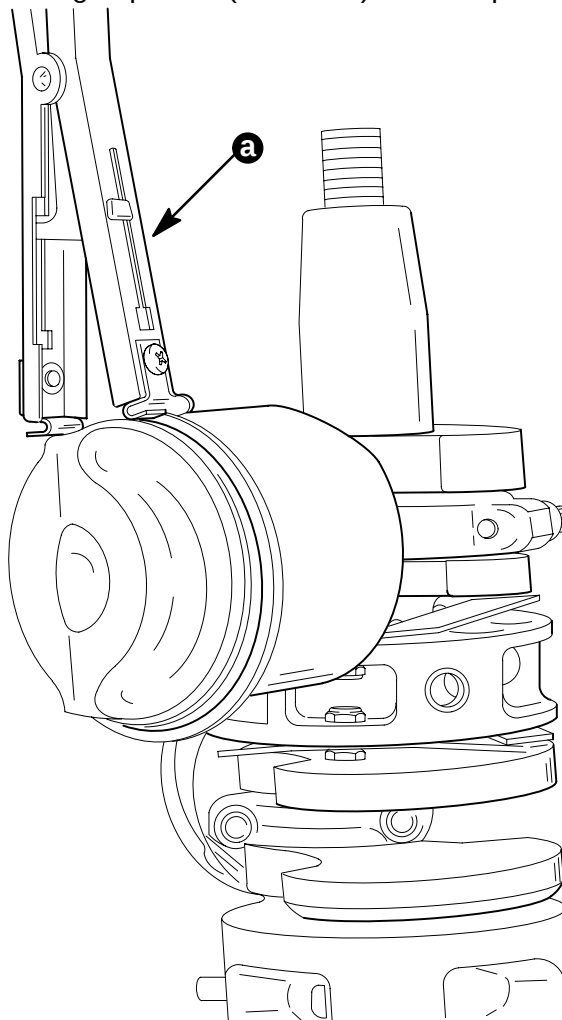
- a - Oil Seals

## Crankshaft Disassembly

### ⚠ WARNING

Eye Protection must be worn while removing piston rings and piston pin lock rings from pistons.

1. Remove piston rings from pistons with Piston Ring Expander (91-24697). Discard piston rings.

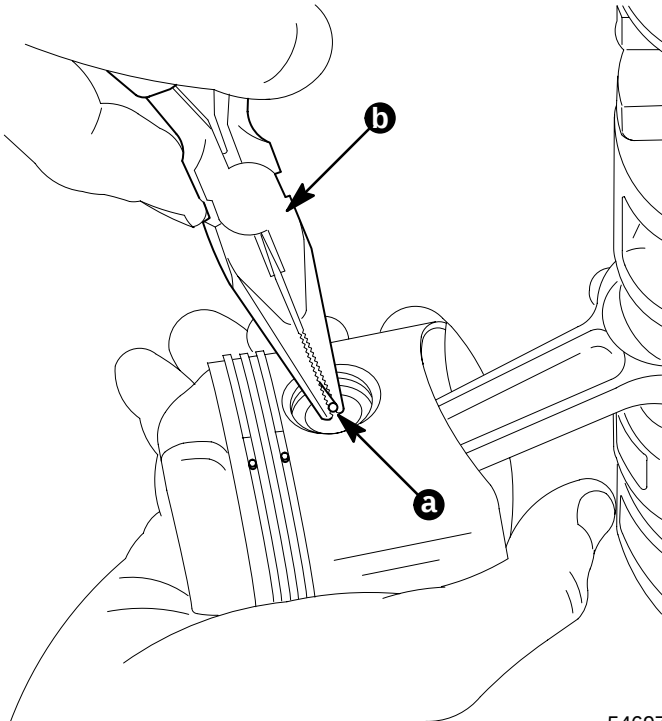


54696

- a - Piston Ring Expander (91-24697)



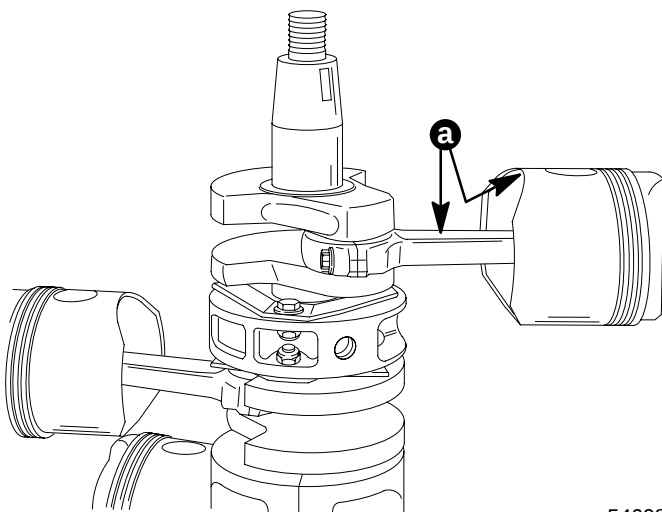
2. Remove piston pin lock rings from both ends of piston pin bores. Discard lock rings. DO NOT re-use piston pin lock rings.



54697

- a - Piston Pin Lock Ring (One Each Side)  
b - Needle Nose Pliers

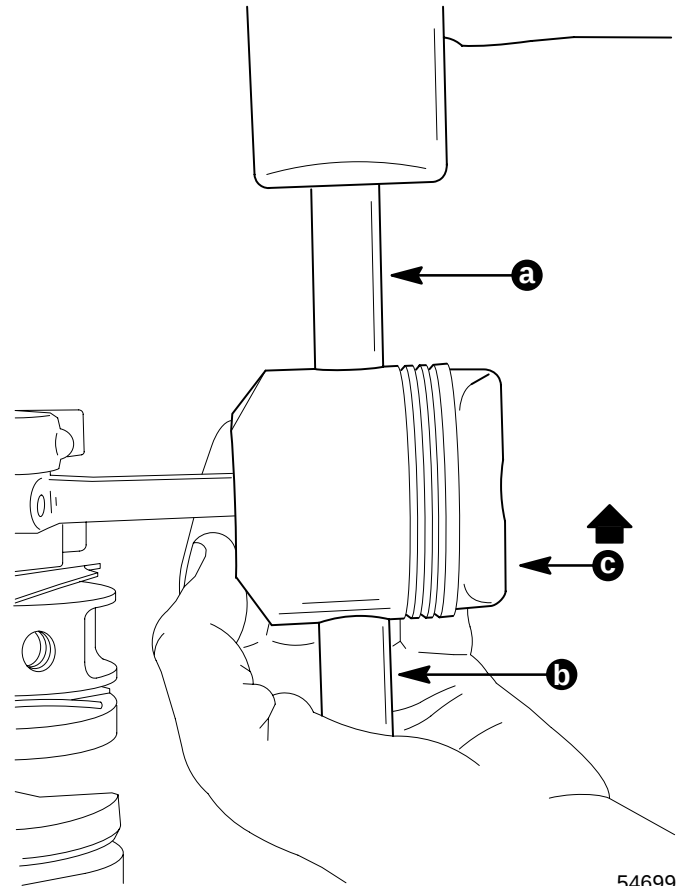
3. Use an awl and mark each connecting rod and piston with the same number as the cylinder to which it is installed. Mark connecting rods on the "I" beam and piston on inside of skirt.



54698

- a - Scribe Identification No. on Connecting Rod and Inside of Piston Skirt

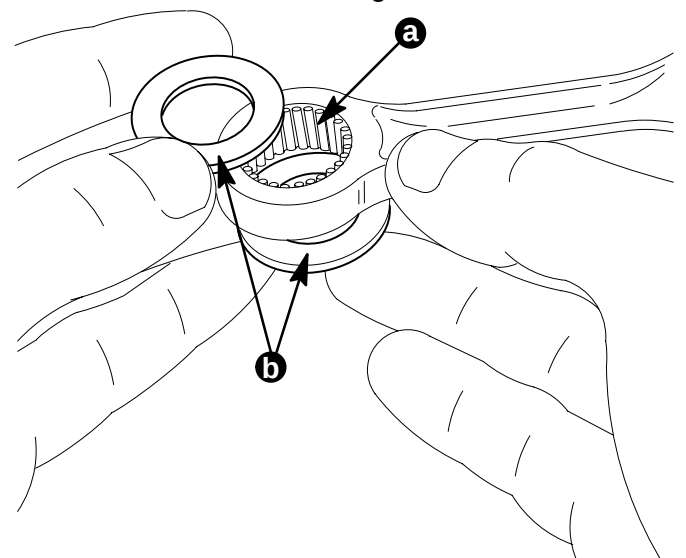
4. Place Piston Pin Tool (91-76160A2) into top of piston pin. Support bottom of piston with hand and tap on end of piston pin tool with mallet, pushing piston pin out of piston. Remove piston from connecting rods.



54699

- a - Piston Pin Tool (91-76160A2)  
b - Piston Pin  
c - Support Piston (Up) While Forcing Piston Pin Out

5. Remove piston pin needle bearings and locating washers from connecting rod.



54700

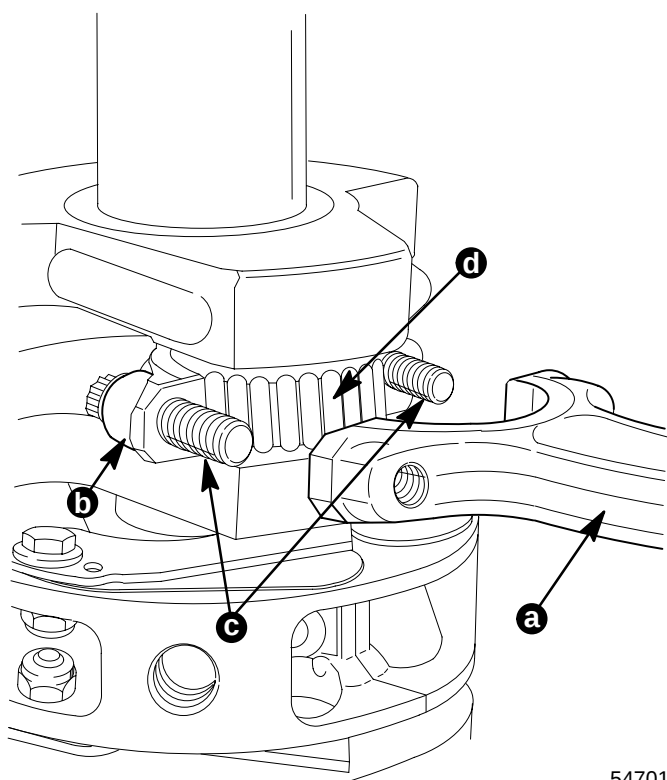
- a - Needle Bearings (27 Required)  
b - Locating Washers



**IMPORTANT:** It is recommended that new needle bearings be installed in connecting rod to ensure lasting repair.

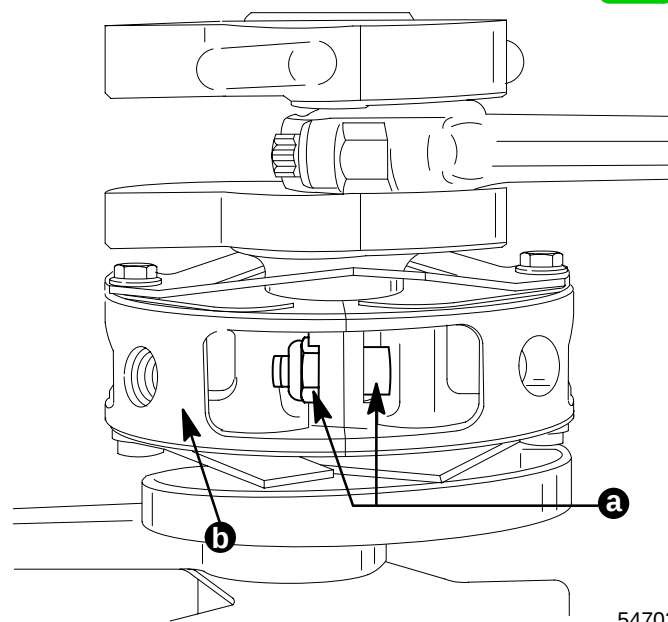
**NOTE:** If needle bearings must be reused, store them in numbered container so they can be reinstalled with same connecting rod. DO NOT intermix needle bearings from one connecting rod with those from another connecting rod. Keep needle bearings clean.

6. Remove and discard connecting rod bolts. Separate connecting rod from rod cap. Remove connecting rod, cap and needle bearings from crank pin throw. Keep connecting rod, cap and needle bearings together, if they are to be reused.



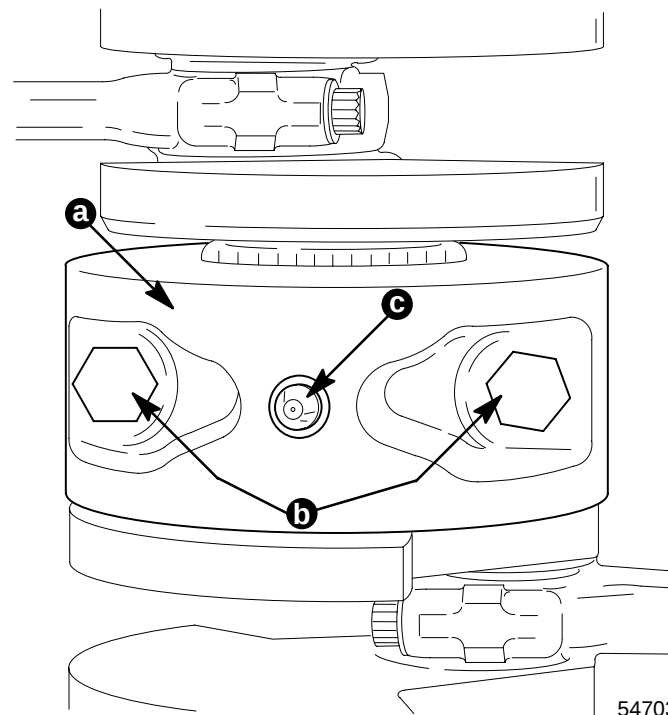
- a - Connecting Rod
- b - Connecting Rod Cap
- c - Connecting Rod Bolts
- d - Needle Bearing (25 Required)

7. Remove two screws and locknuts which secure both halves of reed block together. Remove reed block from crankshaft.



- a - Screw and Nut (One Each Side)
- b - Reed Block

8. Reassemble each reed block as it is removed to assure correct rematch of each assembly.
9. Inspect reed blocks as outlined in "Cleaning and Inspection," following. If inspection indicates that replacement of a part is necessary, remove part from reed block.
10. Remove two bolts which secure both halves of the center main bearing support together. Remove center main bearing support from crankshaft.



- a - Center Main Bearing Support
- b - Bolts
- c - Locating Pin



# Cleaning and Inspection

## Cylinder Block and Crankcase Cover

**IMPORTANT:** Crankcase cover and cylinder block are a matched, line-bored assembly and never should be mismatched by using a different crankcase cover or cylinder block.

### ⚠ CAUTION

While honing and cleaning procedures are being performed on cylinder block, all bleed system components – hoses, fittings and check valve – **MUST BE REMOVED** from cylinder block to prevent damage from abrasive materials.

## Cylinder Bore (Cleaning and Inspection)

1. Inspect cylinder bores for scoring, scuffing or a transfer of aluminum from piston to cylinder wall. Scoring or scuffing, if NOT TOO SEVERE, can normally be removed by honing. If a transfer of aluminum has occurred, an acidic solution such as "Tidy Bowl Cleaner" should be applied to the areas of the cylinder bore where transfer of aluminum has occurred. After the acidic solution has removed the transferred aluminum, thoroughly flush the cylinder bore(s) to remove any remaining acid. Cylinder walls may now be honed to remove any glaze and to aid in the seating of new piston rings.

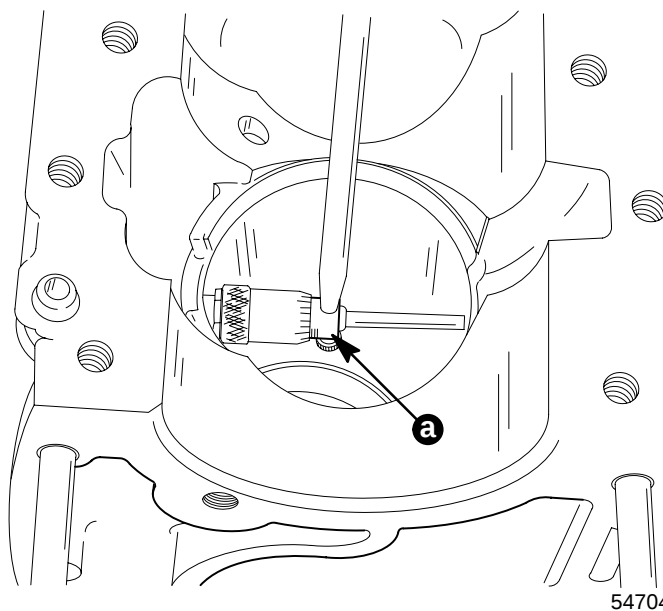
### HONING PROCEDURE

- a. When cylinders are to be honed, follow the hone manufacturer's recommendations for use of the hone, cleaning and lubrication during honing.
- b. For best results, a continuous flow of honing oil should be pumped into the work area. If pumping oil is not practical, use an oil can. Apply oil generously and frequently on both stones and work.

### ⚠ CAUTION

When honing cylinder block, remove hone frequently and check condition of cylinder walls. **DO NOT** hone any more than absolutely necessary, as hone can remove cylinder wall material rapidly.

- c. Localize stroking in the smallest diameter until drill speed is constant throughout length of bore. Maintain firm stone pressure against cylinder wall to assure fast stock removal and accurate results. Expand stones, as necessary, to compensate for stock removal and stone wear. Stroke at a rate of 30 complete cycles per minute to produce best crosshatch pattern. Use honing oil generously.
  - d. Thoroughly clean cylinder bores with hot water and detergent. Scrub well with a stiff bristle brush and rinse thoroughly with hot water. A good cleaning is essential. If any of the abrasive material is allowed to remain in the cylinder bore, it will cause rapid wear of new piston rings, cylinder bore and bearings. After cleaning, bores should be swabbed several times with engine oil and a clean cloth, then wiped with a clean, dry cloth. Cylinders **SHOULD NOT** be cleaned with kerosene or gasoline. Clean remainder of cylinder block to remove excess material spread during honing operating.
2. Hone all cylinder walls **JUST ENOUGH** to deglaze walls.
  3. Measure cylinder bore diameter (with an inside micrometer) of each cylinder. Check for tapered, out-of-round ("egg-shaped") and oversized bore.



a - Inside Micrometer



## Cylinder Bore Size

| Piston Size                | Cylinder Bore Finish Hone |
|----------------------------|---------------------------|
| With Standard Size Piston  | 2.565" (65.15mm)          |
| With .015" Oversize Piston | 2.580" (65.53mm)          |
| With .030" Oversize Piston | 2.595" (65.91mm)          |

1. If cylinder bore is tapered, out-of-round or worn more than .004" (0.10mm) from "STANDARD PISTON DIAMETERS and CYLINDER BLOCK FINISH HONE" (refer to chart, preceding), it will be necessary to re-bore cylinders to .015" (0.38mm) or .030" (0.762mm) oversize and install oversize piston(s) and piston rings during reassembly. If .030" oversize cylinder block finish hone diameter is tapered, out-of-round or worn more than .004", cylinder block must be replaced.

**NOTE:** The weight of an oversize piston is approximately the same as a standard size piston, therefore, it is not necessary to re-bore all cylinders in a block just because one cylinder requires re-boring.

2. After honing and thoroughly cleaning cylinder bores, apply light oil to cylinder walls to prevent rusting.

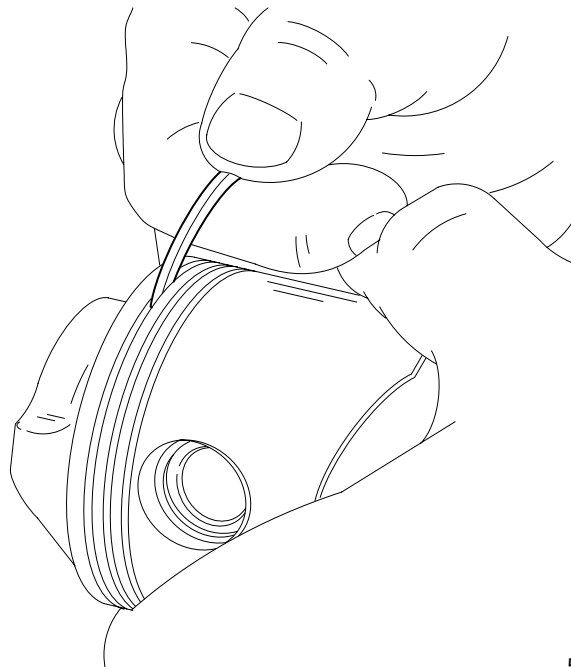
## Pistons

**NOTE:** To assure lasting repairs and proper engine operation after repairs, it is important that piston rings be replaced.

**IMPORTANT:** If engine was submerged while engine was running, piston pin and/or connecting rod may be bent. If piston pin is bent, piston must be replaced. (Piston pins are not sold separately because of matched fit into piston.) If piston pin is bent, connecting rod must be checked for straightness (refer to "Connecting Rods," following, on how to check straightness).

1. Check pistons for scoring, cracks, metal damage and cracked or worn piston pin bosses. If any of these conditions are found, replace piston(s).

2. Inspect piston ring grooves for wear, burns, distortion or loose piston ring locating pins.
3. Clean piston dome, ring grooves and piston skirt. Use recessed end of a broken piston ring to clean carbon deposits from ring grooves. DO NOT use an automotive type ring groove cleaner, as this type tool could loosen piston ring locating pins.



54705

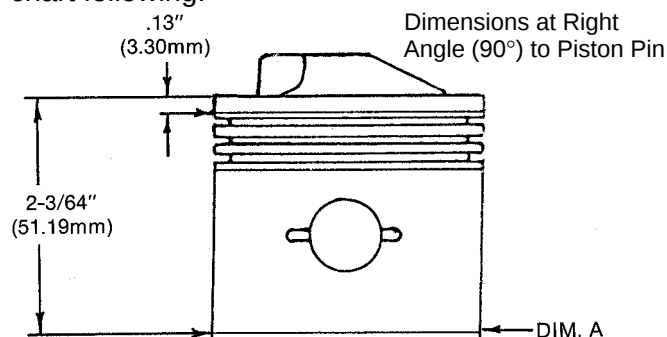
4. Clean carbon deposits from top of pistons with a soft wire brush, carbon removal solution or sand blasting. When wire brushing top of piston, DO NOT burr or round machined edges. Clean (polish) piston skirt with crocus cloth.
5. After thoroughly cleaning pistons, check each piston size and roundness, using a micrometer. Piston must be measured as described, following.



## Measuring Piston Roundness

Piston has a tapered cam profile shape and is not a true diameter.

Using a micrometer, measure dimension "A" at location shown. Dimension should be as indicated in chart following.

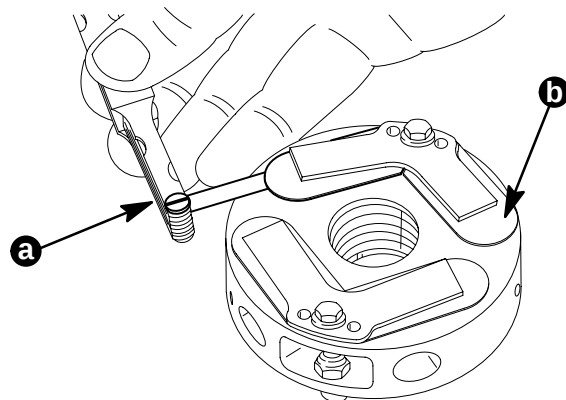


| Piston Size           | Piston Measurements Dimension "A" | Cyl. Block Finish Hone |
|-----------------------|-----------------------------------|------------------------|
| Standard Piston       | 2.558" (64.97mm)                  | 2.565" (65.15mm)       |
| .015" Oversize Piston | 2.573" (65.35mm)                  | 2.580" (65.53mm)       |
| .030" Oversize Piston | 2.588" (65.74mm)                  | 2.595" (65.91mm)       |

## Reed Blocks

**IMPORTANT: DO NOT** remove reeds from reed block, unless replacement is necessary. **DO NOT** turn used reeds over for re-use.

1. Thoroughly clean reeds and reed block.
2. Place reed block halves together and secure with screws and nuts.
3. Check for wear (indentation) on face of each reed block. If reeds have made indentations, replace block.
4. Check for chipped or broken reeds.
5. Check reeds to be sure that they are not pre-loaded (adhere tightly to reed block) and that they are not standing open an excessive amount [greater than .007" (0.78mm)].



54706

a - Feeler Gauge

b - Reed

6. Replace reeds as necessary.

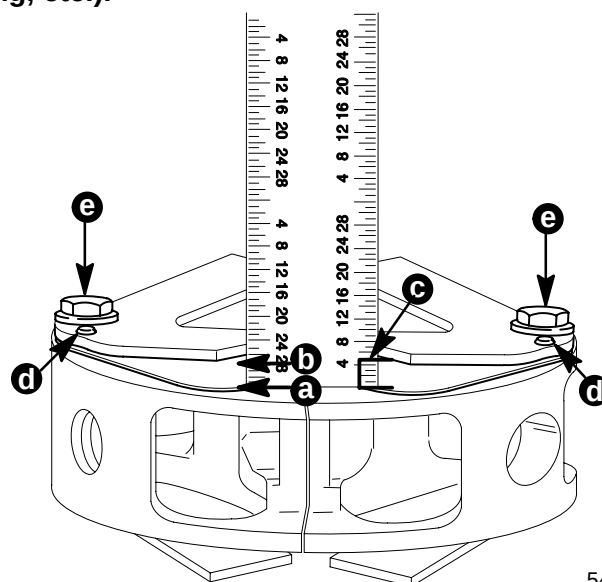
**IMPORTANT: Replace reeds in sets only. DO NOT** turn used reed over for re-use.

7. Measuring from top of closed reed to inside of reed stop, check reed stop opening of each reed stop.

Specified reed stop opening is 5/32" (3.97mm). If reed stop opening is not correct, carefully bend reed stop to achieve specified opening.

8. After installing any new reeds [and having torqued reed retaining screws to 30 lb. in. (3.3 N·m)], check new reeds as outlined in Step 5, preceding.

**IMPORTANT: If engine shows indications of having been overheated, check condition of nylon locating pins. Damaged (melted) locating pins will affect engine operation (poor idle, hard starting, etc.).**



54707

a - Top of Closed Reed

b - Inside of Reed Stop

c - Reed Stop Opening 5/32" (3.97mm)

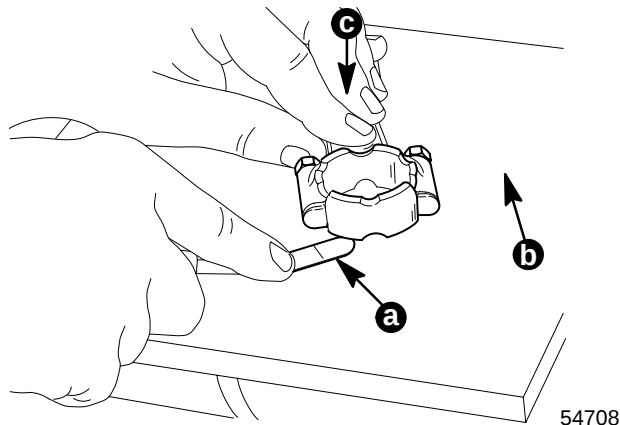
d - Locating Pins

e - Reed Retaining Screws [Torque to 30 lb. in. (3.3 N·m)]



## Connecting Rods

1. Check connecting rod for alignment by placing rods on a surface plate. If light can be seen under any portion of machined surfaces, if rod has a slight wobble on plate or, if a .002" feeler gauge can be inserted between any machined surface and surface plate, rod is bent and must be discarded.



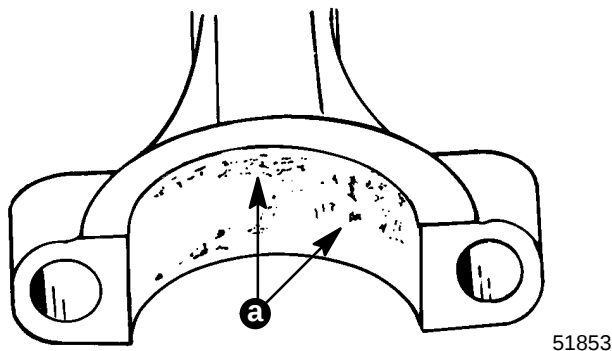
- a - Feeler Gauge  
b - Surface Plate  
c - Even Downward Pressure

2. Carefully inspect connecting rod bearings for rust or signs of bearing failure. Replace bearings as necessary.

### ⚠ CAUTION

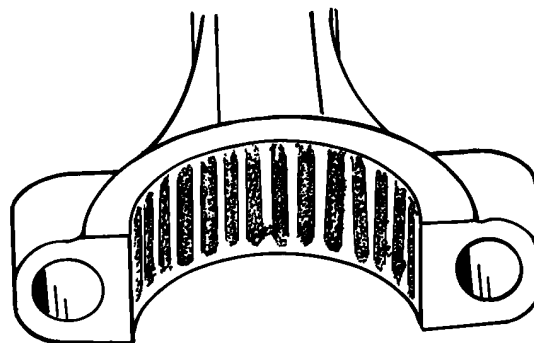
**DO NOT** intermix new and used needle bearings. If replacement of some bearings is required, replace all bearings at that location.

3. Inspect crankshaft end and piston pin end bearing surfaces of connecting rod for the following:
  - a. **Rust:** Rust formation on bearing surfaces causes uneven pitting of surface(s).



a - Pitting

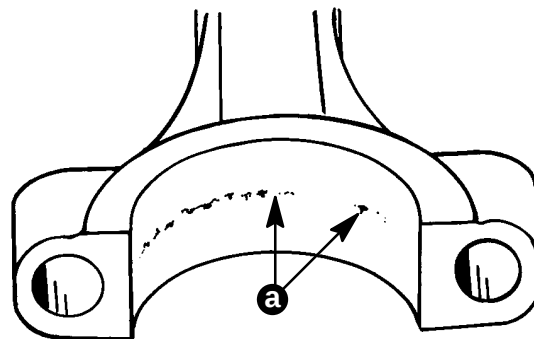
- b. **Water Marks:** When bearing surfaces are subjected to water contamination, a bearing surface "etching" occurs. This etching resembles the size of the bearing.



51853

### Connecting Rod with Water Marks

- c. **Spalling:** Spalling is the loss of bearing surface; it resembles flaking or chipping. Spalling will be most evident on the thrust portion of the connecting rod in line with the "I" beam. The general deterioration of the bearing surface could be caused by, or accelerated by, improper lubrication.

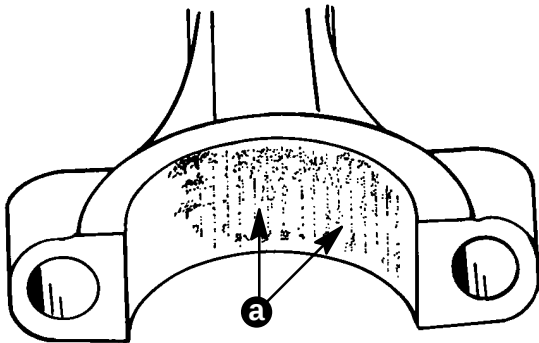


51853

a - Spalling



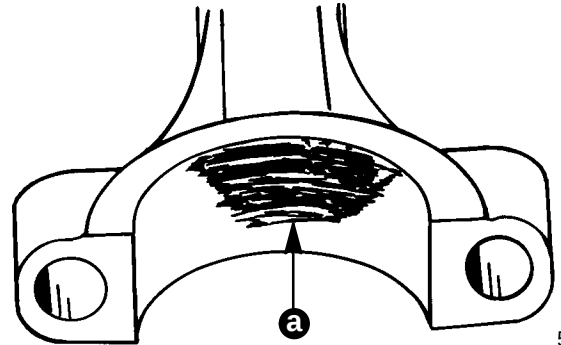
- d. **Chatter Marks:** Chatter marks are the result of a combination of low speed-low load-cold water temperature operation that is aggravated by inadequate lubrication and/or improper fuel. Under these conditions, the crankshaft journal is hammered by the connecting rod. As ignition occurs in the cylinder, the piston pushes the connecting rod with tremendous force, and this force is transferred to the connecting rod journal. Since there is little or no load on the crankshaft, it bounces away from the connecting rod. The crankshaft then remains immobile for a split second, until the piston travel causes the connecting rod to catch up to the waiting crankshaft journal, then hammers it. The repetition of this action causes a rough bearing surface(s) that resembles a tiny washboard. In some instances, the connecting rod crank pin bore becomes highly polished. During operation, the engine will emit a "whirr" and/or "chirp" sound when it is accelerated rapidly from idle speed to approximately 1500 RPM, then quickly returned to idle. If the preceding conditions are found, replace both the crankshaft and connecting rod.



51853

a - Chatter Marks between Arrows

- e. **Uneven Wear:** Uneven wear could be caused by a bent connecting rod or improper shimming of crankshaft end play [failure to maintain approximately the same amount of shim(s) under end cap, thereby causing the crankshaft journal not to be centered over the cylinder bore].



51853

a - Uneven Wear between Arrows

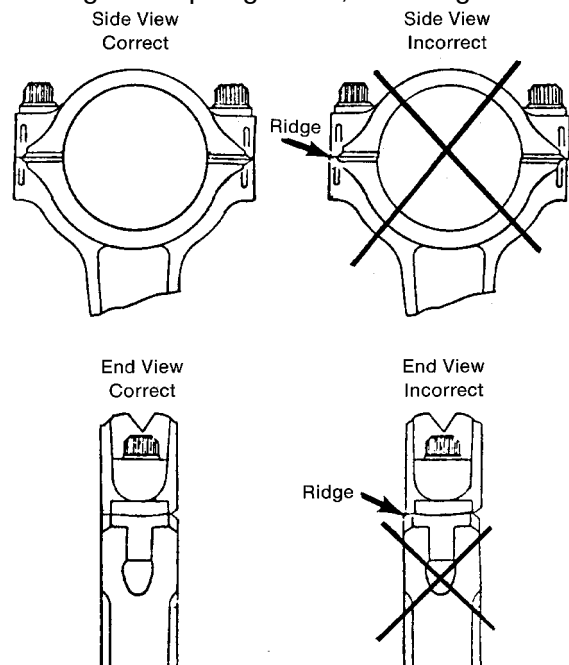
- f. **Overheating:** Overheating is visible as a bluish bearing surface color caused by inadequate lubrication or excessive RPM.



## Cleaning Connecting Rods

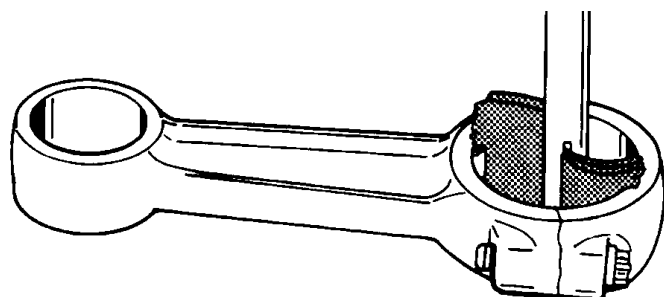
1. If necessary, clean connecting rod bearing surfaces, as follows:

- a. Install connecting rod cap and bolts (using 1/4"-12 point socket). Be sure that cap is aligned with rod correctly. Refer to connecting rod cap alignment, following.



- b. Clean CRANKSHAFT END of connecting rod by using 320 CLOTH placed in a slotted 3/8" (9.5mm) diameter shaft, as shown. Chuck shaft in a drill press and operating press at high speed while keeping connecting rod at a 90° angle to slotted shaft.

**IMPORTANT:** Clean connecting rod just enough to clean up bearing surfaces. DO NOT continue to clean after marks are removed from bearing surfaces.

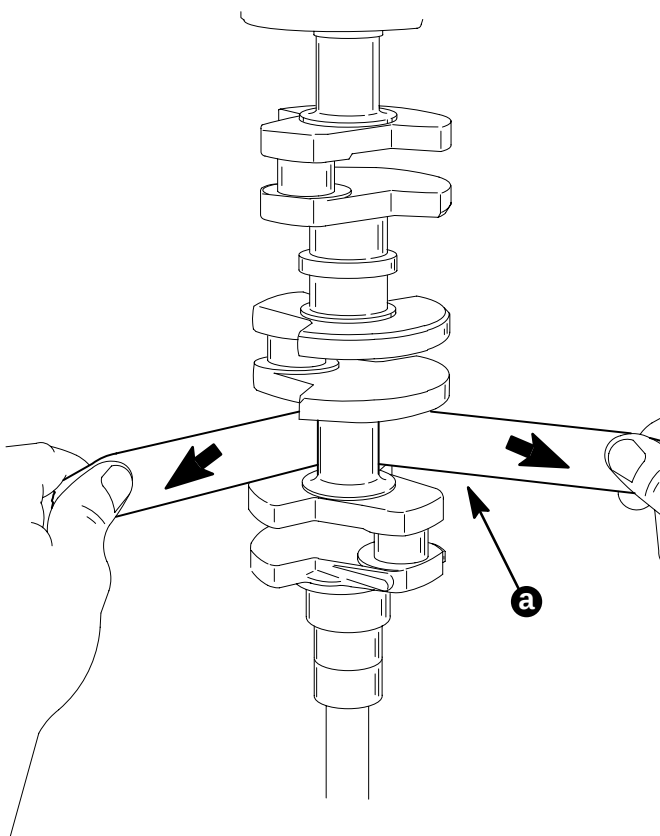


51083

- c. Clean PISTON PIN END of connecting rod, using same method as in Step "b", preceding, using 320 grit carborundum cloth.
- d. Thoroughly wash connecting rods to remove abrasive grit. Recheck bearing surfaces of connecting rods. Replace any connecting rod(s) that cannot be properly "cleaned up." Lubricate bearing surfaces of connecting rods (which will be re-used) with light oil to prevent rust.

## Crankshaft

1. Inspect crankshaft to drive shaft splines for wear. (Replace crankshaft, if necessary.)
2. Check crankshaft for straightness. Replace as necessary.
3. Inspect crankshaft oil seal surfaces. Sealing surfaces must not be grooved, pitted or scratched. Replace as necessary.
4. Check all crankshaft bearing surfaces for rust, water marks, chatter marks, uneven wear and/or overheating. (Refer to "Connecting Rod," Step 3, preceding.)
5. If necessary, clean crankshaft surfaces with 320 cloth.



54709

a - 320 Cloth



## ⚠ WARNING

**DO NOT spin-dry crankshaft ball bearings with compressed air.**

6. Thoroughly clean (with solvent) and dry crankshaft ball bearings. Recheck surfaces of crankshaft. Replace crankshaft, if surfaces cannot be properly "cleaned up." If crankshaft will be re-used, lubricate surfaces of crankshaft with light oil to prevent rust.

### Ball Bearing

1. Clean ball bearings with solvent and dry with compressed air.
2. Attempt to work inner bearing race in-and-out. There should not be excessive play.
3. Lubricate ball bearing with light oil. Rotate outer bearing race. Bearing should have smooth action and no rust stains. If ball bearing sounds or feels "rough" or has "catches," remove and discard bearing. (Refer to "Powerhead Disassembly," preceding.)

## Powerhead Reassembly

### General

Before proceeding with powerhead reassembly, be sure that all parts to be re-used have been carefully cleaned and thoroughly inspected, as outlined in "Cleaning and Inspection," preceding. Parts, which have not been properly cleaned (or which are questionable), can severely damage an otherwise perfectly good powerhead within the first few minutes of operation. All new powerhead gaskets **MUST BE** installed during reassembly.

During reassembly, lubricate parts with Quicksilver Formula 50-D 2-Cycle Outboard Lubricant when "light oil" is specified or with Quicksilver Needle Bearing Assembly Lubricant whenever "grease" is specified. Quicksilver part numbers of lubricants, sealers and locking compounds are listed in the Tool Catalog and in accessories brochures.

A torque wrench is **essential** for correct reassembly of powerhead. **DO NOT** attempt to reassemble powerhead without using a torque wrench. Attaching bolts for covers, housings and cylinder heads **MUST BE** torqued by tightening bolts in 3 progressive steps (following specified torque sequence) until specified torque is reached (see "Example," following).

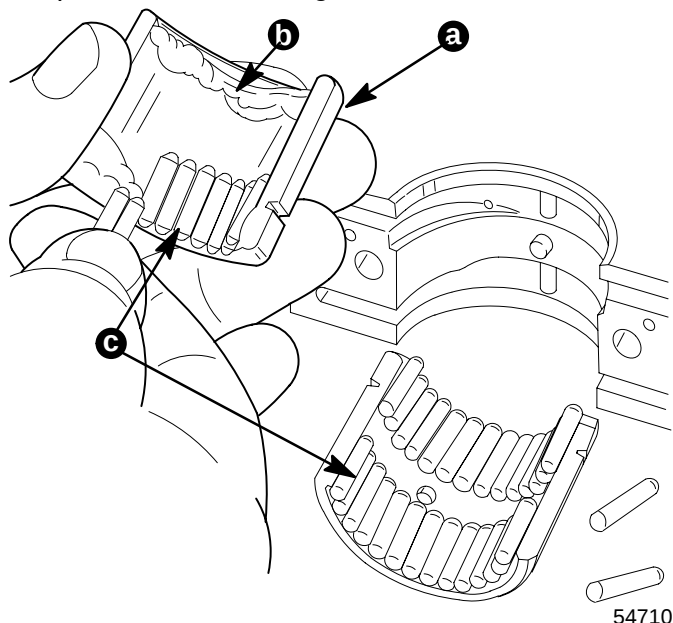
*Example:* If cylinder cover attaching bolts require a torque of 70 lb. in. (81 kg-cm), a) tighten all bolts to **20 lb. in. (2.2 N·m)**, following specified torque sequence, b) tighten all bolts to **50 lb. in. (5.5 N·m)**, following torque sequence, then finally c) tighten all bolts to **70 lb. in. (7.7 N·m)** following torque sequence.

Powerhead torques are listed in "General Information Powerhead," preceding.



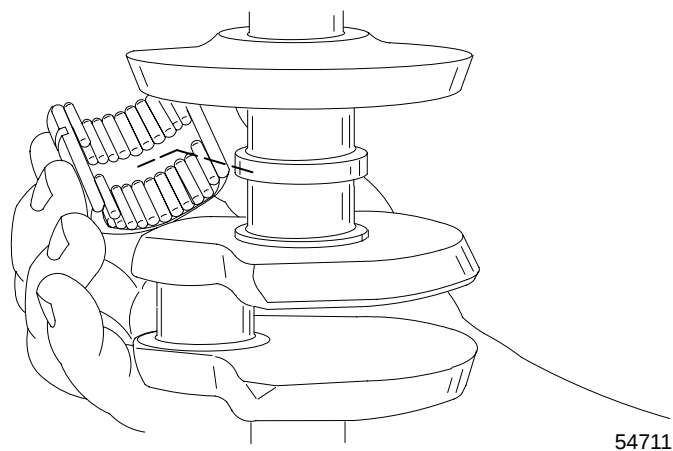
## Crankshaft Reassembly

1. Lubricate main bearing outer race with Quicksilver Needle Bearing Assembly Lubricant and place needle bearings on race.

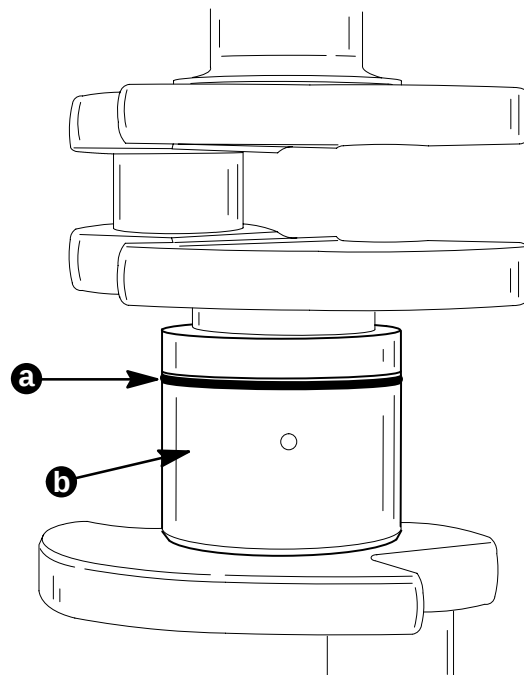


- a - Outer Race
- b - Needle Bearing Assembly Lubricant
- c - Needle Bearings (56 Required)

2. Install bearing race with needle bearings in place on crankshaft. Secure both halves of race together with snap ring.



### Installing Main Bearing Race on Crankshaft

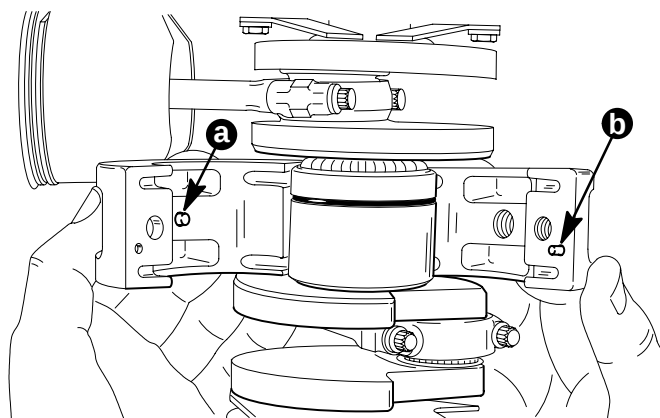


54712

- a - Snap Ring
- b - Outer race

### Main Bearing Installed

3. Install main bearing support onto main bearing race. Locating pin must enter hole in main bearing race.

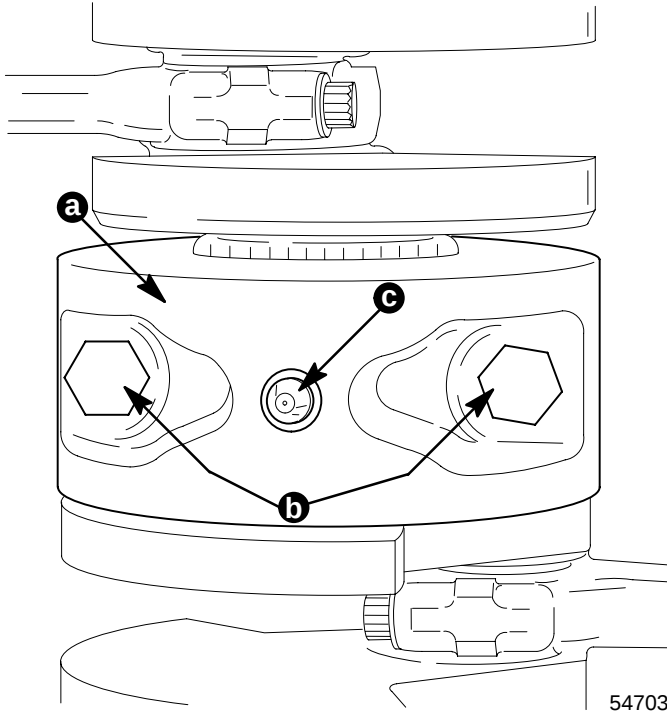


54713

- a - Locating Pin - Position in Main Bearing Race
- b - Alignment Pins (2 Required)



4. Secure both halves of each main bearing race together with two bolts. Torque bolts to 80 lb. in. (9.0 N·m).

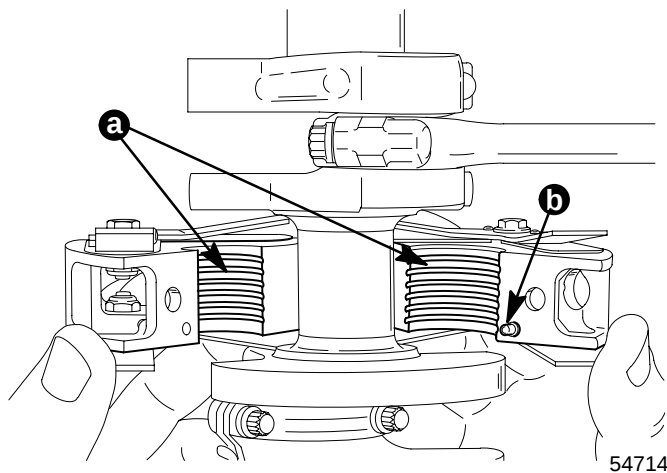


- a - Main Bearing  
b - Bolts [Torque to 80 lb. in. (9.0 N·m)]  
c - Locating Pin

**IMPORTANT:** Check reed stop setting for proper opening. Larger opening can cause reed breakage; smaller opening will not allow sufficient air/fuel mixture to enter at higher RPM.

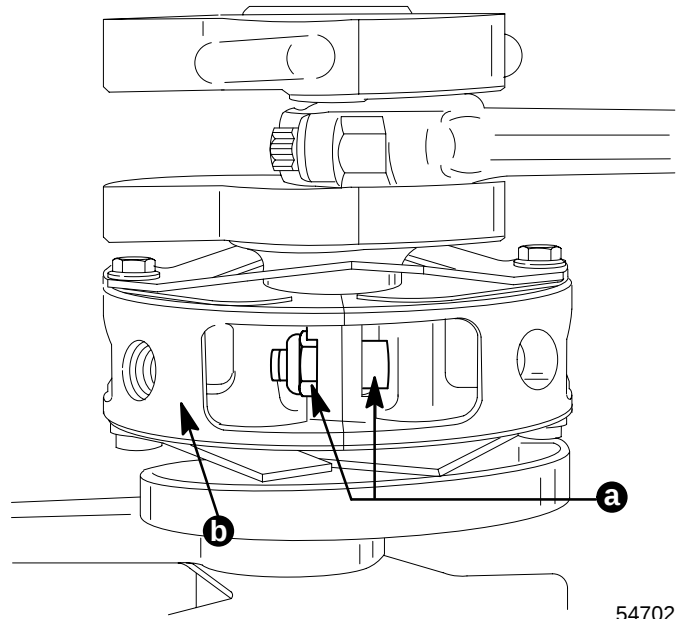
**NOTE:** Either side of reed block can be facing up.

5. Lubricate inner bore of reed blocks with Light Oil and install onto crankshaft.



- a - Lubricate Inner Bore with Light Oil  
b - Insert Locating Pins into Holes and Press Together

6. Secure both halves of reed block together with two screws and nuts. Torque reed block screws to 55 lb. in. (6.2 N·m).



- a - Torque Screws (One Each Side) to 55 lb. in. (6.2 N·m)  
b - Reed Block

### **CAUTION**

Clean connecting rod bolts with solvent and dry with compressed air to prevent damage to threads while torquing. **DO NOT** lubricate threads prior to installation.

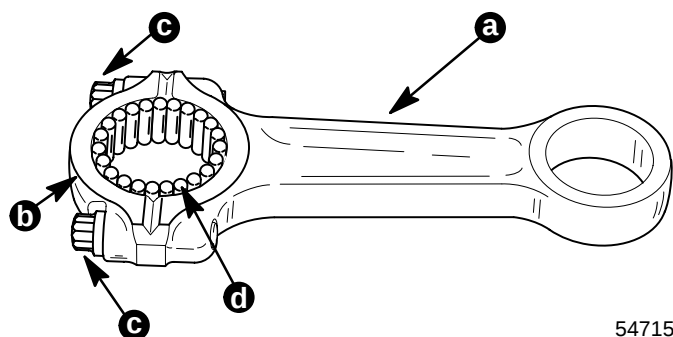
- Clean a sufficient amount of new connecting rod bolts with solvent and dry with compressed air.
- Apply a thin coat of Quicksilver Needle Bearing Assembly Lubricant to crank pin bearing surface of connecting rod and rod cap to hold needle bearings in place.



## ⚠ CAUTION

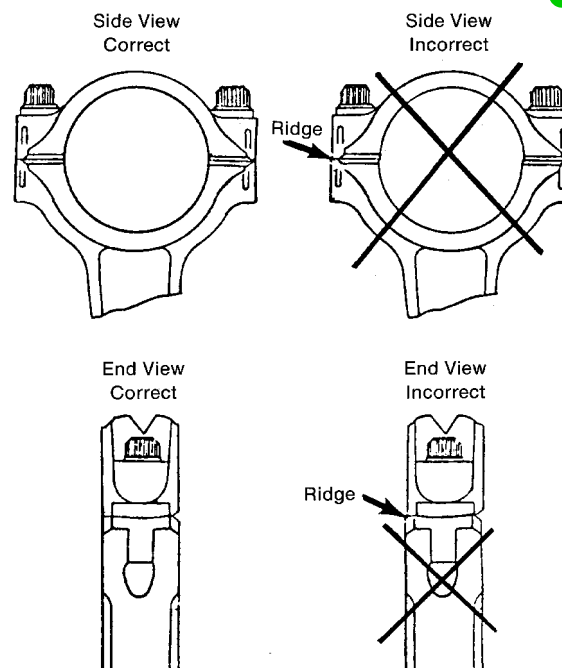
Never inter-mix new needle bearings with used bearings. If any bearing requires replacement, replace all needle bearings.

- c. Place needle bearings (25 required) around crank pin bearing surface of connecting rod and cap.



- a - Connecting Rod  
b - Rod Cap  
c - Bolts  
d - Needle Bearings

- d. Place connecting rod and cap together on crank pin.  
e. Apply Loctite Grade "A" (271) to rod bolt threads.  
f. Thread connecting rod bolts finger-tight while checking for correct alignment of the rod cap.



### Correct Connecting Rod Cap Alignment

- g. Tighten connecting rod bolts (using 1/4"-12 point socket) evenly in three progressive steps until torqued to 200 lb. in. (22.5 N·m).  
h. Check each connecting rod cap for correct alignment. If not aligned, a ridge can be seen or felt at the separating line as shown. Correct any misalignment.
7. Use a small diameter wire and try to spread needle bearings apart. If needle bearings do not spread the width of a single bearing, the correct number of bearings has been used. Rotate connecting rod (after torquing), checking that it rotates freely. If rough, remove and check race and needle bearings.
8. Repeat preceding procedure for remaining connecting rods.



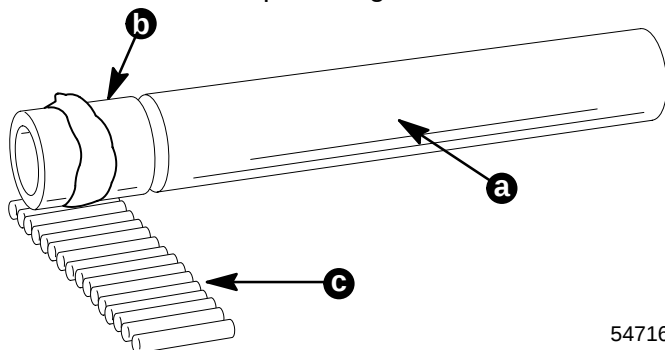
## Piston Installation

1. Place a piece of paper on bench and line up piston pin needle bearings.

### ⚠ CAUTION

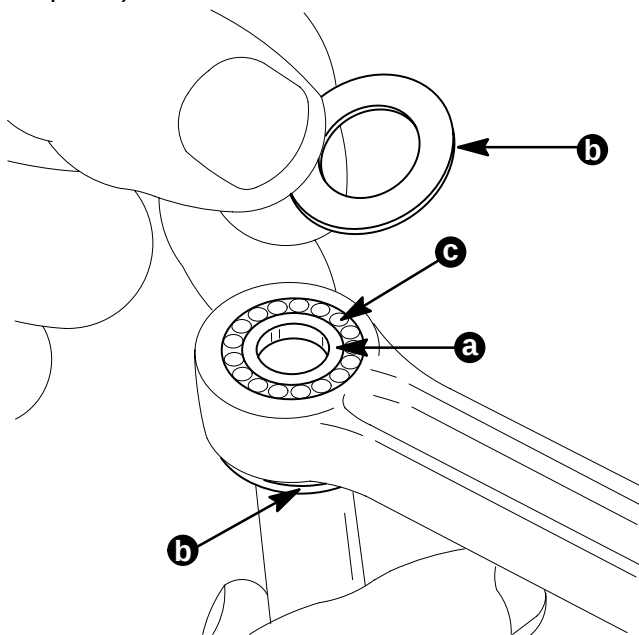
**Never inter-mix new needle bearings with used bearings at the same piston pin end. If any needle bearing requires replacement, replace all bearings.**

2. Place sleeve on Piston Pin Tool (91-76160A2) and apply a small amount of Quicksilver Needle Bearing Assembly Lubricant around sleeve. Roll tool over lined-up bearings.



- a - Piston Pin Tool (91-76160A2)  
b - Sleeve  
c - Needle Bearings (27 Required)

3. Place lower locating washer on connecting rod and slide sleeve (along with needle bearings) thru washer and into connecting rod. Add needle bearings until race will accept no more (27 required).



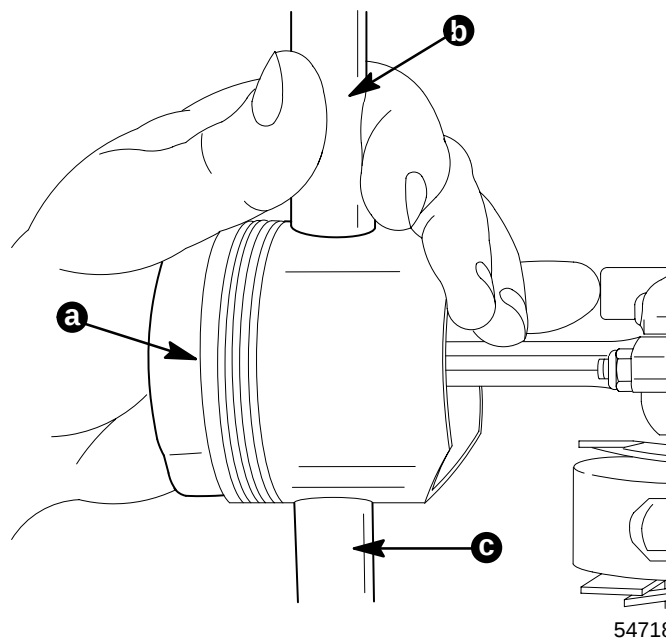
- a - Sleeve  
b - Locating Washer  
c - Needle Bearings (27 Required)

4. Place upper locating washer over sleeve on piston pin tool, then slide piston pin tool out of sleeve (sleeve and washers will hold needle bearings in position in connecting rod).

5. Place piston on connecting rod. Position piston pin bore directly over sleeve and slide piston pin tool thru upper pin bore and into sleeve.

**IMPORTANT: Intake side of piston deflector must face towards intake ports.**

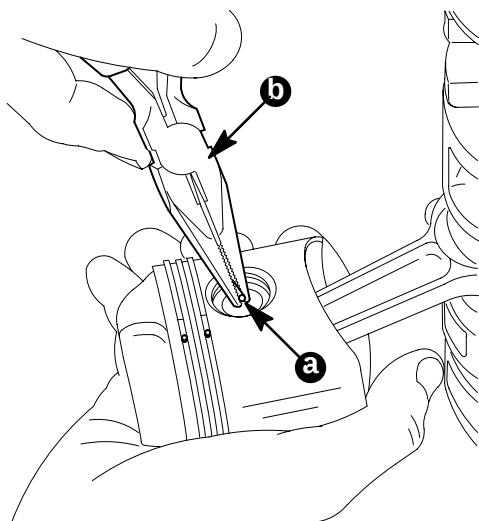
6. Lubricate piston pin with light oil. Use a mallet and drive piston pin into piston while maintaining the position of piston pin tool with other hand. Continue to drive pin into piston as tool and sleeve are driven out.



- a - Install Piston so that Deflector will be Toward Intake Ports  
b - Piston Pin Tool  
c - Piston Pin



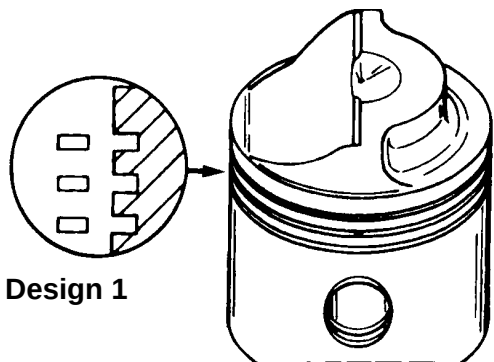
7. Secure piston pin in piston by installing new "G" type piston lockrings into groove in each end of piston pin bore. Make sure that lockrings are seated in grooves.



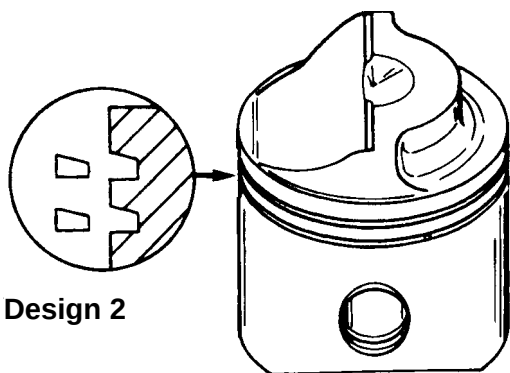
54697

- a - Piston Pin Lockring (One Each Side)  
b - Needle Nose Pliers

8. Install new piston rings on piston with Piston Ring Expander Tool (91-24697). Spread each ring just enough to slip over piston. Check that piston rings rotate freely in ring grooves. If ring does not rotate freely, condition must be corrected.

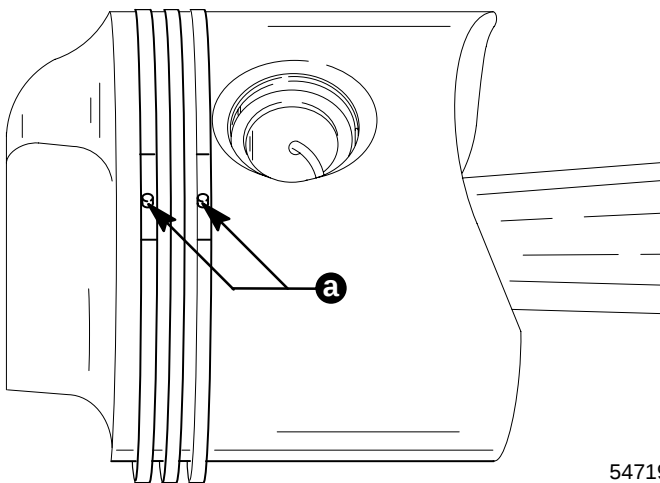


Design 1



Design 2

9. Lubricate rings with light oil and align ring ends with locating pins in ring grooves.



54719

- a - Piston Ring Locating Pin

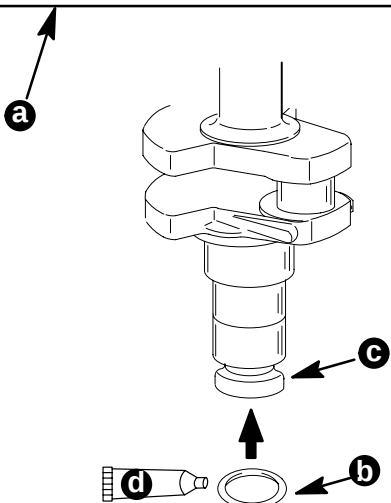
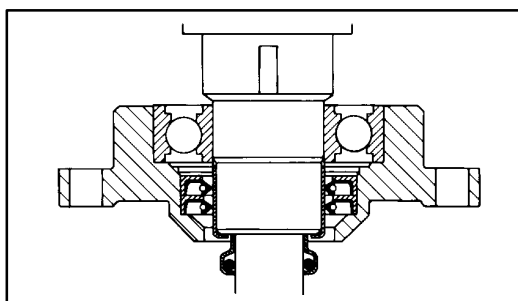


## Crankshaft Seal Installation

**NOTE:** Crankshafts that use Design 1 and Design 3 lower end caps (shown) have a replaceable seal in the bottom of the crankshaft. This seal protects the drive shaft splines. Design 2 type lower end caps have the seal incorporated in the end cap.

### CRANKSHAFTS USING DESIGN 1 LOWER END CAP

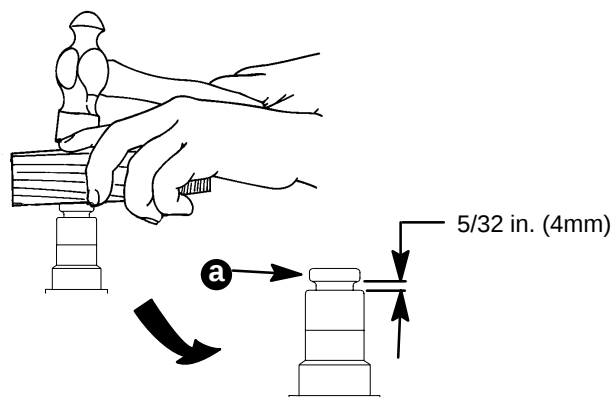
1. Install new O-Ring seal into seal carrier on end of crankshaft.
2. Lubricate seal with 2-4-C Marine Lubricant.



- a - Design 1 Type Lower End Cap
- b - O-Ring Seal
- c - Seal Carrier
- d - Lubricate with 2-4-C Marine Lubricant

### SEAL CARRIER REPLACEMENT (DESIGN 1)

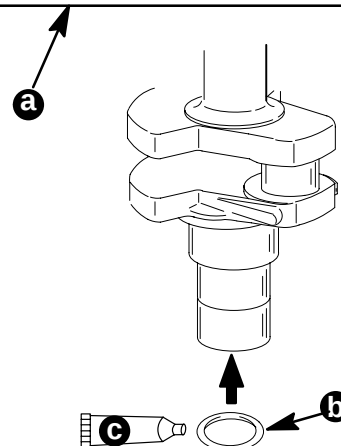
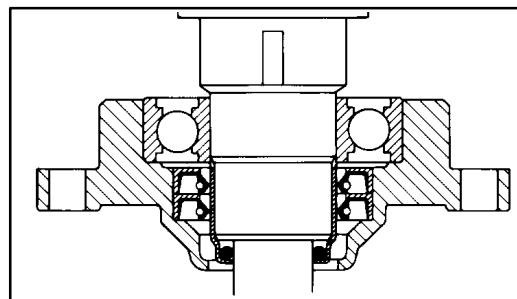
1. Thoroughly clean crankshaft splines with solvent and dry with compressed air.
2. Drive seal carrier squarely into end of crankshaft, using a block of wood to protect seal carrier. Install seal carrier to the dimension shown.



- a - Seal Carrier

### CRANKSHAFTS USING DESIGN 3 LOWER END CAP

1. Install new O-Ring seal into seal carrier on end of crankshaft.
2. Lubricate seal with 2-4-C Marine Lubricant.



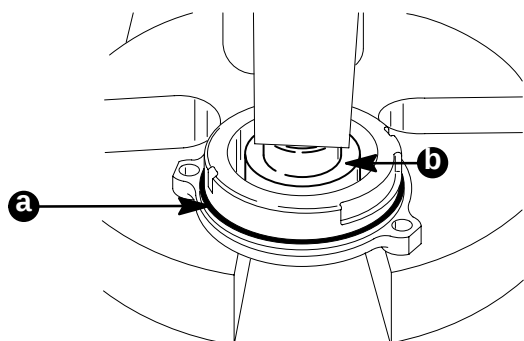
- a - Design 3 Type Lower End Cap
- b - O-Ring Seal
- c - Lubricate with 2-4-C Marine Lubricant



## End Cap Reassembly

### LOWER END CAP

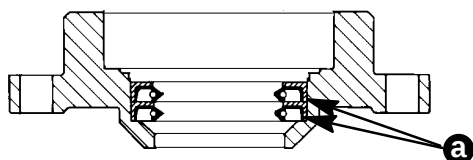
1. Install O-Ring Seal into seal groove.
2. Apply Loctite Grade "A" (271) to outer diameter oil seals and press into end cap using proper mandrel as shown. Wipe off excess Loctite.
3. Apply 2-4-C Marine Lubricant to lips of oil seals.



54722

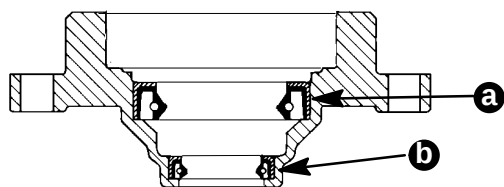
a - O-Ring Seal  
b - Mandrel

### Design 1 End Cap



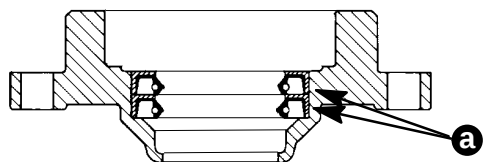
a - 26-41953 Oil Seal (2)

### Design 2 End Cap



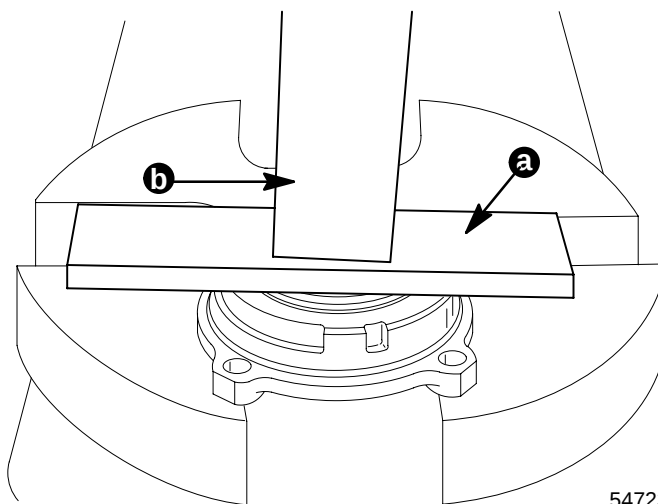
a - 26-41953 Oil Seal (1)  
b - 26-63742 Oil Seal (1)

### Design 3 End Cap



a - 26-41953 Oil Seal (2)

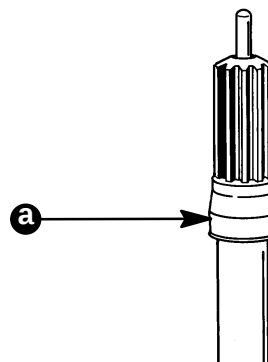
4. Press ball bearing into lower end cap with press block.



54723

a - Block  
b - Arbor Press

**IMPORTANT:** If installing a Design 1, 2 or 3 end cap on engine S/N 0D040454 and below, remove and discard seal (if equipped) from end of drive shaft.



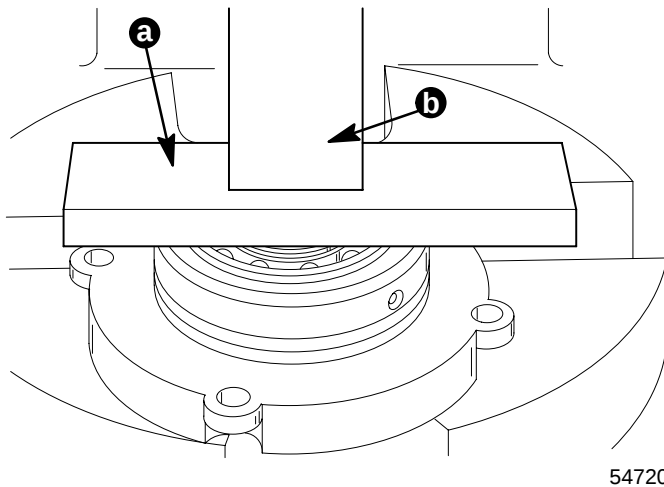
51188

a - Seal



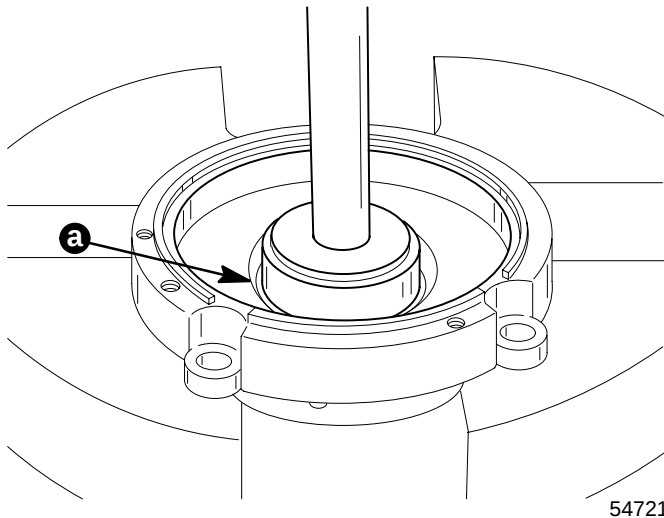
## UPPER END CAP

1. If removed, press ball bearing into upper end cap with press block.



- a - Block  
b - Arbor Press

2. Apply Loctite Grade "A" (271) to outer diameter on oil seal and press into end cap with lip of seal toward ball bearing, using proper mandrel. Remove excess Loctite from end cap.



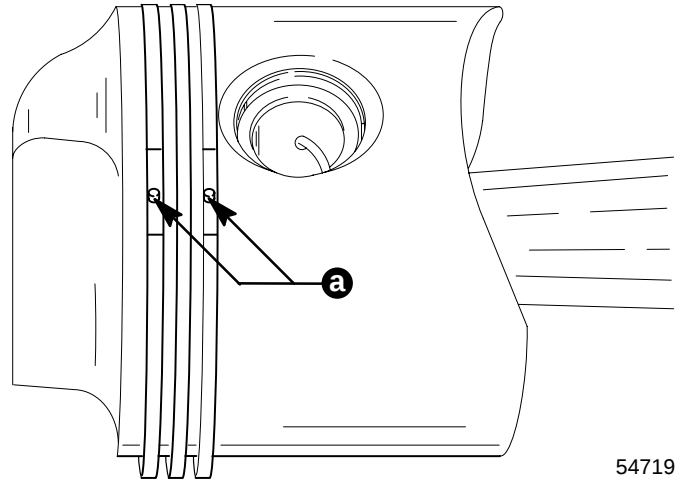
- a - Oil Seal Lip Toward Ball Bearing

## Cylinder Block Reassembly

1. Lubricate piston rings, pistons and cylinder walls with light oil.
2. Rotate and align end of each piston ring with locating pin in ring groove.

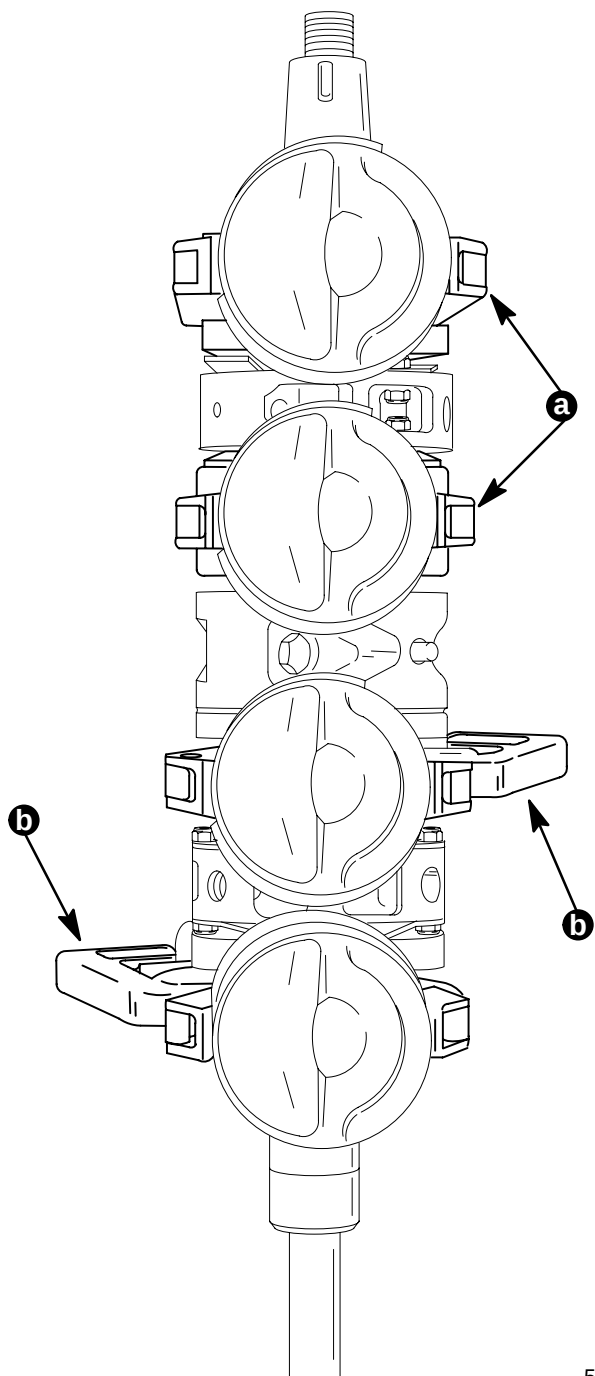
### CAUTION

Piston rings **MUST BE** properly positioned with locating pin between piston ring end gaps. Improperly positioned piston rings may break during installation.



- a - Piston Ring Locating Pin

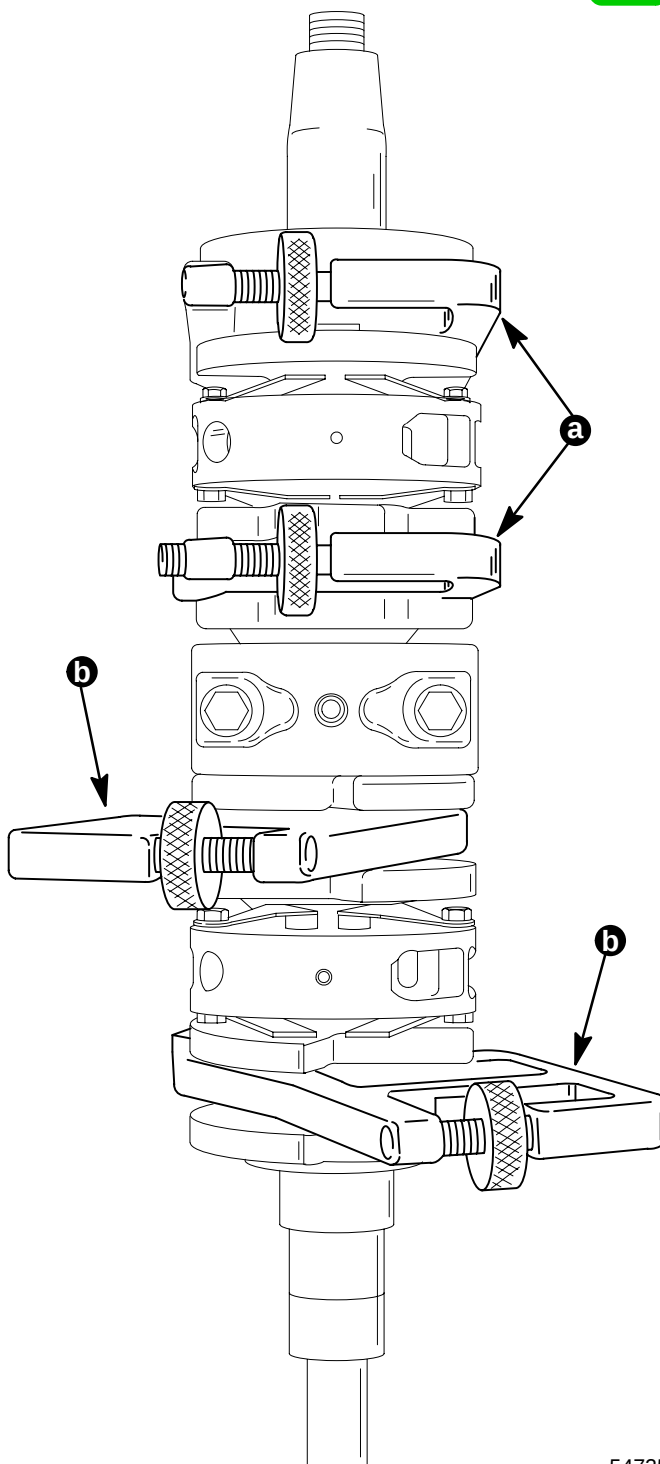
3. Install ring compressors, as follows:
  - a. No. 1 piston must be straight out from crank pin throw and at bottom of stroke. Use straight ring compressor.
  - b. No. 2 piston must be straight out from crank pin throw and at top of stroke. Use a straight compressor.
  - c. No. 3 and No. 4 pistons must be directly in-line with upper pistons and use offset ring compressors.
  - d. Check piston ring end gap alignment (all pistons) with locating pins.



54724

a - Straight Compressors  
b - Offset Compressors

### Ring Compressors Installed on Pistons (Front View)



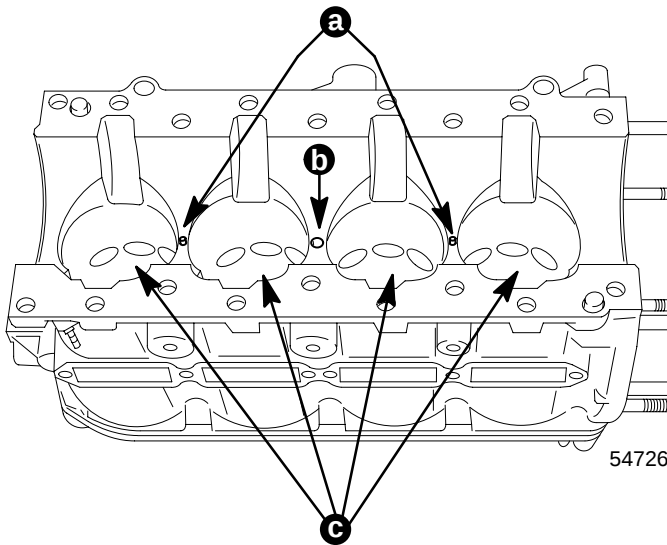
54725

a - Straight Compressors  
b - Offset Compressors

### Ring Compressors Installed on Pistons (Rear View)

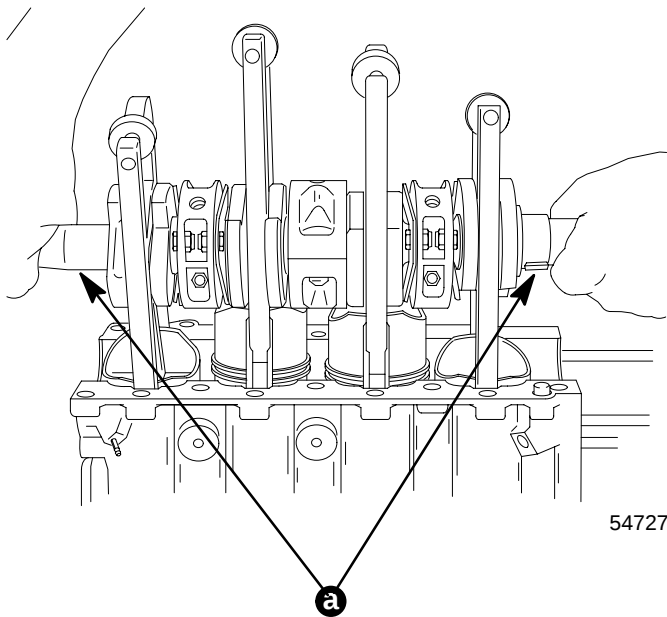


4. If removed, place reed block locating pins into cylinder block.



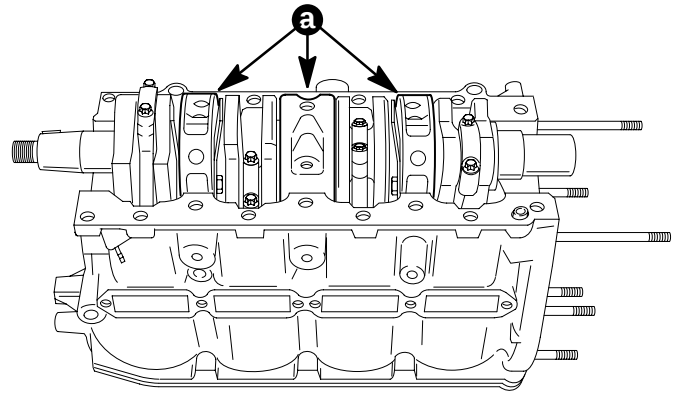
- a - Reed Block Locating Pin  
b - Main Bearing Support Locating Pin (on Some Models, Pin is Located in Bearing Support)  
c - Lubricate Cylinder Walls, Pistons and Piston Rings with Light Oil

5. Install crankshaft assembly into cylinder block. Remove ring compressors as each piston enters cylinder. Make sure that crankshaft is kept horizontal while installing.



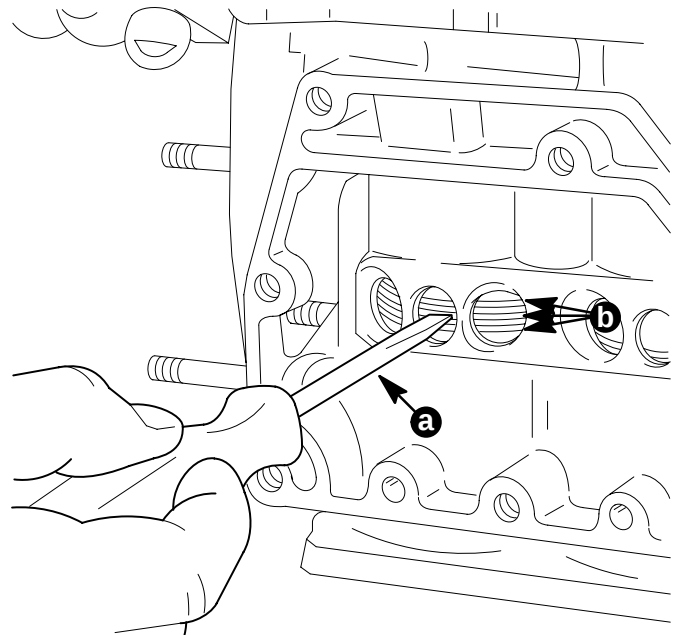
- a - Keep Crankshaft Horizontal

6. Align centermain bearing and reed blocks with locating pins and push centermain bearing and reed blocks downward to seat them in cylinder block.



- a - Align Centermain Bearing Support and Reed Blocks with Locating Pins and Push Downward to Seat

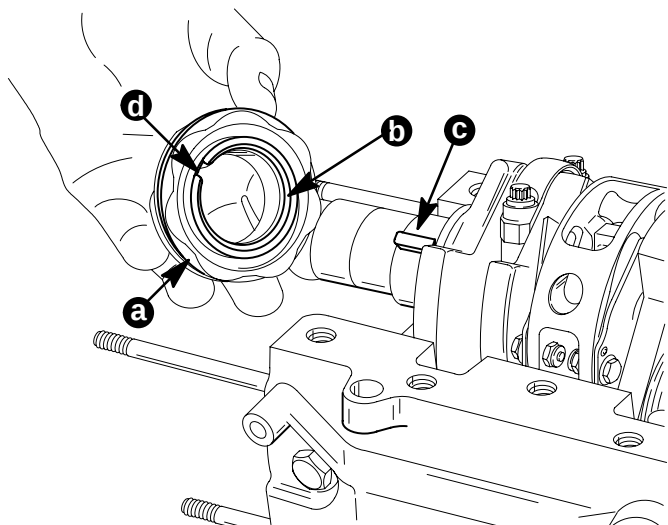
7. Check each piston ring for spring tension thru the exhaust ports by pressing with a screwdriver. If no spring tension exists (ring fails to return to position), it is likely that the piston ring was broken during assembly [replace broken piston ring(s)]. Use caution not to burr piston or ring during inspection.



- a - Screwdriver  
b - Piston Rings



8. Slide oil pump drive gear onto crankshaft. Chamfer side of gear goes towards bottom crankshaft throw. Engage key with slot in gear.



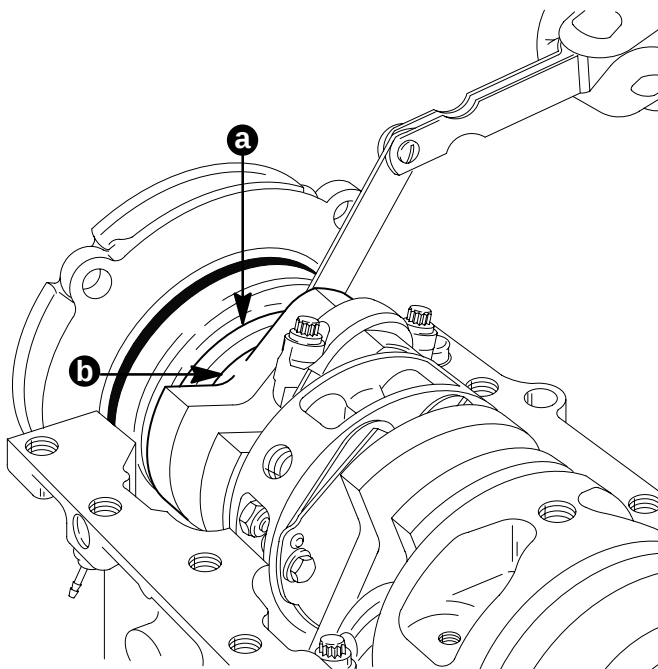
54730

- a - Oil Pump Drive Gear
- b - Chamfer
- c - Key
- d - Slot

9. Use a powerhead stand and rotate crankshaft several times to assure free operation (no binds and/or catches).
10. Check crankshaft end play, as follows:

- a. Temporarily install upper and lower end caps with original shim(s). Secure each end cap to cylinder block with end cap bolts.
- b. Use a mallet and tap crankshaft toward bottom (stud end) of cylinder block. Hold crankshaft tight against lower end cap while making measurement in Step "C".

- c. With crankshaft against lower end cap, use a feeler gauge and check measurement between inner race of **upper ball bearing** and **thrust face of crankshaft**. **Correct end play should be between .008" to .012" (0.203mm to 0.305mm).**



54731

- a - Top End Cap Ball Bearing
- b - Top Crankshaft Throw

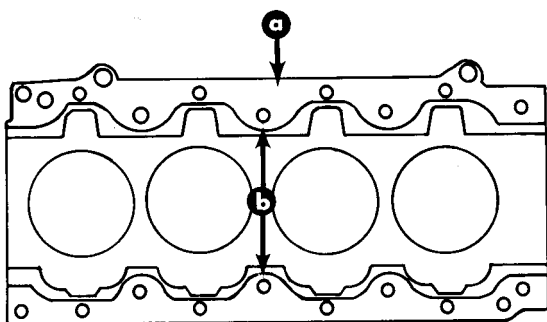
- d. If necessary, add or remove shim(s) to attain correct end play. Keep shim(s) thickness approximately the same [within .005" (0.127mm)] between upper and lower end caps to assure that crank pin throws are centered over cylinders.
11. Loosen end cap bolts several turns and slide end caps away from cylinder block to allow crankcase cover to be installed.
12. Thoroughly clean machined, mating surface of crankcase cover and cylinder block with solvent to remove all oil.

### ⚠ CAUTION

Before applying Loctite Master Gasket (92-12564-1) to cylinder block, make sure that mating surfaces of crankcase cover and cylinder block are clean and free of oil. Locquic Primer "T" can be used to clean these surface. Loctite must be applied in a continuous bead along the inside of mounting bolt holes. If a void should occur when applying a bead of Loctite, either remove the entire bead with a rag or apply with additional bead parallel to the void and overlapping the previously applied bead. Assemble crankcase cover to cylinder block without lateral movement.

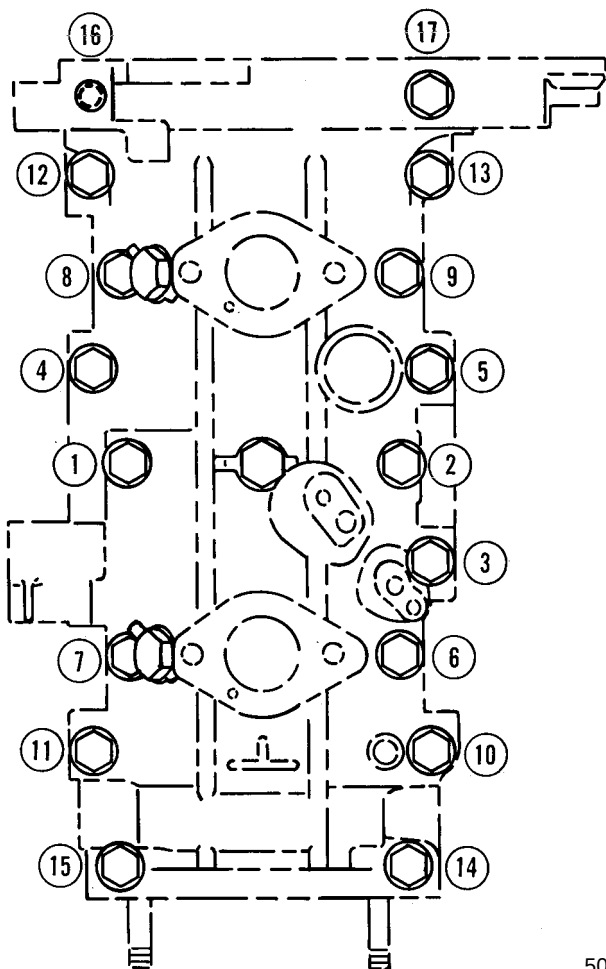


13. Apply a continuous bead of Loctite Master gasket Sealant on cylinder block.



- a - Cylinder Block  
b - Loctite Master Gasket Sealant (92-12564-1); Apply in a Continuous 1/16" (1.6mm) Bead

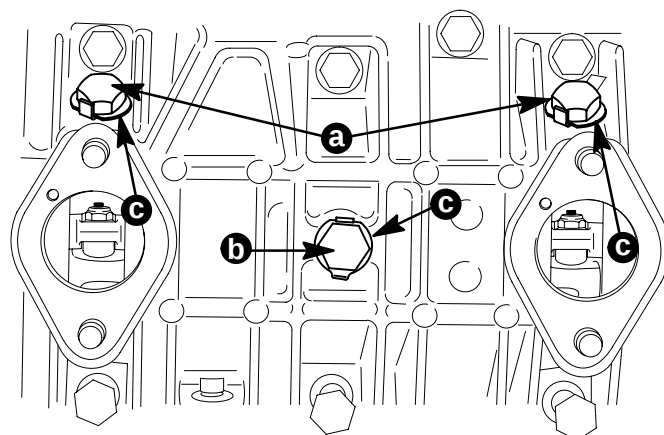
14. Place crankcase cover (without lateral movement) on cylinder block and secure with mounting bolts and lockwashers. Use torquing sequence shown. Torque bolts evenly, to 210 lb. in. (23.7 N·m), in 3 progressive steps.



50545

### Torque Sequence Intake Manifold

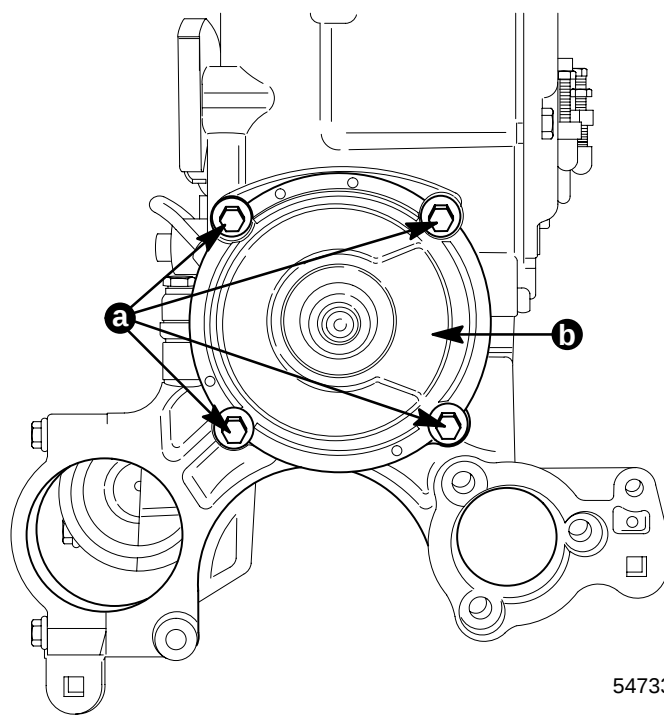
15. Install centermain bearing and reed block mounting bolts with locking tabs. Torque bolts to specified torque and bend locking tabs up and against flat of each bolt.



54732

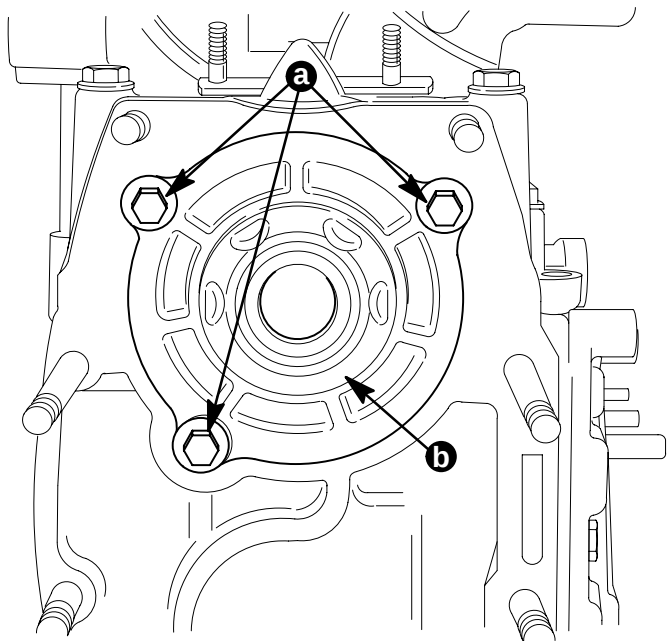
- a - Reed Block Mounting Bolts 5/8" (16mm) Long; Torque to 75 lb. in. (8.5 N·m)  
b - Centermain Mounting Bolt 1" (25mm) Long; Torque to 75 lb. in. (8.5 N·m)  
c - Locking Tab Washers (Bend as Shown)

16. Secure end caps to cylinder block. Torque bolts to specified torque. Rotate crankshaft several times to assure free operation (no binds and/or catches).



54733

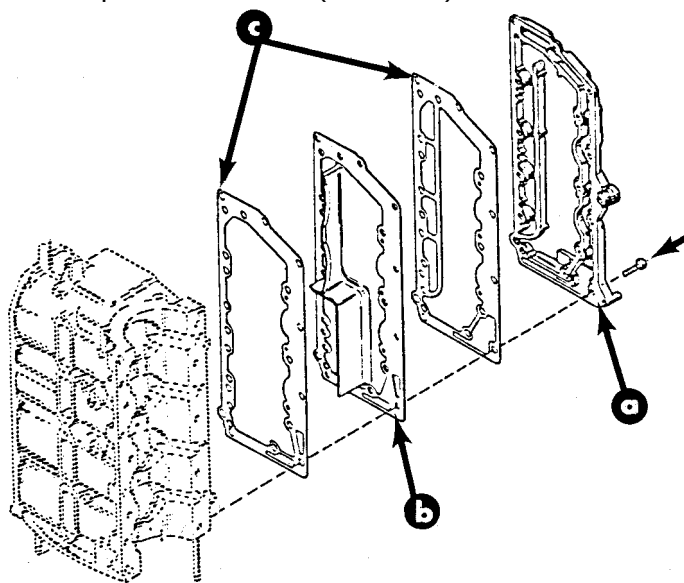
- a - Torque Bolts to 200 lb. in. (22.6 N·m)  
b - Upper End Cap



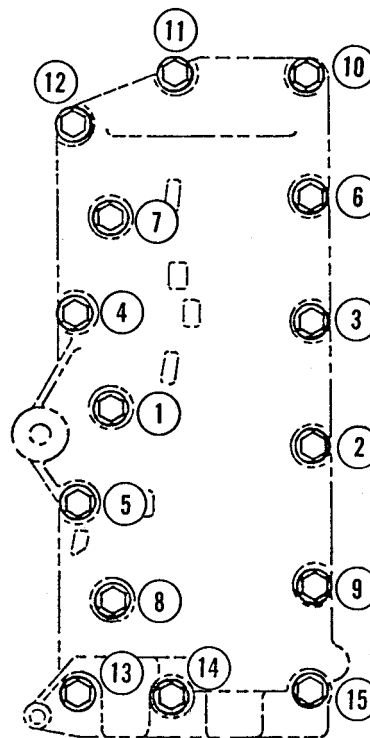
54683

- a - Torque Bolts to 200 lb. in. (22.6 N·m)  
b - Bottom End Cap

17. Install exhaust cover and divider plate with new gaskets. Apply Loctite Grade "A" (271) to bolt threads. Torque bolts evenly in three stages until torque of 200 lb. in. (22.6 N·m) is achieved.



- a - Exhaust Cover  
b - Divider Plate  
c - Gaskets



50532

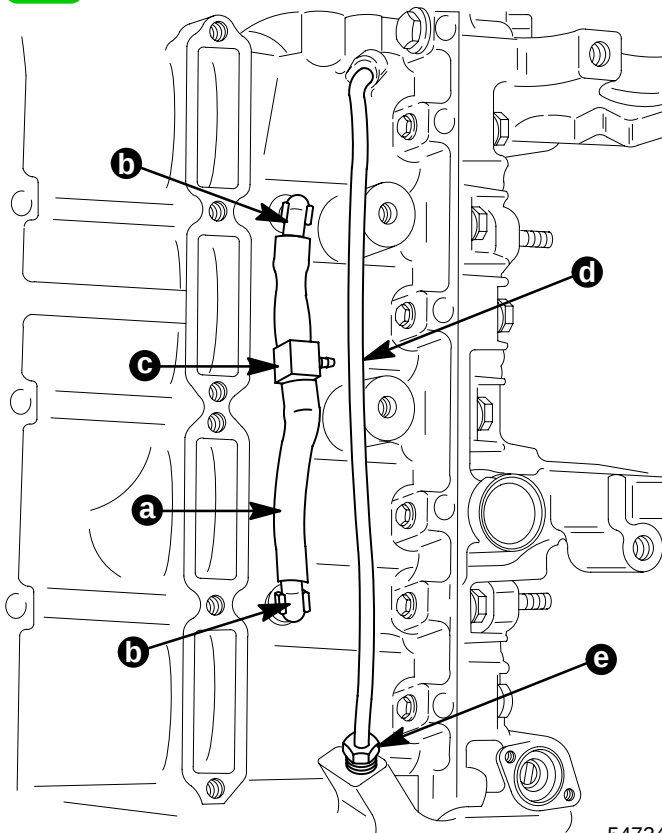
### Torque Sequence Exhaust Cover

18. Install balance tube with fittings into cylinder block. Apply pipe sealant (obtain locally) to fitting threads.

**NOTE:** Manual start models and some early electric models have a T-fitting for the fuel enrichment hose in the balance tube. Later electric start models will not have this T-fitting.

19. Apply pipe sealant (obtain locally) to bleed check valve threads and install bleed hose and check valve on cylinder block.

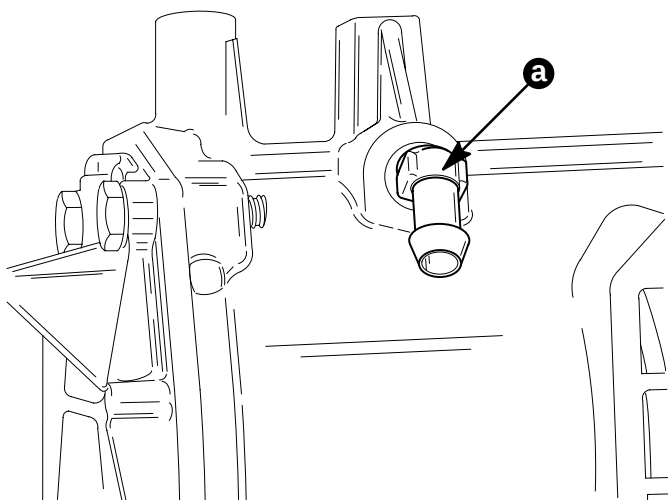
**NOTE:** The bleed check valve allows excess crankcase lubricant to flow one way, from the bottom of the crankcase to the top end cap bearing to provide additional lubrication. Inspect check valve for proper operation by applying vacuum to outlet side of check valve (barbed end). No restriction to flow should be felt. Apply vacuum to threaded side of check valve. A restriction to flow should be felt indicating check ball is seating properly. If these test results are not obtained, check valve must be replaced.



54734

- a - Balance Tube
- b - Fittings
- c - T-Fitting (Fuel Enrichment)
- d - Bleed Hose
- e - Bleed Check Valve

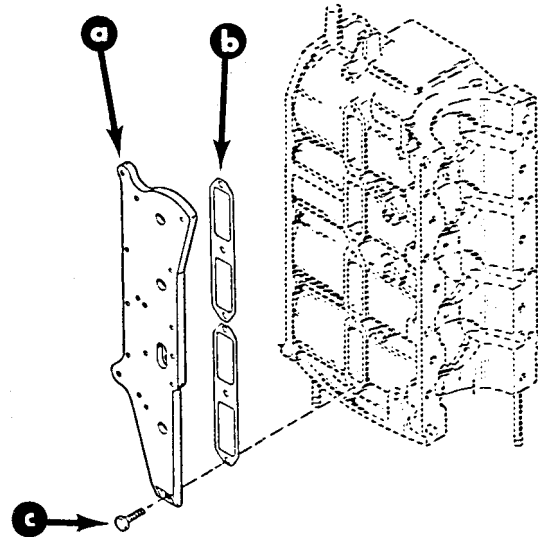
20. Apply pipe sealant (obtain locally) to threads of 45° tell-tale fitting and install fitting and hose.



54735

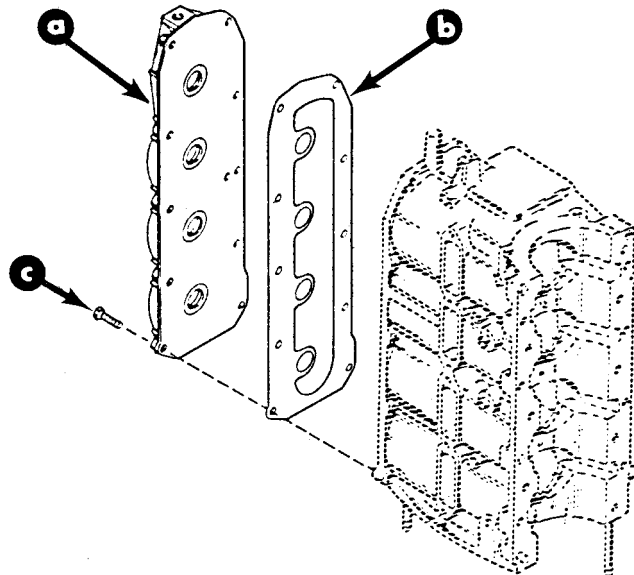
- a - 45° Tell-Tale Fitting

21. Install transfer port cover and new gasket. Apply Loctite Grade "A" to screw threads and torque screws to 65 lb. in. (7.3 N·m).

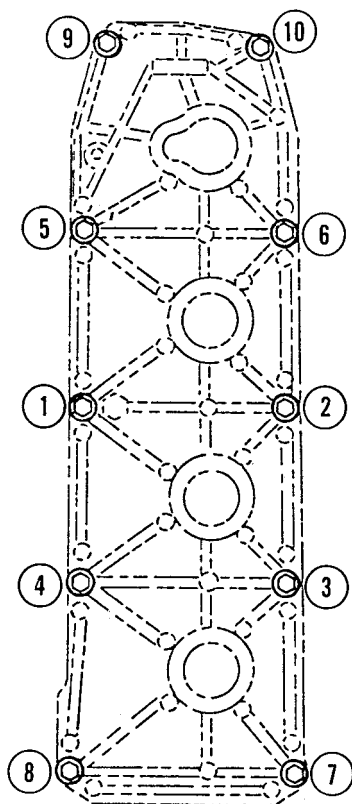


- a - Transfer Port Cover
- b - Gaskets
- c - Screws (6 Each)

22. Install cylinder cover and new gasket. Torque bolts equally in three progressive steps to 100 lb. in. (11.3 N·m).



- a - Cylinder Cover
- b - Gasket
- c - Bolt (10 Each)

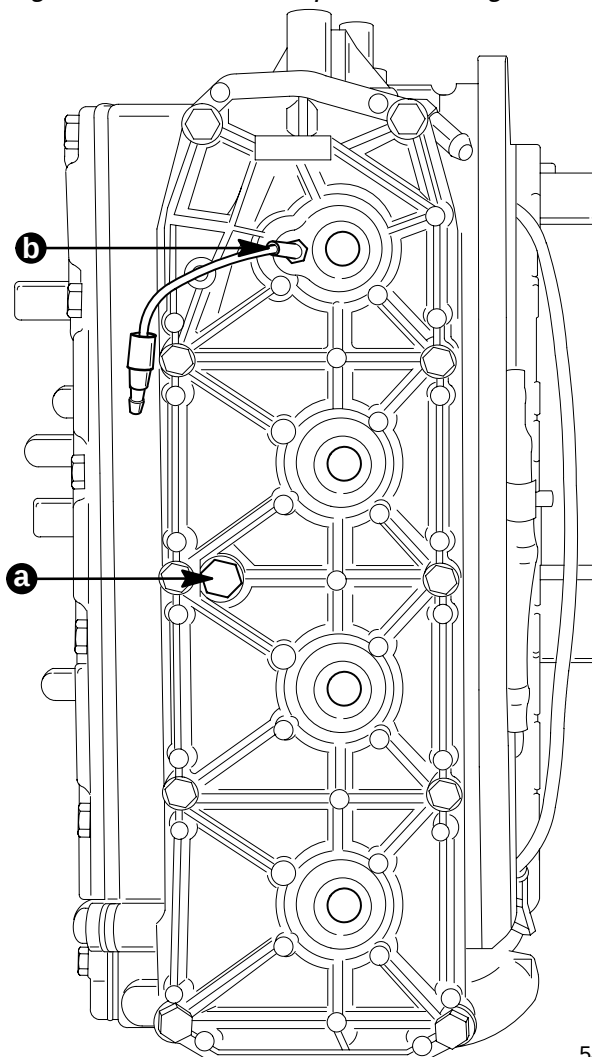


50531

**Cylinder Block Cover Torque Sequence**

23. Install temperature switch in cylinder block.

**NOTE:** A plug is provided on cylinder cover which may be removed for installing a Water Pressure Gauge Kit or a Water Temperature Gauge Kit.



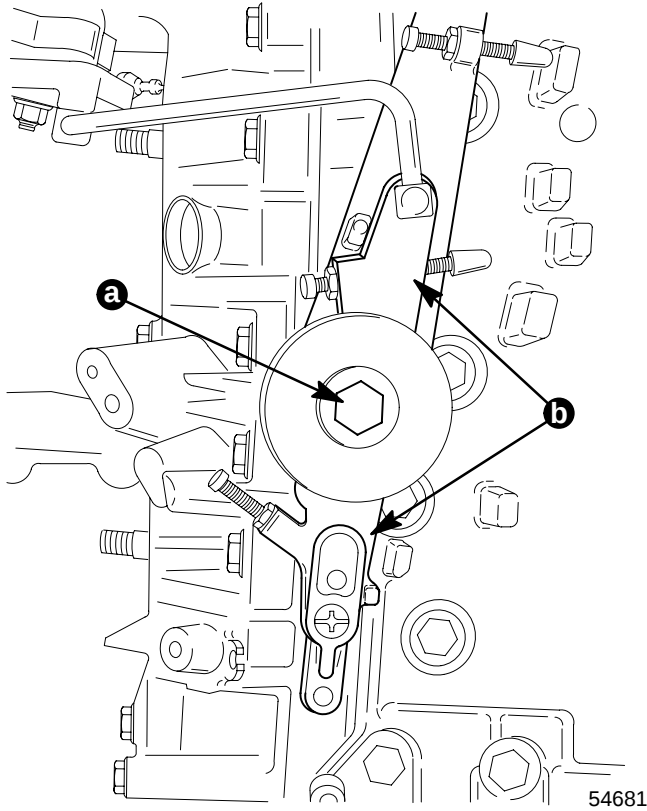
54692

- a - Plug (Remove for Installation of Water Pressure or Water Temperature Gauge Kit)
- b - Temperature Switch

24. On Electric Start Models Only, refer to Section 8, Oil Injection, for proper installation procedure of oil pump.

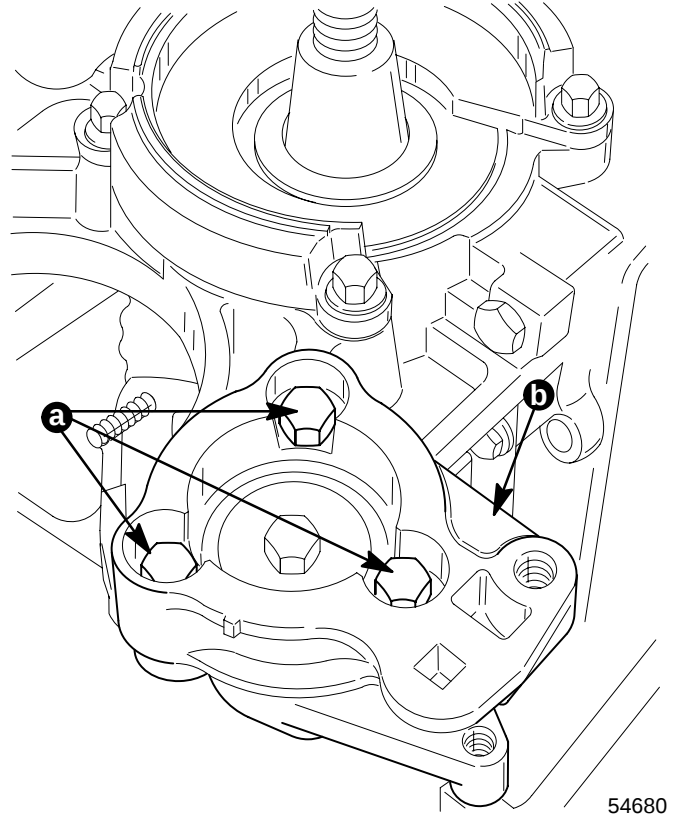


25. Install throttle/spark control arm assembly. Secure control to cylinder block with bolt.



- a - Bolt  
b - Throttle/Spark Control Arm

26. Install throttle actuator assembly to crankcase cover. Secure actuator with three bolts. Torque bolts to 150 lb. in. (16.9 N·m).



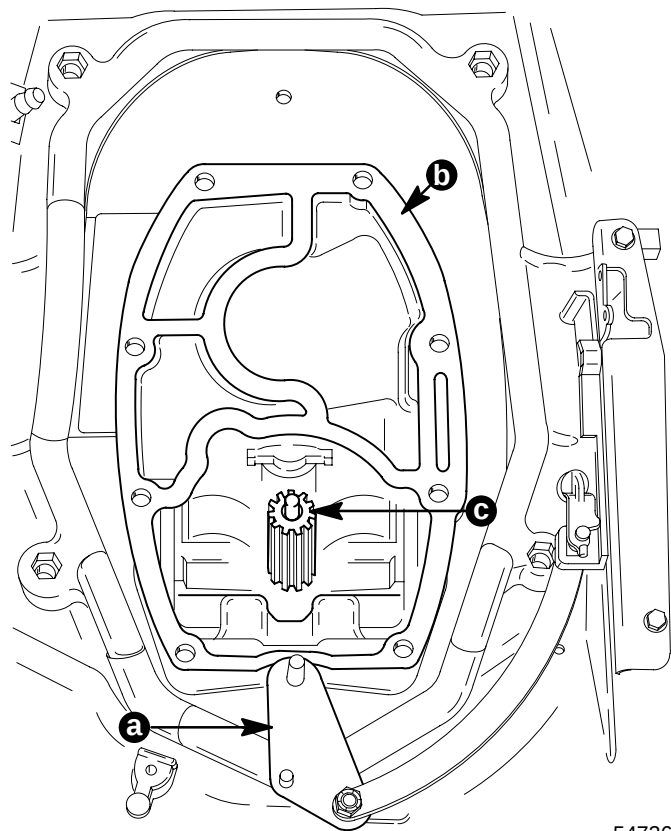
- a - Bolts [Torque to 150 lb. in. (16.9 N·m)]  
b - Throttle Actuator Assembly

27. Referring to Section 3, reinstall carburetors, fuel pump and fuel enrichment components.
28. Referring to Section 2A, reinstall ignition components and flywheel.
29. On Electric Start Models, reinstall starter motor referring to Section B.



## Installing Powerhead on Driveshaft Housing

1. Verify gearcase is in neutral (propeller shaft turns freely in both directions). Shift lever plate should be positioned as shown with gearcase in neutral.
2. Inspect powerhead base gasket surface on both driveshaft housing and bottom of powerhead for cleanliness and roughness. Both surfaces **MUST BE** clean and smooth.
3. Install new powerhead base gasket on driveshaft housing. Apply 2-4-C Marine Lubricant to drive-shaft splines. **DO NOT** apply grease to the top of the driveshaft as this will prevent driveshaft from fully engaging crankshaft.



54736

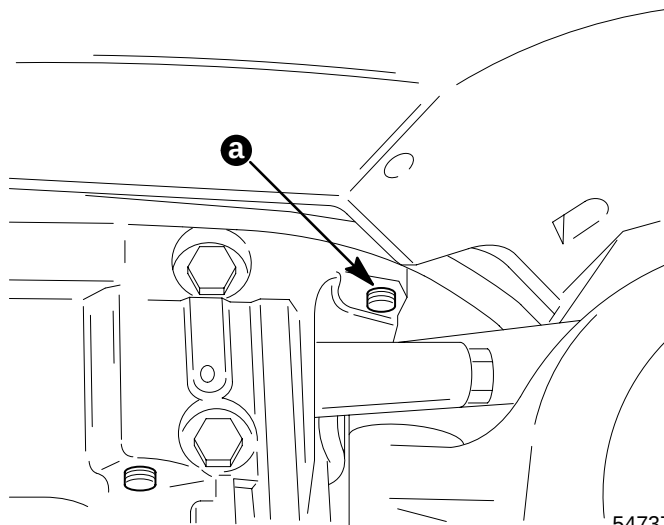
- a - Shift Lever Plate  
b - Gasket  
c - Driveshaft Splines

4. Thread LIFTING EYE (91-75132) into flywheel at least 5 full turns.

5. Using suitable hoist, install powerhead onto driveshaft housing.

**NOTE:** It may be necessary to rotate flywheel slightly to engage crankshaft splines into driveshaft splines when lowering powerhead onto driveshaft housing.

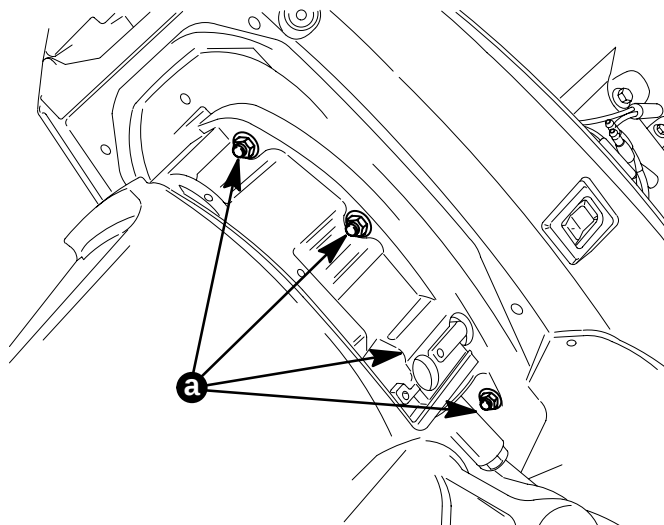
**IMPORTANT:** The forward starboard and port powerhead attaching nuts **MUST BE** started onto their respective studs **BEFORE** powerhead is completely lowered onto driveshaft housing.



54737

- a - Thread Attaching Nut Onto Forward Most Stud (One Each Side) First Before Lowering Powerhead Assembly Completely Onto Driveshaft Housing

6. Install remaining powerhead attaching nuts. Tighten nuts equally in three progressive stages until a torque of 150 lb. in. (16.9 N·m) is obtained.

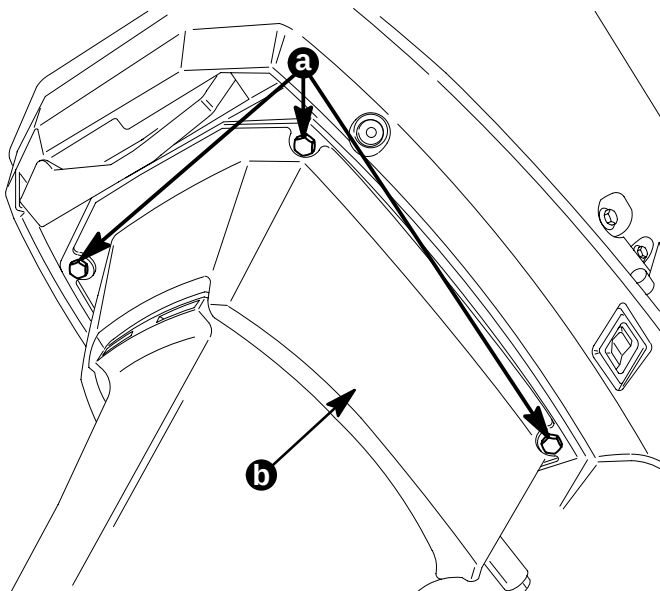


54672

- a - Attaching Nuts (4 Each Side) [Torque to 150 lb. in. (16.9 N·m)]



7. Secure lower trim cover to bottom cowl with four bolts and self-locking nuts (2 each side).



54671

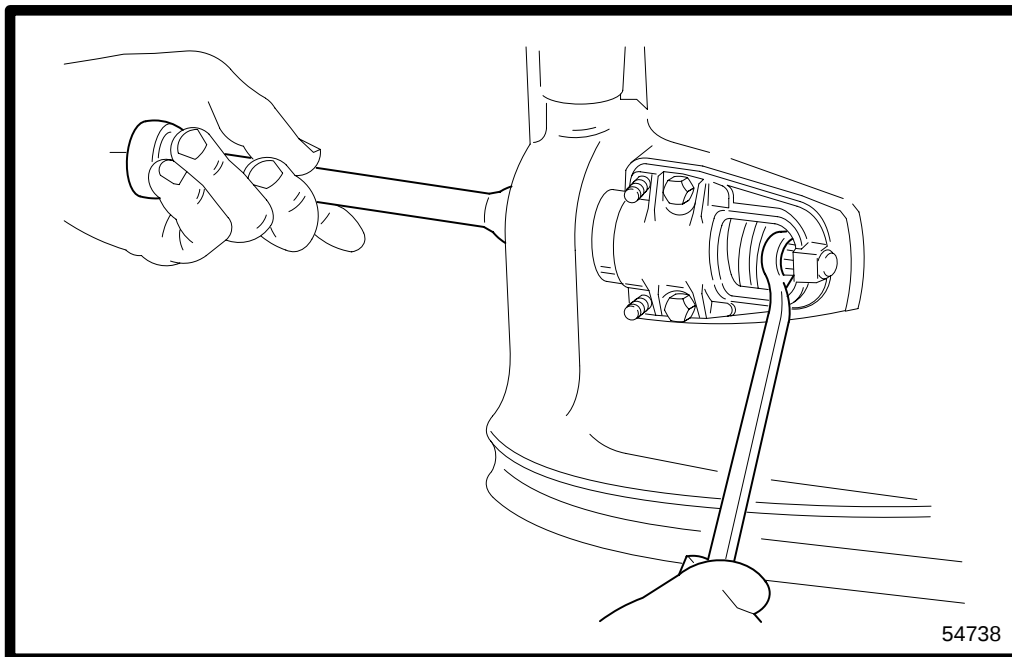
a - Bolts (2 Each Side)  
b - Trim Cover

8. On ELECTRIC START MODELS, reinstall oil tank referring to Section 8.
9. Reinstall rewind starter or flywheel cover, where applicable, referring to Section 2A.
10. Reinstall spark plugs. Torque spark plugs to 20 lb. ft. (27.1 N·m).
11. On ELECTRIC START MODELS, reconnect remote control harness to engine harness.
12. Refer to Section 2C for TIMING/SYNCHRONIZING/ADJUSTING procedure.
13. Attach throttle and shift cables.
14. Attach remote fuel hose to engine.

**NOTE:** Gear Case lubricant level should be checked prior to operating outboard. Refer to Section 5A for correct inspection and filling procedures. If new bearings and piston rings were installed in powerhead, break-in procedures **MUST BE** followed. Refer to OWNERS MANUAL for specific break-in instructions. When initially priming carburetors with fuel using the fuel line primer bulb, inspect all fuel hose connections for signs of fuel leakage.



# MID-SECTION



5

A

## CLAMP/SWIVEL BRACKET AND DRIVE SHAFT HOUSING



# Table of Contents

|                                               | Page |
|-----------------------------------------------|------|
| Swivel Bracket Components .....               | 5A-1 |
| Torque Specifications .....                   | 5A-1 |
| Quicksilver Lubricants and Service Aids ..... | 5A-1 |
| Transom Bracket Components .....              | 5A-2 |
| Torque Specifications .....                   | 5A-2 |
| Quicksilver Lubricants and Service Aids ..... | 5A-2 |
| Drive Shaft Housing Components .....          | 5A-3 |
| Torque Specifications .....                   | 5A-3 |
| Quicksilver Lubricants and Service Aids ..... | 5A-3 |
| Disassembly .....                             | 5A-4 |
| Reassembly .....                              | 5A-4 |
| Tilt Lock Lever/Transom Bracket .....         | 5A-4 |
| Drive Shaft Housing .....                     | 5A-6 |



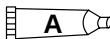
# Swivel Bracket Components

- 1 - Bumper
- 2 - Steering Arm
- 3 - Lock Nut
- 4 - Steering Bracket
- 5 - Locking Plate
- 6 - Bolt (2)
- 7 - Bolt, Steering Arm (2)
- 8 - Steering Link
- 9 - Bolt
- 10- Washer, Upper
- 11- Washer, Lower
- 12- Lock Nut
- 13- Washer (2)
- 14- Oil Seal (2) (Seal Lip Outward)
- 15- Bushing, Swivel Pin (2)
- 16- Bushing, Swivel Bracket
- 17- Swivel Bracket
- 18- Grease Fitting
- 19- Yoke
- 20- Retaining Ring

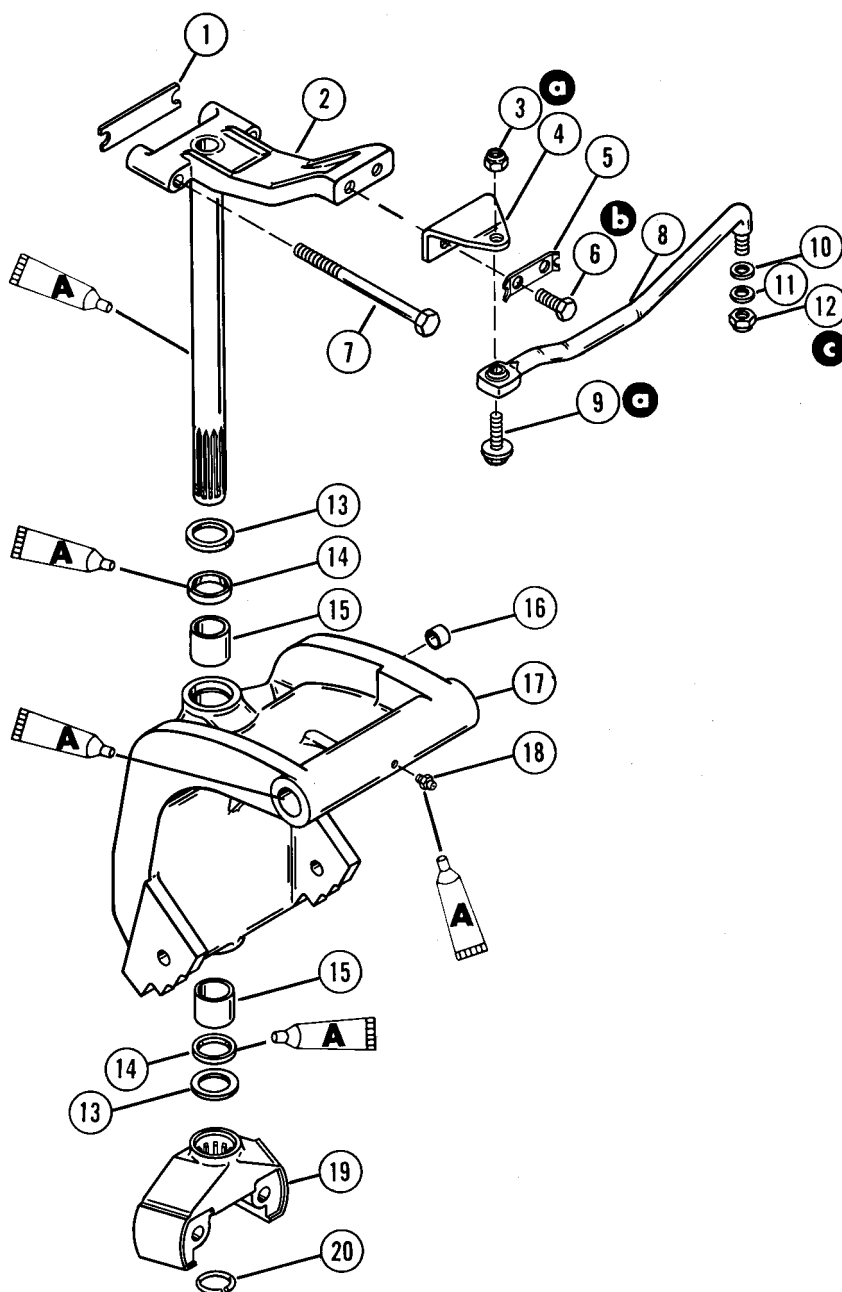
## Torque Specifications

- a** 20 lb. ft. (27 N·m)
- b** 40 lb. ft. (54.2 N·m)
- c** Torque until it seats, then back off 1/4 turn.

## Quicksilver Lubricants and Service Aids

 **A** 2-4-C Marine Lubricant\*

\*See Quicksilver Accessories Guide for part number.





# Transom Bracket Components

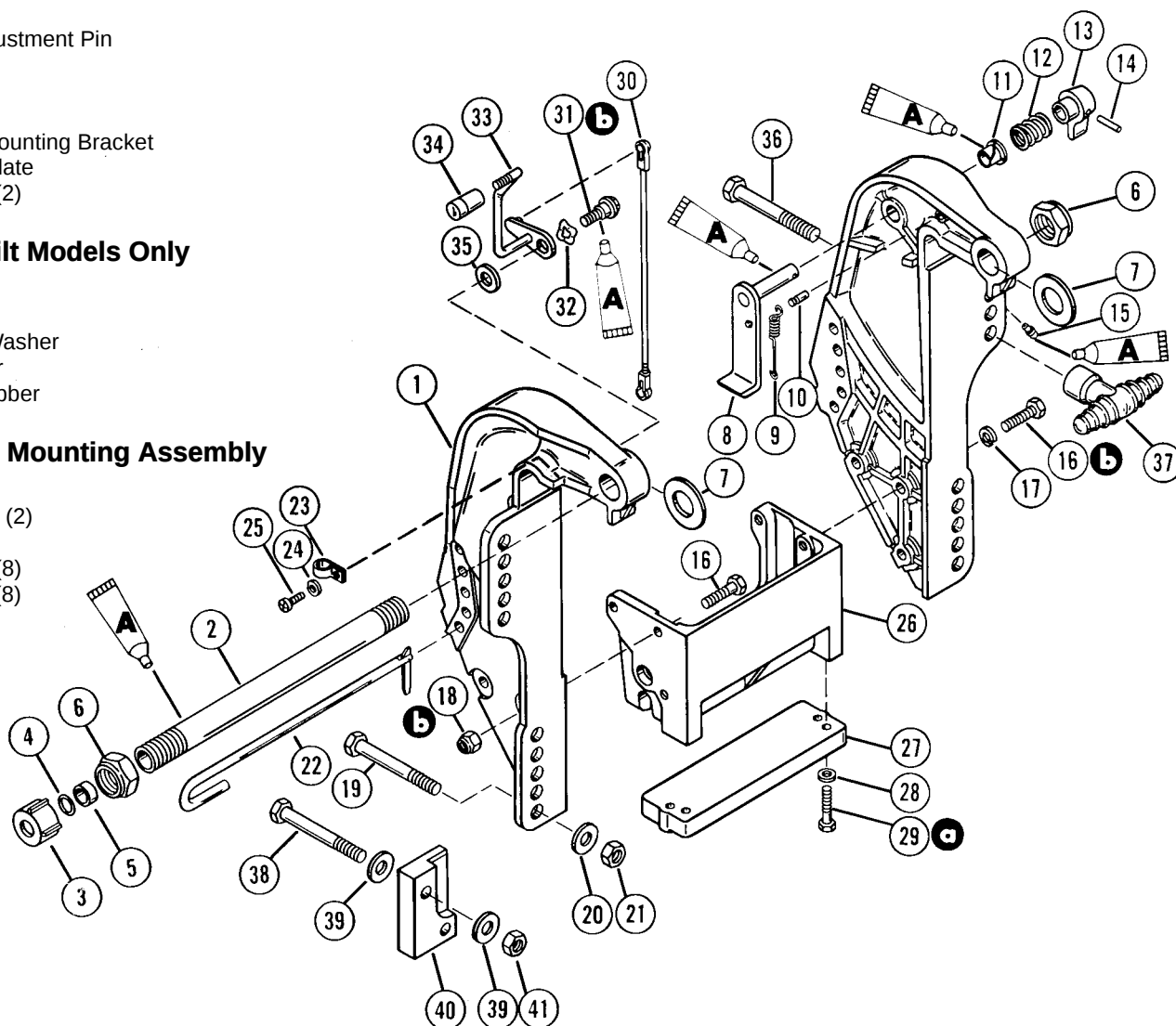
- 1 - Transom Bracket (2)
- 2 - Tilt Tube
- 3 - Cap, Nylon
- 4 - O-ring
- 5 - Spacer
- 6 - Lock Nut (2)
- 7 - Washer (2)
- 8 - Tilt Lock Lever
- 9 - Spring
- 10 - Pin
- 11 - Bushing
- 12 - Spring
- 13 - Lever
- 14 - Roll Pin
- 15 - Grease Fitting
- 16 - Bolt (6)
- 17 - Lock Washer (4)
- 18 - Lock Nut (2)
- 19 - Bolt (4)
- 20 - Washer (4)
- 21 - Nut (4)
- 22 - Trim Adjustment Pin
- 23 - Clamp
- 24 - Washer
- 25 - Bolt
- 26 - Lower Mounting Bracket
- 27 - Anode Plate
- 28 - Washer (2)
- 29 - Bolt (2)

## Manual Tilt Models Only

- 30 - Link
- 31 - Bolt
- 32 - Spring Washer
- 33 - Tilt Lever
- 34 - Grip, Rubber
- 35 - Washer

## Outboard Mounting Assembly

- 36 - Bolt (2)
- 37 - T-handle (2)
- 38 - Bolt (4)
- 39 - Washer (8)
- 40 - Bracket (8)
- 41 - Nut (4)



## Torque Specifications

**a** 60 lb. in. (6.8 N·m)

**b** 25 lb. ft. (33.9 N·m)

## Quicksilver Lubricants and Service Aids

 **A** 2-4-C Marine Lubricant\*

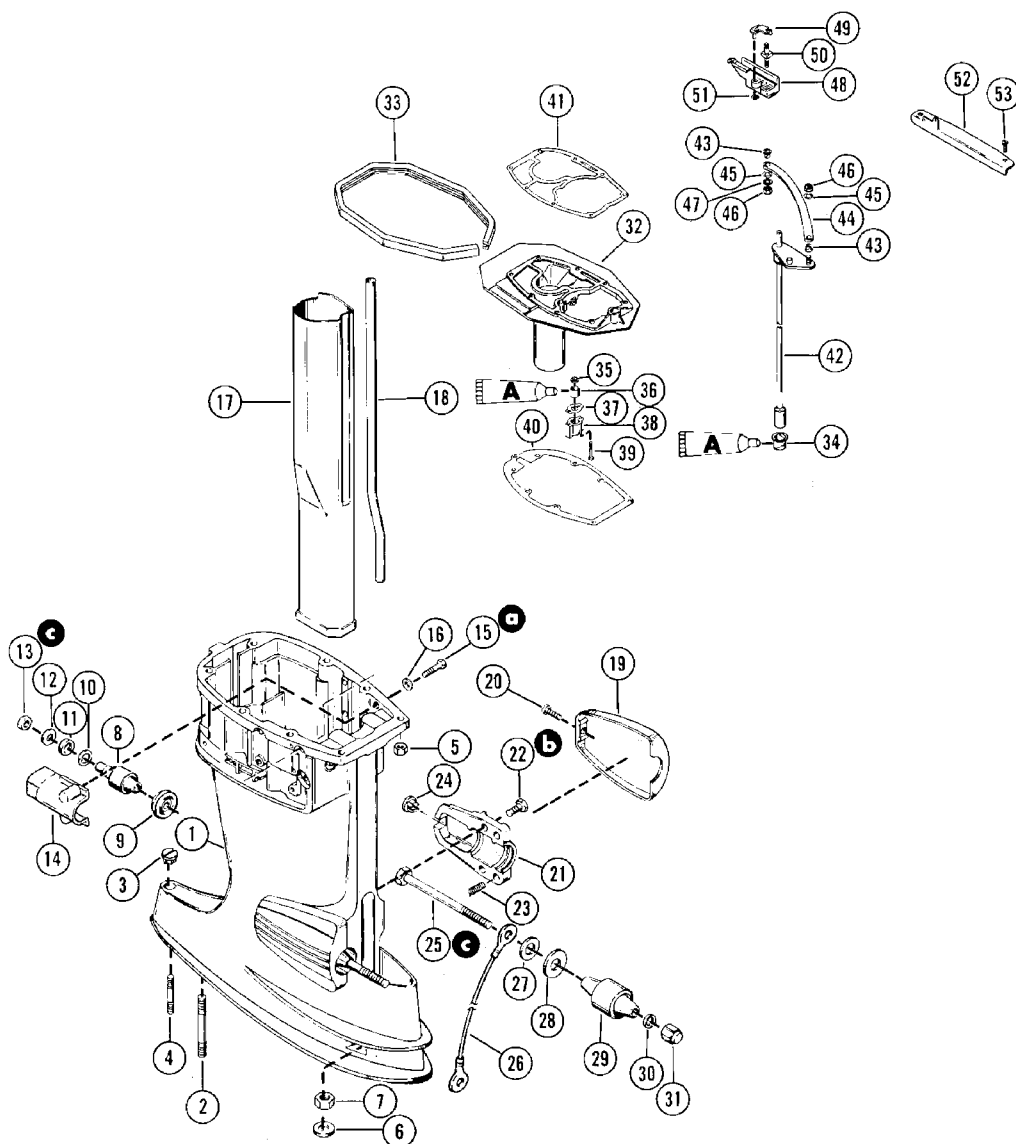
\*See Quicksilver Accessories Guide for part number.

50373



# Drive Shaft Housing Components

- 1 - Drive Shaft Housing
- 2 - Stud
- 3 - Plug
- 4 - Stud
- 5 - Nut (8)
- 6 - Washer (2)
- 7 - Nut (2)
- 8 - Mount, Rubber - Upper (2)
- 9 - Seal, Upper Mount (2)
- 10 - Washer (2)
- 11 - Washer, Rubber (2)
- 12 - Washer (2)
- 13 - Nut (2)
- 14 - Cover, Upper Mount (2)
- 15 - Screw (4)
- 16 - Washer (4)
- 17 - Tube, Exhaust
- 18 - Tube, Water Inlet
- 19 - Cover, Lower Mount Clamp
- 20 - Screw (2)
- 21 - Clamp, Lower Mount (2)
- 22 - Screw (4)
- 23 - Spring, Tension (4)
- 24 - Nut (2)
- 25 - Screw (2)
- 26 - Ground Wire
- 27 - Washer (2)
- 28 - Washer, Rubber (2)
- 29 - Mount, Rubber - Lower (2)
- 30 - Washer (2)
- 31 - Nut (2)
- 32 - Exhaust Adaptor Plate
- 33 - Seal
- 34 - Bushing
- 35 - Washer, Nylon
- 36 - Seal, Rubber
- 37 - Gasket
- 38 - Housing
- 39 - Screw (2)
- 40 - Gasket
- 41 - Gasket
- 42 - Shift Shaft Lever
- 43 - Bushing (2)
- 44 - Shift Link
- 45 - Wave Washer (2)
- 46 - Nut (2)
- 47 - Washer (2)
- 48 - Slider
- 49 - Retainer
- 50 - Stud
- 51 - Retaining Ring
- 52 - Retainer
- 53 - Screw (2)



## Torque Specifications

- a** 80 lb. in. (9.0 N·m)
- b** 150 lb. in. (17 N·m)
- c** 40 lb. ft. (54.2 N·m)

## Quicksilver Lubricants and Service Aids

 **A** 2-4-C Marine Lubricant\*

\*See Quicksilver Accessories Guide for part number.



## Disassembly

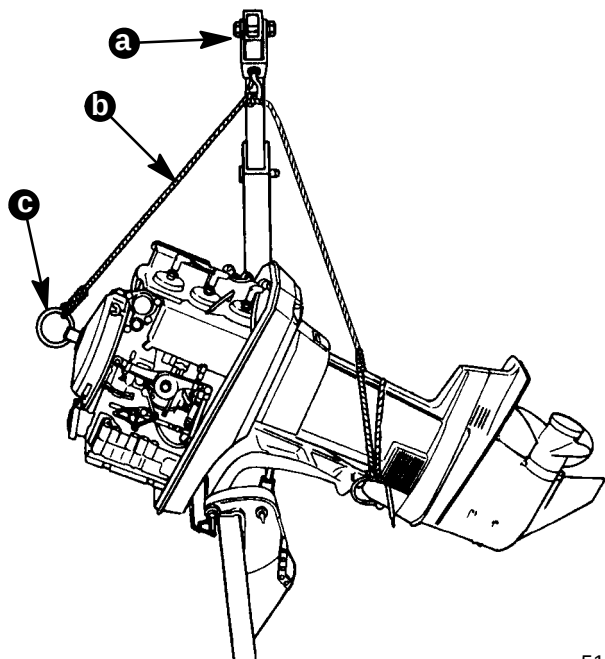
1. Remove shock system assembly (refer to Section 5D) from non power trim models.
2. Remove power trim assembly (refer to Section 5 B or 5C) from power trim models.

**NOTE:** Servicing components such as steering arm, driveshaft housing, exhaust assembly etc. generally require powerhead and/or gear housing removal. Refer to appropriate section in service manual. Components such as swivel bracket, transom bracket, lower mount bracket, tilt tube and lower engine mounts can be serviced without powerhead/gear housing removal; however, outboard must be supported (shown) before servicing components not requiring powerhead/gear housing removal.

### ⚠ WARNING

Failure to support outboard as shown could result in personal injury and/or damage to outboard or boat.

#### Typical Outboard Shown



51078

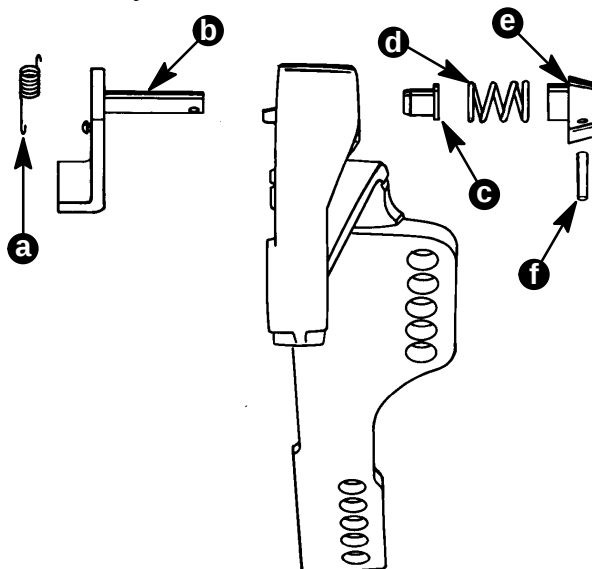
- a - Hoist
- b - Rope
- c - Lifting Eye (P/N 91-90455)

**NOTE:** Refer to parts views on pages 1, 2 and 3 and disassemble mid-section components as required.

## Reassembly

### Tilt Lock Lever/Transom Bracket

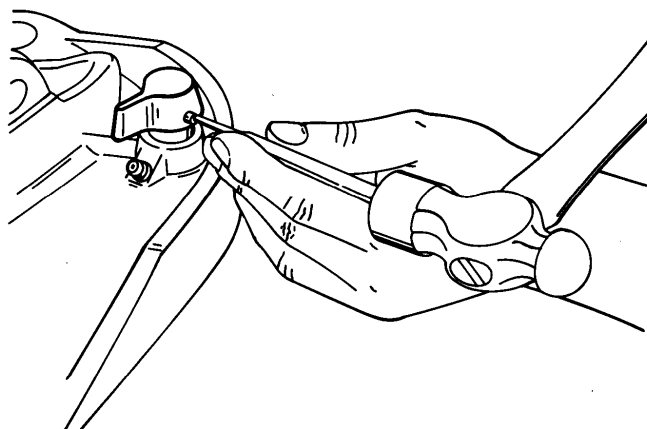
1. Apply Quicksilver 2-4-C Marine Lubricant to tilt lock lever shank, spacer and bushing prior to re-assembly.



51079

- a - Spring
- b - Tilt Lock Lever
- c - Bushing
- d - Spring
- e - Lever
- f - Roll Pin

2. Install roll pin to tilt lock lever assembly using appropriate punch.



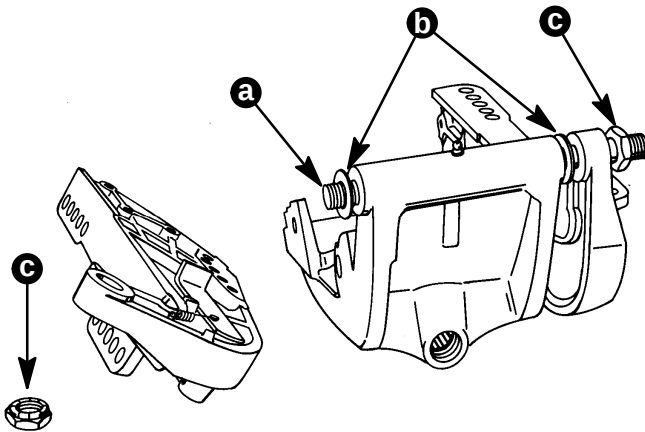
51078

### ⚠ CAUTION

When reinstalling outboard tilt tube, longer threaded end of tilt tube must extend approximately 3/4 in. (19mm) toward steering cable "nut" side of boat.



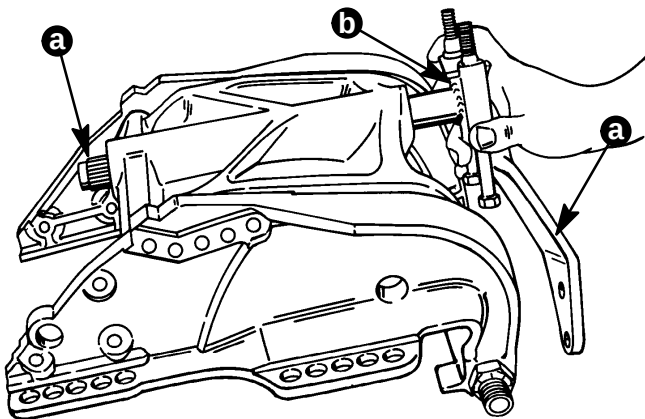
3. Lubricate outboard tilt tube using Quicksilver 2-4-C Marine Lubricant and install into swivel bracket.
4. Secure transom brackets into place using fiber washers and lock nuts.



51078

- a - Tilt Tube  
b - Fiber Washer  
c - Lock Nuts

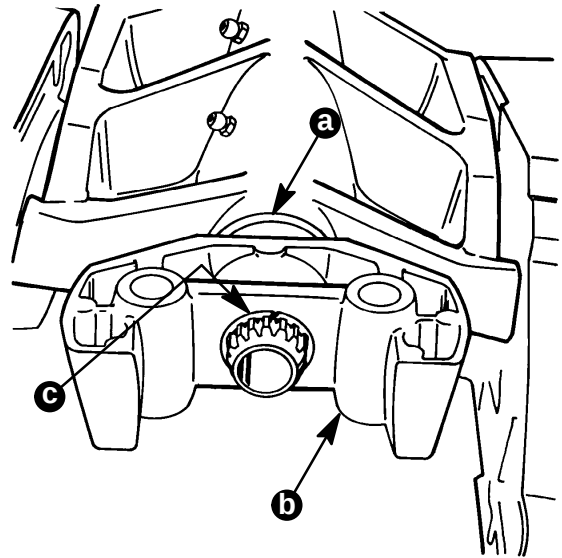
5. Apply Quicksilver 2-4-C Marine Lubricant to steering arm shaft and install.



51079

- a - Steering Arm  
b - Washer

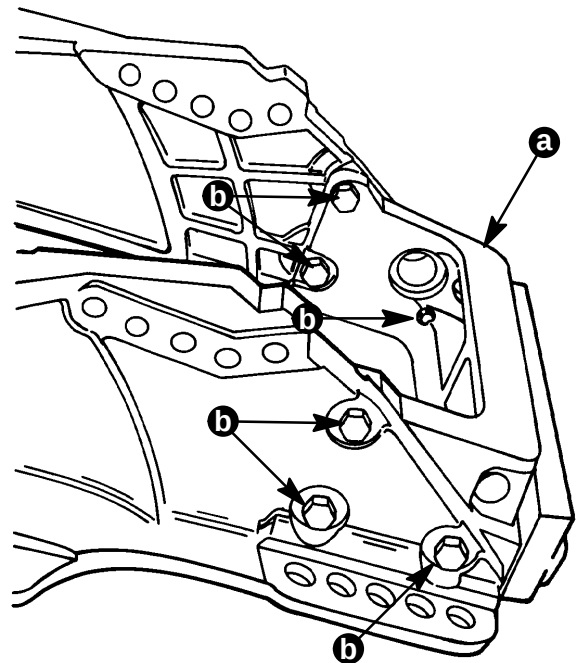
6. Install and secure yoke and washer using snap ring.



51079

- a - Washer  
b - Yoke  
c - Snap Ring

7. Install lower mounting bracket to transom brackets.



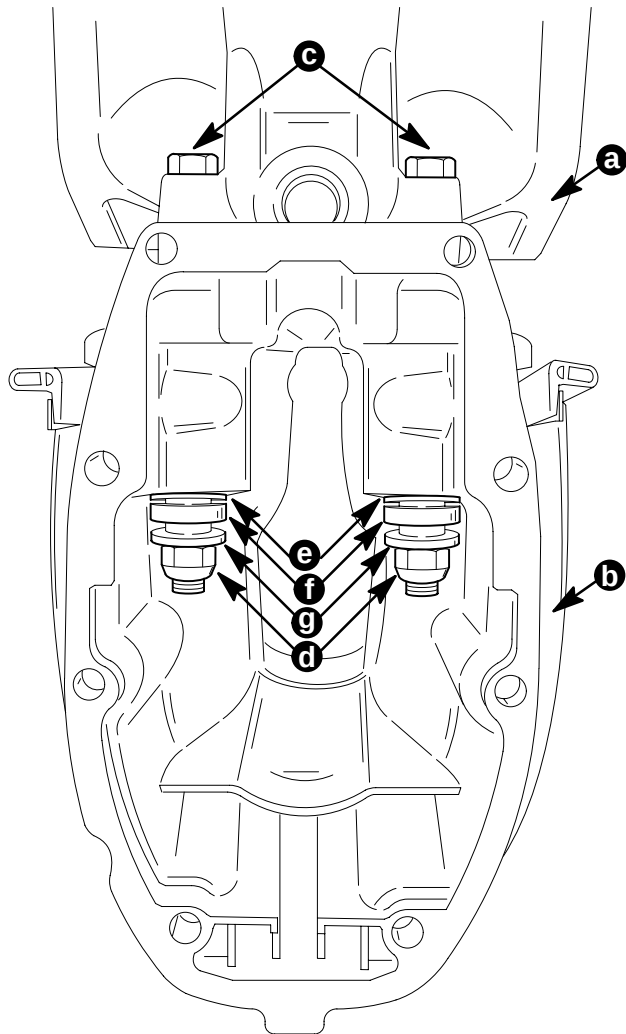
51079

- a - Lower Mounting Bracket  
b - Bolt



## Drive Shaft Housing

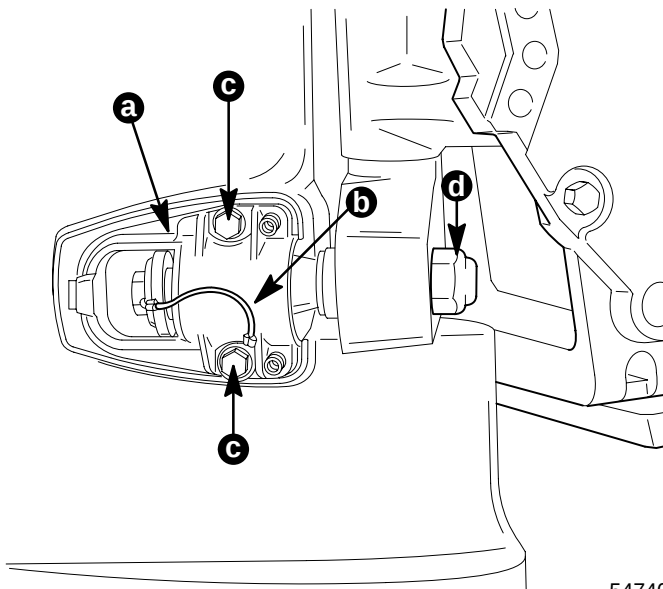
1. Secure transom bracket assembly to transom.
2. Install drive shaft housing to transom bracket assembly. Secure using bolts and components as shown.



54739

- a - Transom Bracket Assembly
- b - Drive Shaft Housing
- c - Bolts
- d - Lock Nuts [Torque to 40 lb. ft. (54.2 N·m)]
- e - Washer
- f - Rubber Mount
- g - Washer

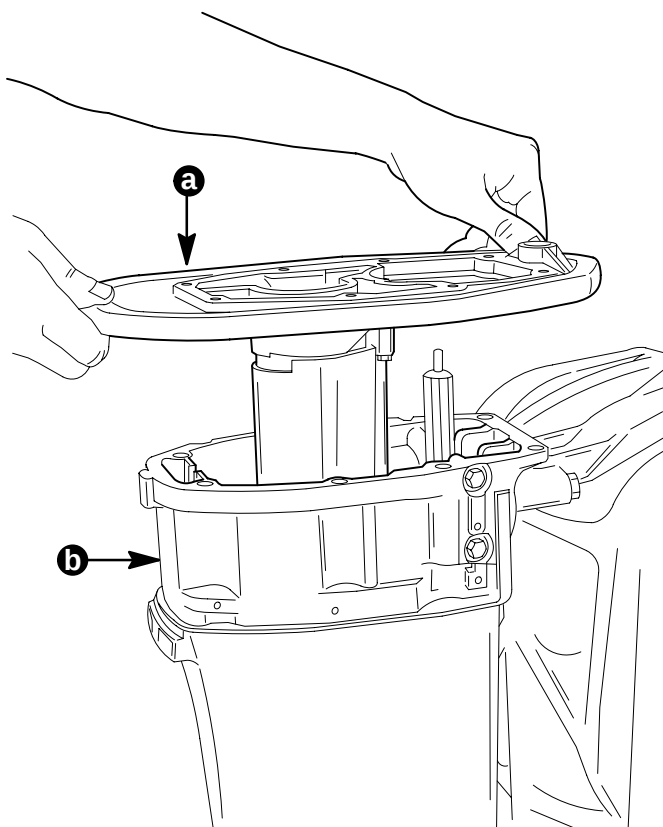
3. Secure lower mount assembly to drive shaft housing. Secure drive shaft housing to yoke.



54740

- a - Lower Mount Assembly
- b - Ground Cable
- c - Bolt [Torque to 150 lb. in. (17 N·m)]
- d - Lock Nut [Torque to 60 lb. ft. (81.3 N·m)]

4. Install exhaust plate assembly to drive shaft housing using new exhaust plate gasket.

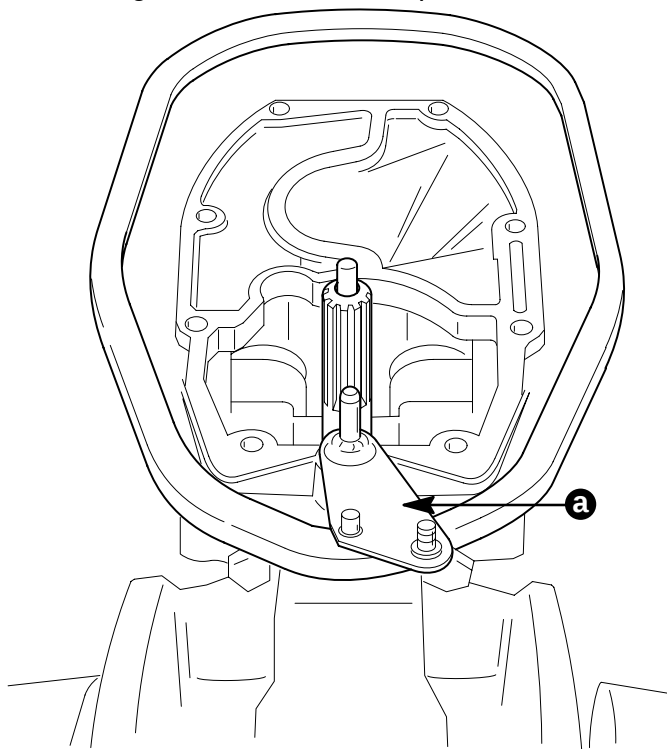


54741

- a - Exhaust Plate Assembly
- b - Drive Shaft Housing



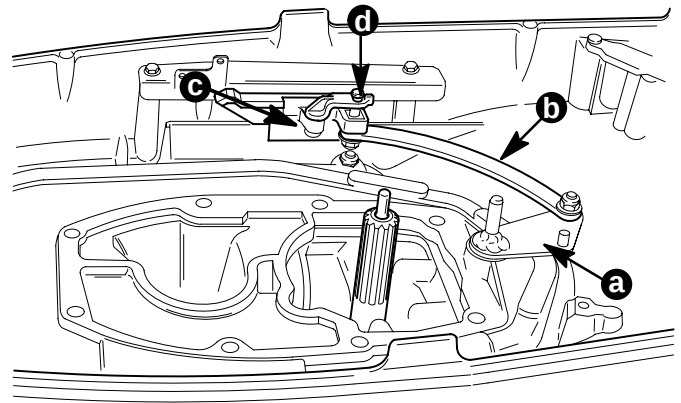
5. Place gearcase shift shaft in neutral position (propeller shaft turns freely in both direction) and install to mid-section. Refer to Section 6A.
6. Install shift lever plate and bushing into mid-section as shown. Shift lever plate must face forward while gearcase is in neutral position.



54742

a - Shift Lever Plate

7. Install shift linkage to bottom cowl as shown.



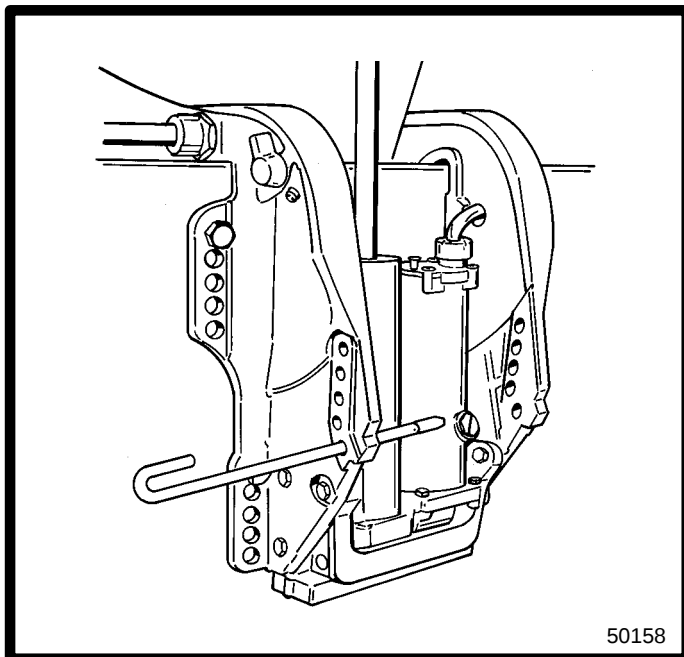
54634

- a - Shift Lever Plate
- b - Shift Link
- c - Slider
- d - Retainer

8. Install power head (refer to Section 4).



# MID-SECTION



5

B

## POWER TRIM (DESIGN 1)



# Table of Contents

|                                              | Page  |
|----------------------------------------------|-------|
| Power Trim General Information .....         | 5B-1  |
| Description .....                            | 5B-1  |
| Trimming Characteristics .....               | 5B-1  |
| Trimming Outboard "Up" ("Out") .....         | 5B-1  |
| Trimming Outboard "Down" ("In") .....        | 5B-1  |
| Trailing Outboard .....                      | 5B-2  |
| Tilting Outboard Up and Down Manually ..     | 5B-2  |
| Trim "In" Angle Adjustment .....             | 5B-2  |
| Power Trim System Components .....           | 5B-3  |
| Torque Specifications .....                  | 5B-3  |
| Quicksilver Lubricants and Service Aids ..   | 5B-3  |
| Power Trim Flow Diagrams Design 1 .....      | 5B-4  |
| Determine if Problem is Electrical or        |       |
| Hydraulic .....                              | 5B-11 |
| Trouble Chart .....                          | 5B-11 |
| Hydraulic System Troubleshooting .....       | 5B-12 |
| Preliminary Checks .....                     | 5B-12 |
| Leak Down Check – Pump and Manifold          |       |
| Assembly .....                               | 5B-12 |
| Leak Down Check – Pilot Valve                |       |
| Assembly .....                               | 5B-13 |
| Leak Down Check – Manual Release             |       |
| Valve .....                                  | 5B-13 |
| Leakage Past Ball and Seat – Piston          |       |
| Assembly .....                               | 5B-13 |
| Troubleshooting Flow Diagram .....           | 5B-14 |
| Troubleshooting Flow Diagram .....           | 5B-15 |
| Electrical System Troubleshooting .....      | 5B-16 |
| COMMANDER 2000 Side Mount Remote             |       |
| Control (Power Trim/Tilt Electric Start with |       |
| Warning Horn) Wiring Diagram .....           | 5B-16 |
| Power Trim System Wiring Diagram .....       | 5B-17 |
| Troubleshooting the "Down" Circuit*          |       |
| (When "Up" Circuit is OK) .....              | 5B-18 |
| Troubleshooting the "Up" Circuit*            |       |
| (When "Down" Circuit Is OK) .....            | 5B-19 |
| Troubleshooting the "Down" and "Up" Circuits |       |
| (All Circuits Inoperative)* .....            | 5B-20 |

|                                         | Page  |
|-----------------------------------------|-------|
| Power Trim System Removal .....         | 5B-21 |
| Power Trim System Disassembly .....     | 5B-22 |
| Trim Rod Removal .....                  | 5B-22 |
| Trim Rod Disassembly .....              | 5B-23 |
| Trim "Motor" Removal .....              | 5B-25 |
| Trim "Motor" Disassembly .....          | 5B-25 |
| Reservoir Assembly Removal .....        | 5B-26 |
| Oil Pump Removal .....                  | 5B-27 |
| Manifold Removal .....                  | 5B-27 |
| Cleaning and Inspection of Trim Rod     |       |
| Components .....                        | 5B-28 |
| Motor and Electrical Tests/Repair ..... | 5B-29 |
| Trim Pump Motor Test .....              | 5B-29 |
| Thermal Overload Switch Test .....      | 5B-29 |
| Motor Assembled .....                   | 5B-29 |
| Motor Disassembled .....                | 5B-29 |
| Armature Tests .....                    | 5B-30 |
| Test for Shorts .....                   | 5B-30 |
| Test for Ground .....                   | 5B-30 |
| Checking and Cleaning Commutator ..     | 5B-30 |
| Power Trim System Reassembly .....      | 5B-30 |
| Manifold Installation .....             | 5B-30 |
| Oil Pump Installation .....             | 5B-31 |
| Trim Motor Reassembly .....             | 5B-32 |
| Reservoir Installation .....            | 5B-33 |
| Trim Rod Re-assembly .....              | 5B-35 |
| Trim Rod Installation .....             | 5B-36 |
| Bleeding Power Trim Unit .....          | 5B-37 |
| Power Trim Unit Installation .....      | 5B-37 |



# Power Trim General Information

## Description

The Power Trim system consists of an electric motor, pressurized fluid reservoir, pump and trim cylinder.

The remote control (or trim panel) is equipped with a switch that is used for trimming the outboard “up” and “down”, and for tilting the outboard for shallow water operation (at slow speed) or for “trailing”. The outboard can be trimmed “up” or “down” while engine is under power or when engine is not running.

## Trimming Characteristics

**NOTE:** Because varying hull designs react differently in various degrees of rough water, it is recommended to experiment with trim positions to determine whether trimming “up” or “down” will improve the ride in rough water.

When trimming your outboard from a mid-trim position (trim tab in neutral, straight fore-and-aft, position), you can expect the following results:

### TRIMMING OUTBOARD “UP” (“OUT”)

#### WARNING

**Excessive trim “out” may reduce the stability of some high speed hulls. To correct instability at high speed, reduce the power gradually and trim the motor “in” slightly before resuming high speed operation. (Rapid reduction in power will cause a sudden change of steering torque and may cause additional momentary boat instability.)**

Will lift bow of boat, generally increasing top speed.

Transfers steering torque harder to left on installations below 23” transom height.

Increases clearance over submerged objects.

In excess, can cause porpoising and/or ventilation.

In excess, can cause insufficient water supply to water pump resulting in serious water pump and/or powerhead overheating damage.

#### WARNING

**Excessive engine trim angle will result in insufficient water supply to water pump causing water pump and/or powerhead overheating damage.**

**Make sure that water level is above gear housing water intake holes whenever engine is running.**

Operating “up” circuit will actuate the “up” solenoid (located under engine cowl) and close the electric motor circuit. The electric motor will drive the pump, thus forcing automatic transmission fluid thru internal passageways into the “up” side of the trim cylinder.

The trim cylinder/trim ram will position the engine at the desired trim angle within the 20° maximum trim range. The Power Trim system is designed so the engine cannot be trimmed beyond the 20° maximum trim angle as long as engine RPM is above approximately 2000 RPM.

The engine can be raised beyond the 20° maximum trim angle for shallow water operation, etc., by keeping the engine RPM below 2000 RPM. If engine RPM increases above 2000 RPM, the thrust created by the propeller (if deep enough in the water) will cause the trim system to automatically lower the engine back to the 20° maximum trim angle.

### TRIMMING OUTBOARD “DOWN” (“IN”)

#### WARNING

**Excessive speed at minimum trim “In” may cause undesirable and/or unsafe steering conditions. Each boat should be tested for handling characteristics after any adjustment is made to the tilt angle (tilt pin relocation).**

Will help planing off, particularly with a heavy load.

Usually improves ride in choppy water.

In excess, can cause boat to veer to the left or right (bow steer).

Transfers steering torque harder to right (or less to the left).

Improves planing speed acceleration (by moving tilt pin one hole closer to transom).

Operating “Down” circuit will actuate the “down” solenoid (located under engine cowl) and close the electric motor circuit (motor will run in opposite direction of the “Up” circuit). The electric motor will drive the pump, thus forcing automatic fluid thru internal passageways into the “down” side of the tilt ram. The tilt ram will move the engine downward to the desired angle.



## Trailing Outboard

### ⚠ WARNING

Excessive engine trim angle will result in insufficient water supply to water pump causing water pump and/or powerhead overheating damage. Make sure that water level is above gear housing water intake holes whenever engine is running.

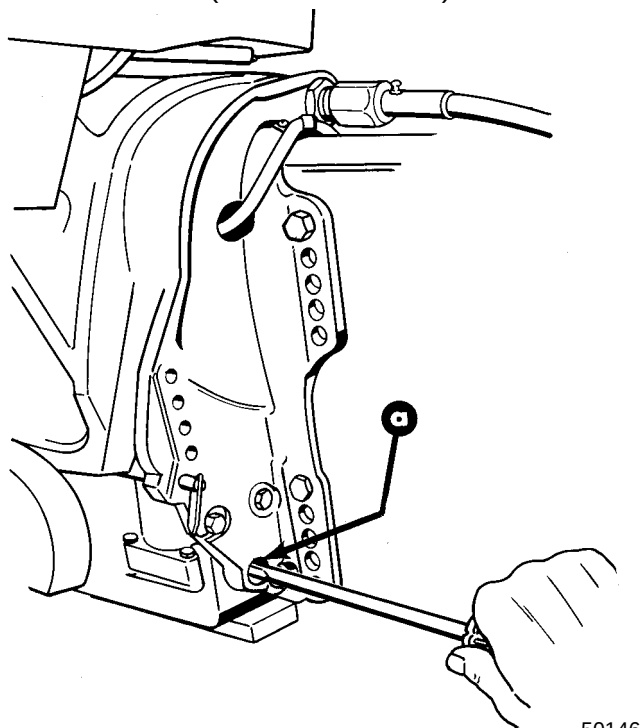
While operating “up” circuit, tilt ram will continue to tilt outboard to full up position for trailering.

## Tilting Outboard Up and Down Manually

### ⚠ WARNING

Before loosening the manual release valve, make sure all persons are clear of engine as engine will drop to full “down” position when valve is loosened.

With power trim installed, the outboard can be raised or lowered manually by opening the manual release valve 3 to 4 turns (counterclockwise).



50146

a - Manual Release Valve

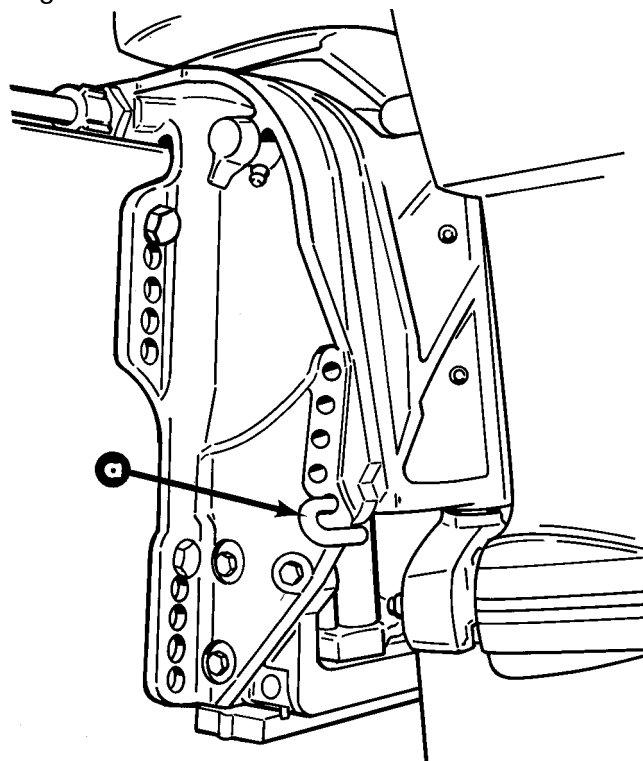
## Trim “In” Angle Adjustment

### ⚠ WARNING

Operating some boats with engine trimmed to the full “in” trim angle [not using trim adjustment pin (a)] at planing speed will cause undesirable and/or unsafe steering conditions. Each boat must be water tested for handling characteristics after engine installation and after any trim adjustments.

**IMPORTANT:** Some boat/motor combinations, that do not use the trim adjustment pin (a) and are trimmed to the full “in” trim angle, will not experience any undesirable and/or unsafe steering conditions during planing speed. Thus, not using trim adjustment pin may be desired. However, some boats with engine trimmed to the full “in” trim angle at planing speeds will cause undesirable and/or unsafe steering conditions. If these steering conditions are experienced, under no circumstances should the engine be operated without the trim adjustment pin and without the pin adjusted in the proper holes to prevent unsafe handling characteristics.

Water test the boat not using the trim adjustment pin. If undesirable and/or unsafe steering conditions are experienced (boat runs with nose down), install trim adjustment pin in proper hole to prevent unsafe handling characteristics.



50157



# Power Trim System Components

- 1 - Trim Rod
- 2 - Dowel Pin (Upper)
- 3 - Upper Pivot Pin
- 4 - Rod Wiper
- 5 - O-ring .671 in. I.D.
- 6 - Cylinder Cap
- 7 - O-ring 1.864 in. I.D.
- 8 - O-ring .614 in. I.D.
- 9 - Trim Rod Piston
- 10- Ball (5)
- 11- Spring Seat (5)
- 12- Spring (5)
- 13- Retaining Plate
- 14- Screw (5)
- 15- O-ring 1.600 in I.D. (Rod Piston)
- 16- O-ring 1.600 in. I.D. (Memory Piston)
- 17- Memory Piston
- 18- Trim Rod Cylinder
- 19- Screw (2)
- 20- O-ring .208 in I.D. (2)
- 21- Filter
- 22- O-ring .301 in. I.D.
- 23- Valve Seat
- 24- O-ring .364 in. I.D.
- 25- Ball
- 26- Spring Guide
- 27- Spring
- 28- Dowel Pin (2)
- 29- Reservoir
- 30- Fill Screw
- 31- O-ring .583 in. I.D.
- 32- Screw (4)
- 33- Washer (4)
- 34- O-ring 2.364 in. I.D.
- 35- Screw
- 36- Drive Shaft
- 37- Pump
- 38- O-ring .176 in. I.D. (2)
- 39- Dowel Pin
- 40- Manifold
- 41- O-ring .114 in. I.D.
- 42- O-ring .208 in. I.D.
- 43- O-ring .239 in. I.D.
- 44- Relief Valve
- 45- "E" Clip
- 46- Wire Harness
- 47- Cap
- 48- Washer
- 49- Grommet
- 50- Screw (4)
- 51- Screw
- 52- Reservoir Cap
- 53- O-ring 2.364 in. I.D.
- 54- Disk Foam Pad
- 55- Nut (2)
- 56- End Cap
- 57- Washer (.030 in. Thick) (2)
- 58- Washer, Thrust
- 59- Armature
- 60- Washer (.010 in. Thick)
- 61- Housing
- 62- O-ring
- 63- End Frame
- 64- O-ring .489 in. I.D.
- 65- Screw (2)

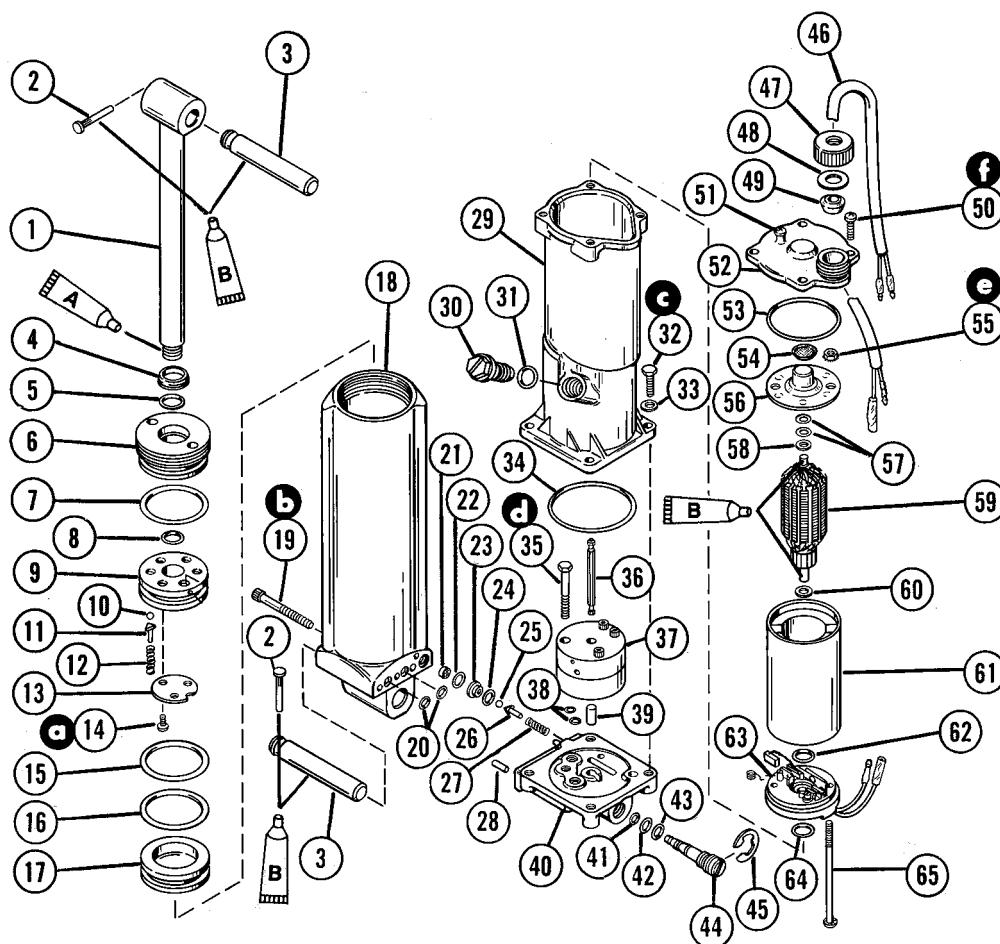
**NOTE:** It is recommended that "ALL" O-rings be replaced when servicing tilt system.

## Torque Specifications

- a** 35 lb. in. (4.0 N·m)
- b** 100 lb. in. (11.2 N·m)
- c** 70 lb. in. (7.9 N·m)
- d** 90 lb. in. (10.2 N·m)
- e** 25 lb. in. (2.8 N·m)
- f** 13 lb. in. (1.5 N·m)

## Quicksilver Lubricants and Service Aids

- A** Loctite Grade "A" (271)
- B** 2-4-C Marine Lubricant (92-90018A12)



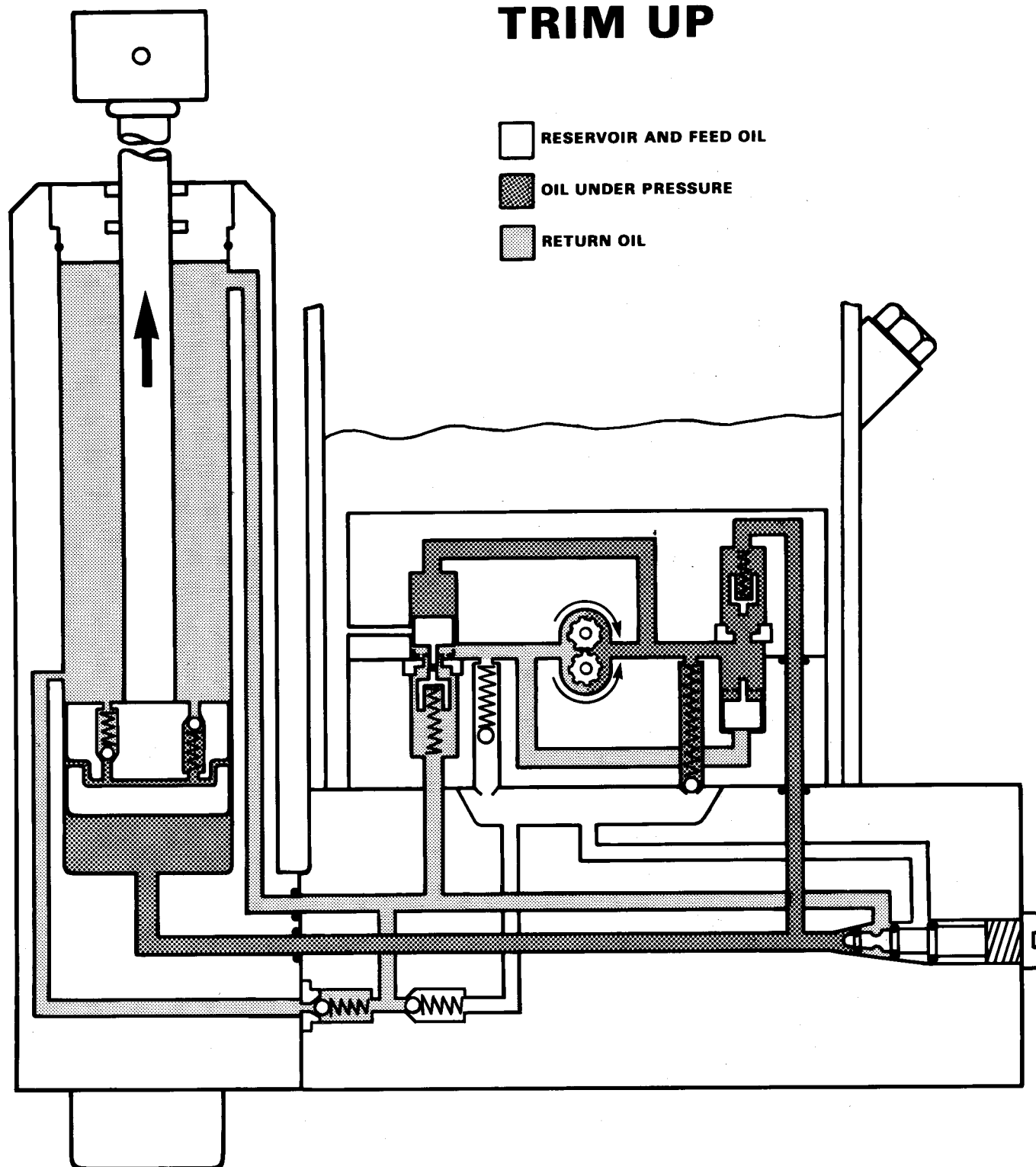
26153



# Power Trim Flow Diagrams

## Design 1

### TRIM UP

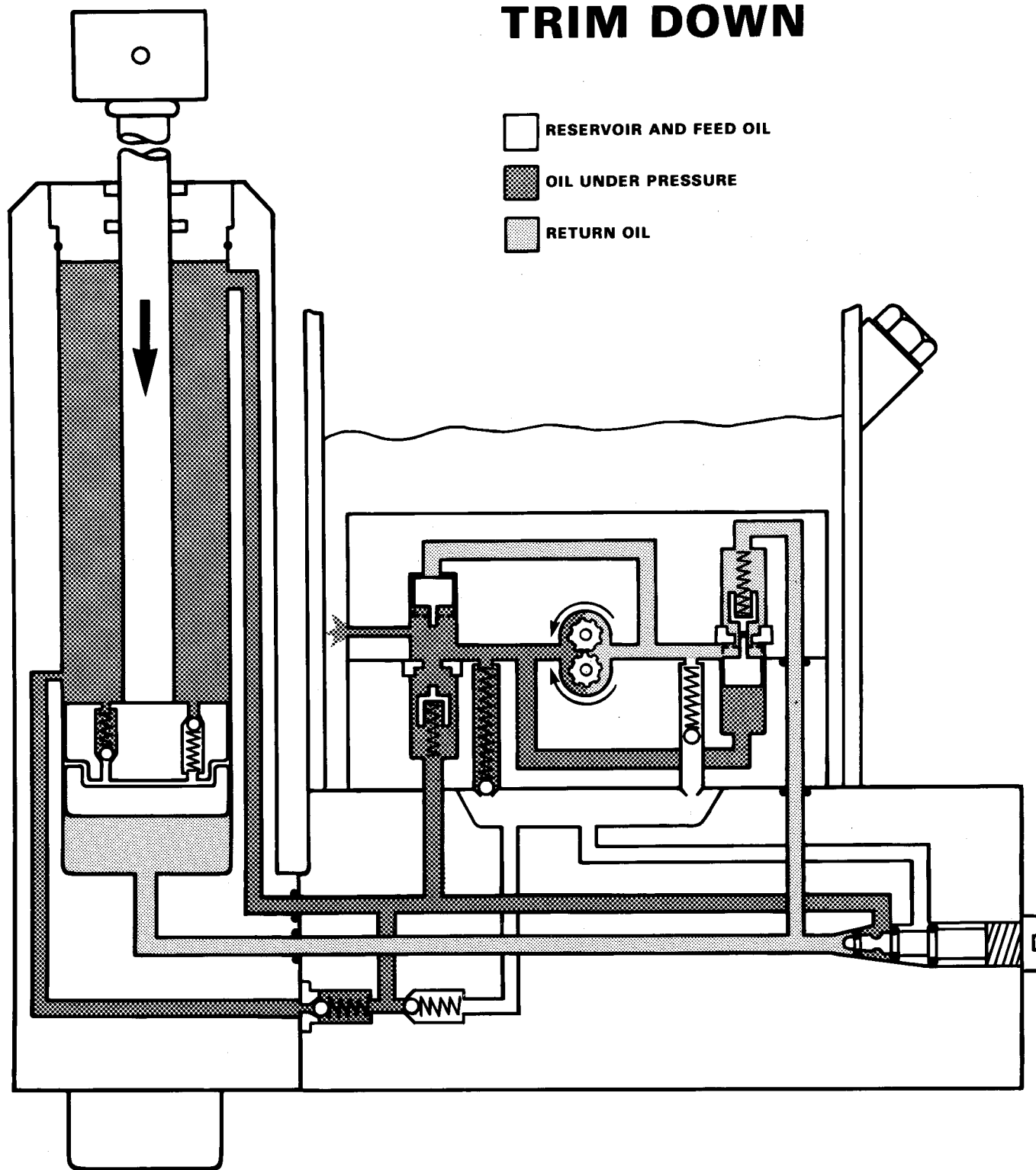


51638



## Design 1

### TRIM DOWN

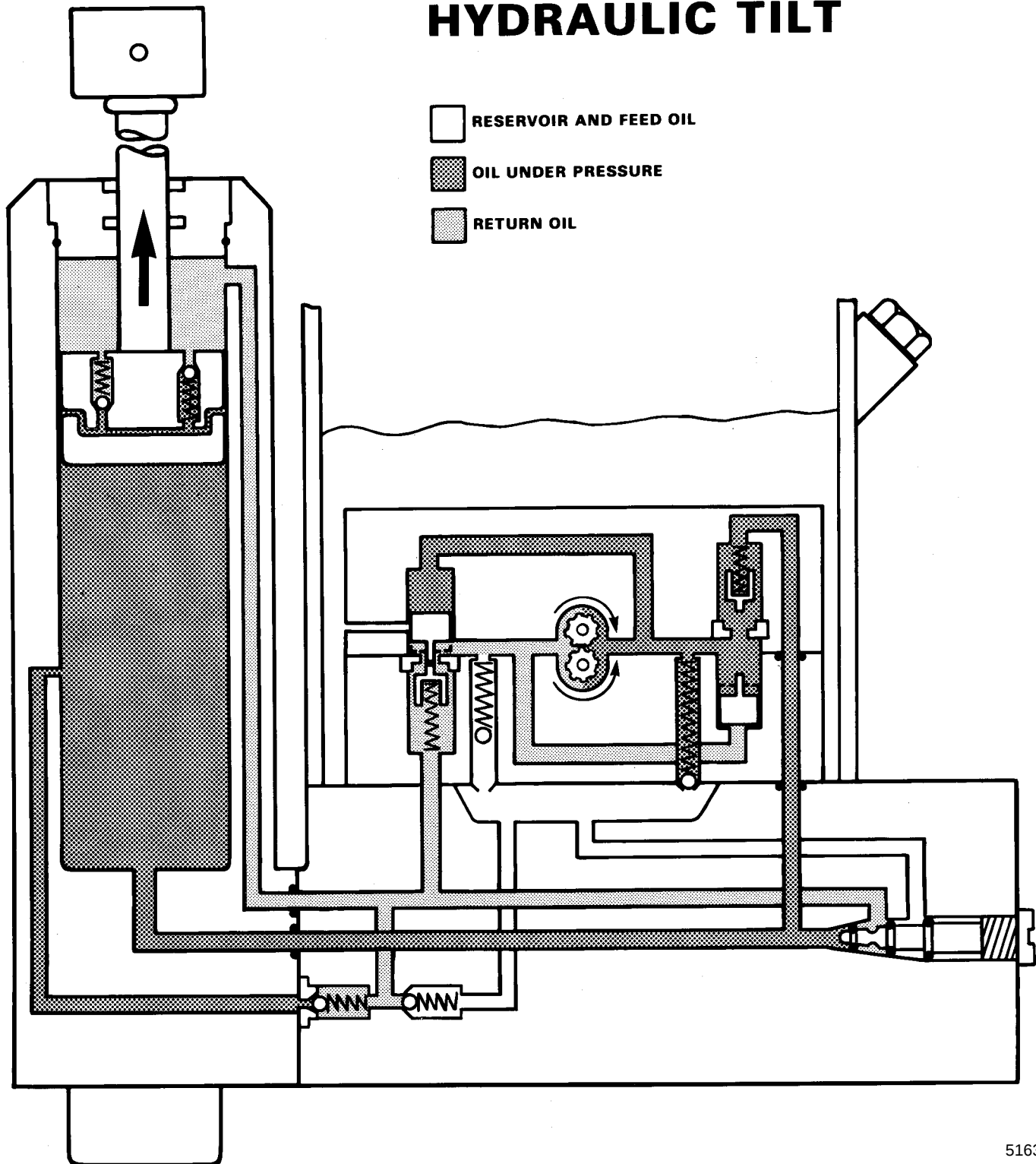


51637



## Design 1

# HYDRAULIC TILT

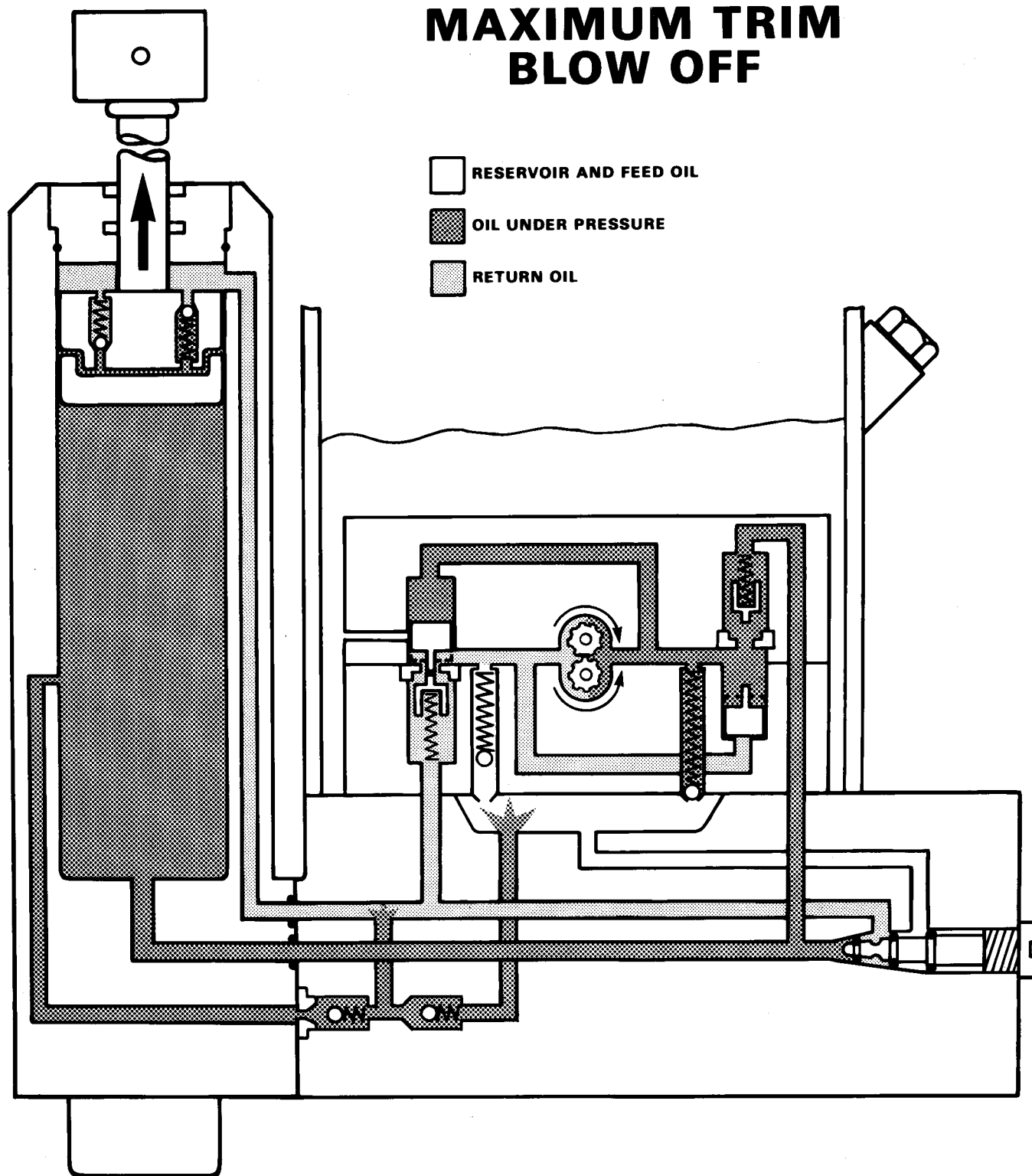


51639



## Design 1

# MAXIMUM TRIM BLOW OFF

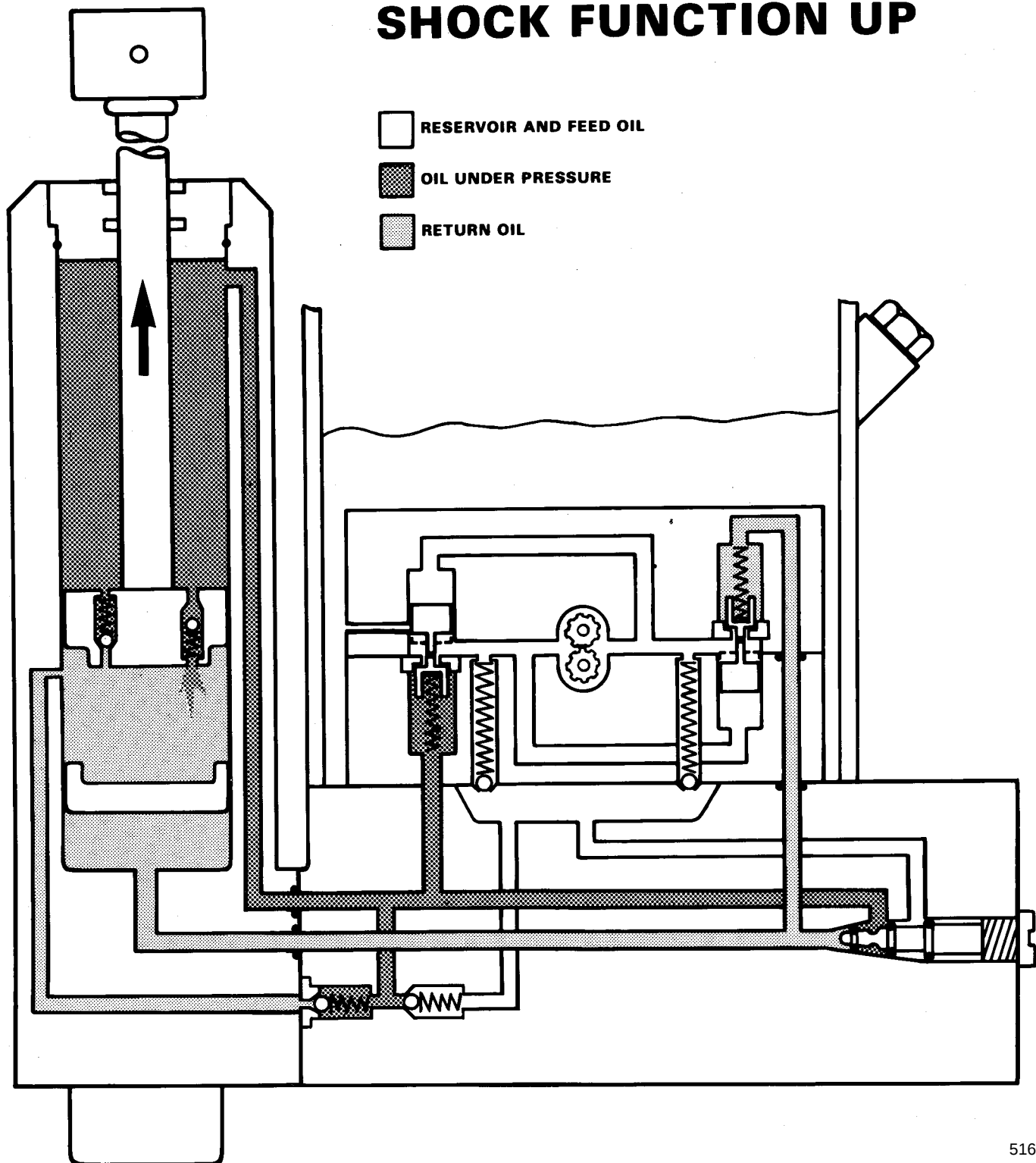


51640



## Design 1

# SHOCK FUNCTION UP

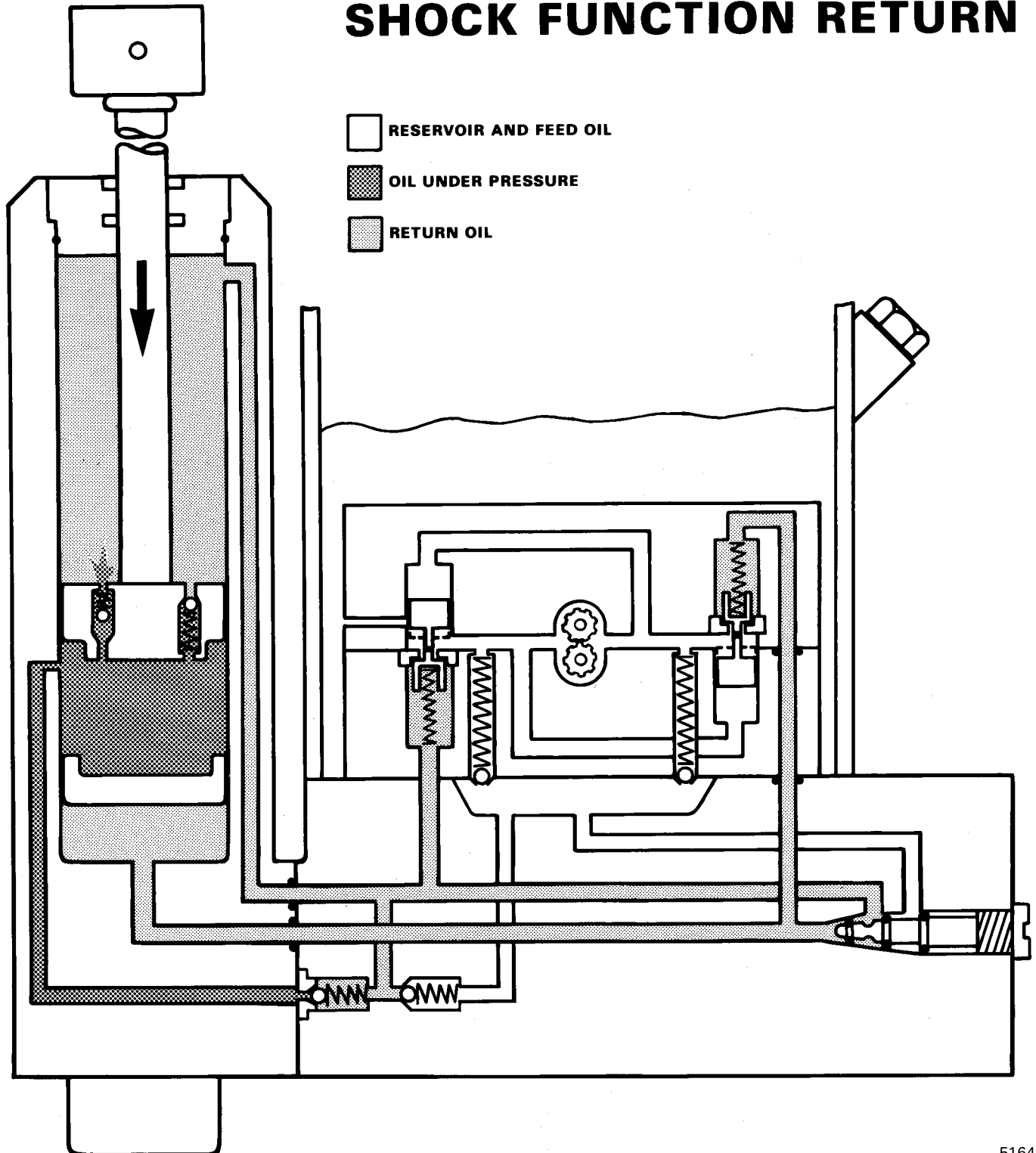


51641



## Design 1

# SHOCK FUNCTION RETURN



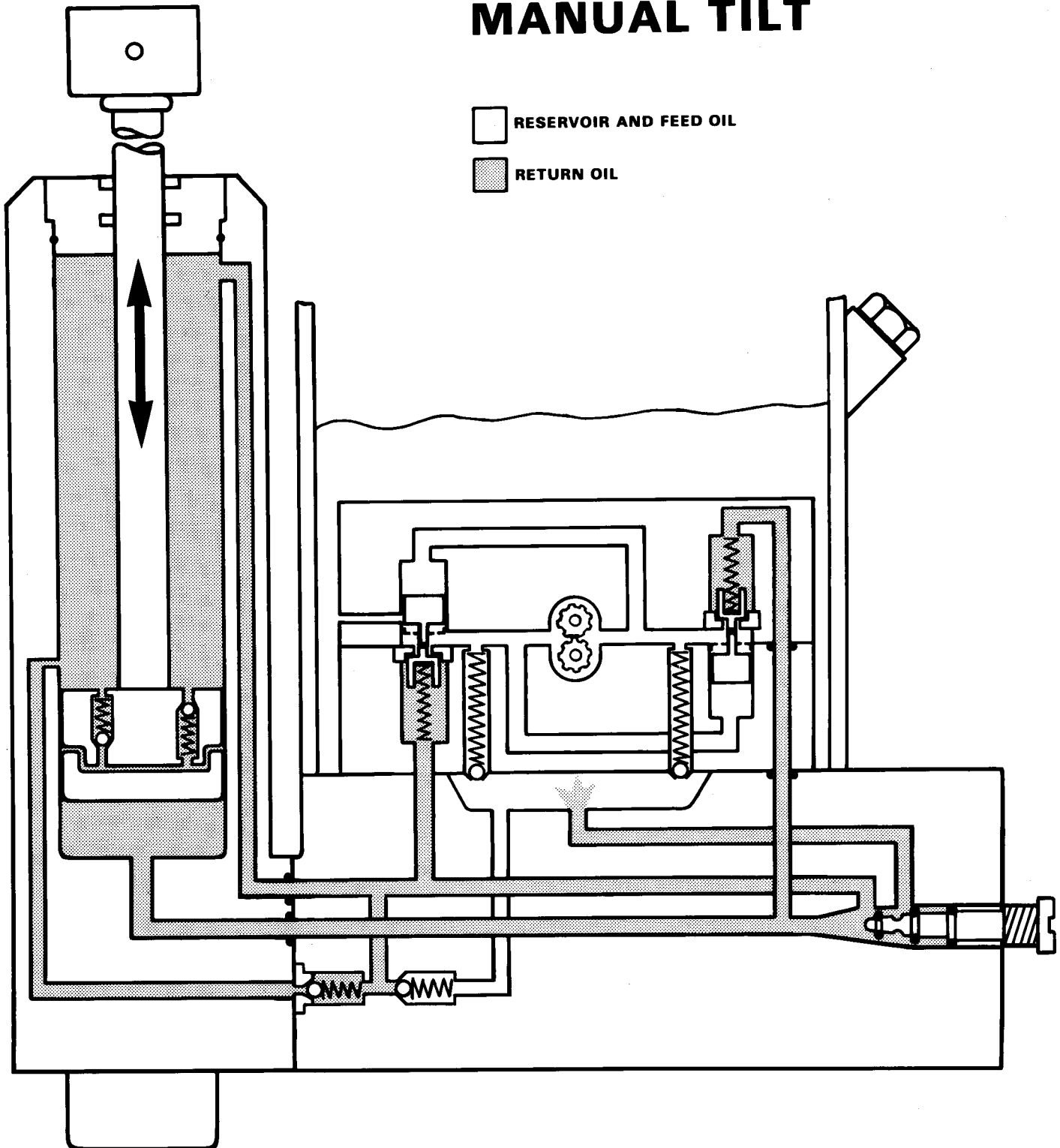
51642



## Design 1

# MANUAL TILT

-  RESERVOIR AND FEED OIL
-  RETURN OIL



51643

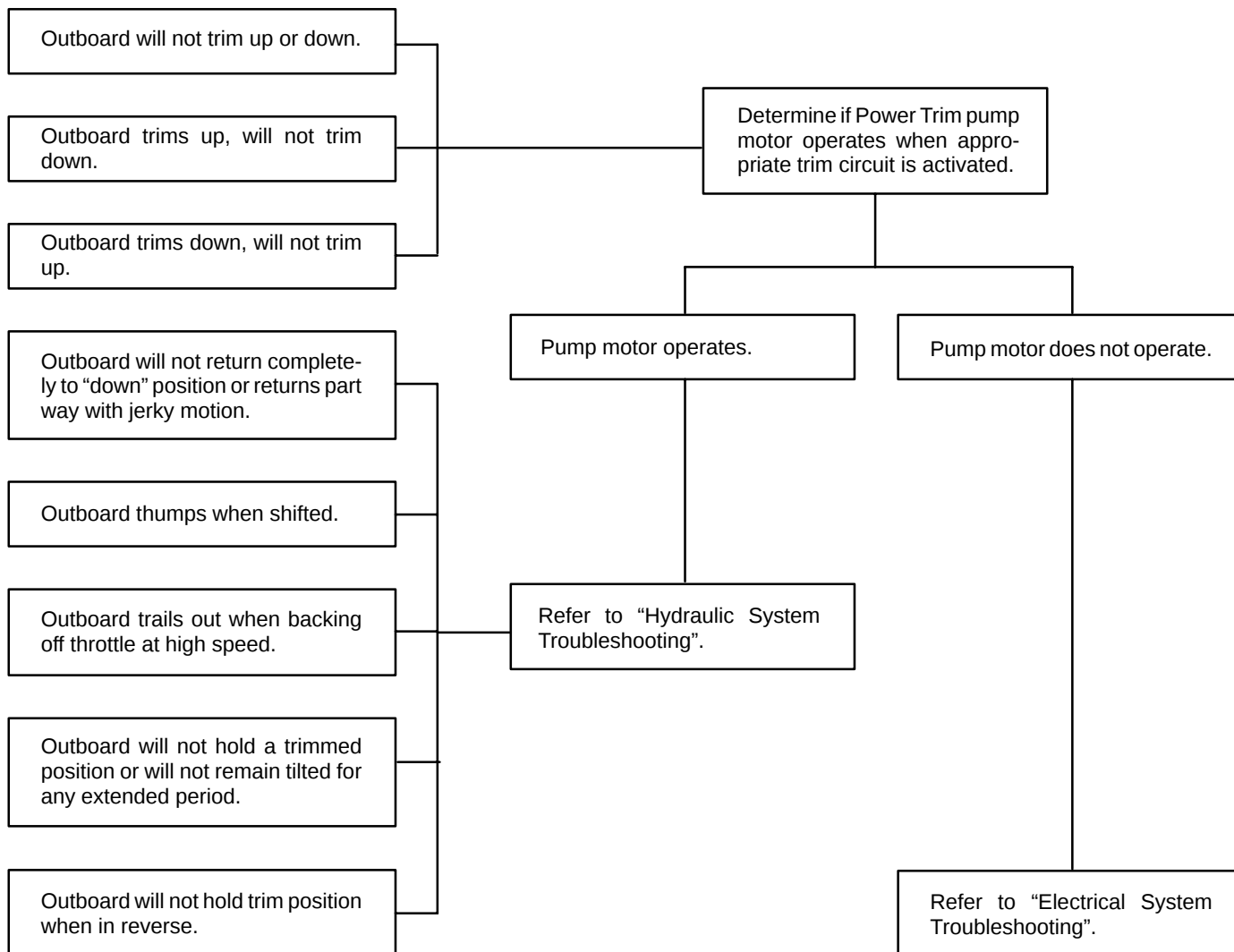


# Troubleshooting

## Determine if Problem is Electrical or Hydraulic

Refer to the following chart to determine which system is at fault.

### Trouble Chart





## Hydraulic System Troubleshooting

Support outboard with tilt lock lever when servicing power trim system.

**IMPORTANT:** After debris or failed components have been found (during troubleshooting procedure) it is recommended that unit be disassembled completely and ALL O-rings be replaced. Check ball valve components and castings must be cleaned using engine cleaner and compressed air or replaced prior to reassembly.

**IMPORTANT:** Power trim system is pressurized. Outboard must be in the full "UP" position (cylinder fully extended) prior to fill screw or manual release valve removal.

Refer to instructions following if disassembly is required.

Follow preliminary checks before proceeding to troubleshooting flow diagrams (following).

## Preliminary Checks

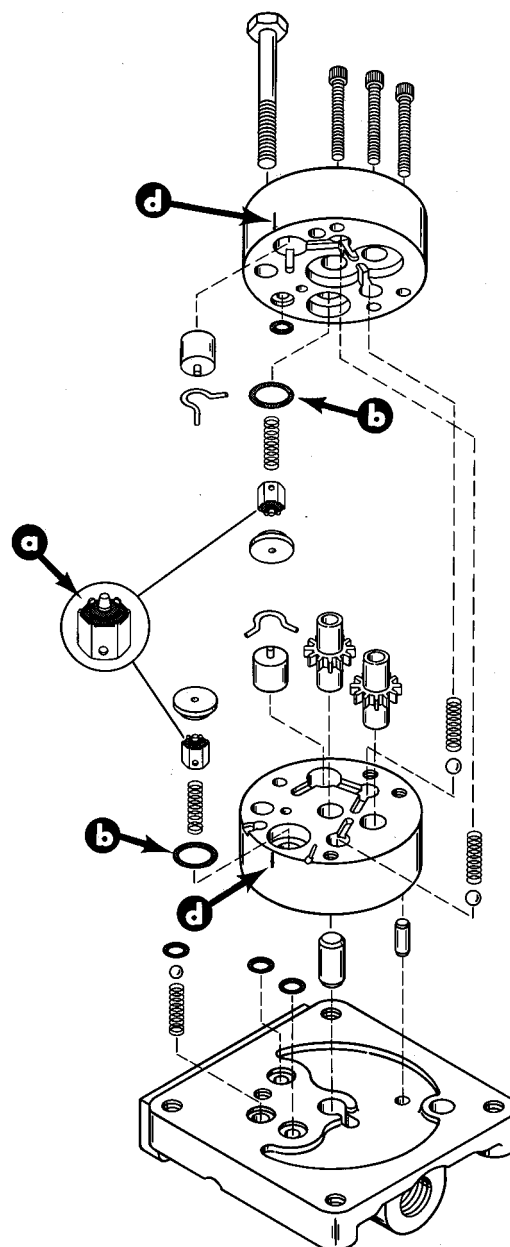
**IMPORTANT:** Operate Power Trim system after each check to see if problem has been corrected. If problem has not been corrected proceed to next check.

1. Check that manual release valve is tightened to full right (clockwise) position.
2. Check trim pump fluid level with outboard in full "UP" position and fill if necessary. Refer to "Fill and Purge the Power Trim System".
3. Check for external leaks in Power Trim system. Replace defective part(s) if leak is found.
4. Outboard not holding tilted position (falls to trim in position) indicates debris or defective components in trim valve assembly. Clean or replace components as required.
5. Check manual release valve for broken stem and one O-ring remaining in the release valve passage. (Separate the manifold assembly from the cylinder to dislodge broken stem.) Install new release valve and test system.
6. Check for nicked, deteriorated or misplaced O-rings throughout trim system.

## Leak Down Check – Pump and Manifold Assembly

**NOTE:** Scribe (d) pump housing halves before disassembly.

1. Debris or chips between valve and seat (a). Usually imbedded in rubber valve seat.
2. Nicked or deteriorated O-ring (b).
3. Nicked, deteriorated or misplaced O-ring between manifold and trim cylinder. Refer to "Manifold Removal" for O-ring location.



51735

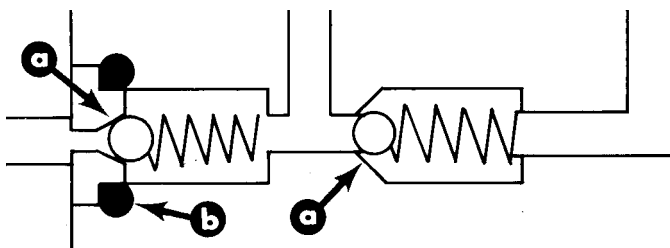
4. After reassembly, insert driveshaft and check pump rotation resistance to turning – housing halves can shift/turn during reassembly. Align scribe marks (d) carefully.



## Leak Down Check – Pilot Valve Assembly

1. Debris or chips between check ball and seat (a), usually imbedded in rubber valve seat.
2. Nicked or deteriorated O-ring (b).

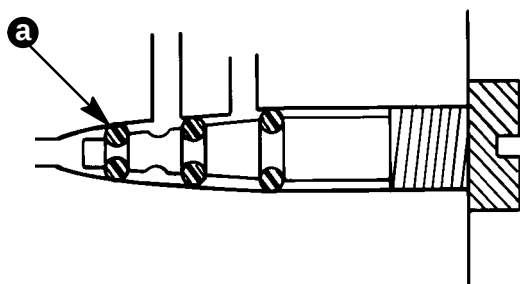
A leak path is created between the UP side of the cylinder and the reservoir. The trim system will leak DOWN until the trim port in cylinder is covered.



a - Check Ball and Seat  
b - O-ring

## Leak Down Check – Manual Release Valve

1. Debris or chips under O-ring (a).
2. Flash from valve molding causing O-ring (a) to not seal.
3. Nicked O-ring (a).



a - O-ring

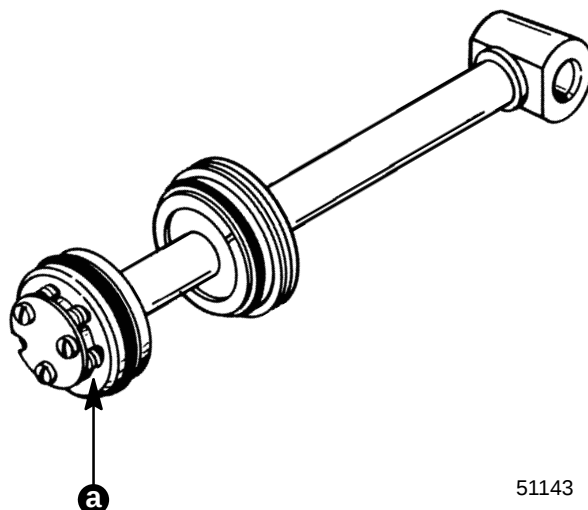
51560

## Leakage Past Ball and Seat – Piston Assembly

Unit will trim to full or near full DOWN position and then will begin to trim UP while trim switch is held in "DOWN" mode.

If trim switch is released, outboard can be pushed (by hand) DOWN to the point where trim UP started.

1. Inspect balls and seats in piston assembly for debris or damage. Repair or replace balls/seats.

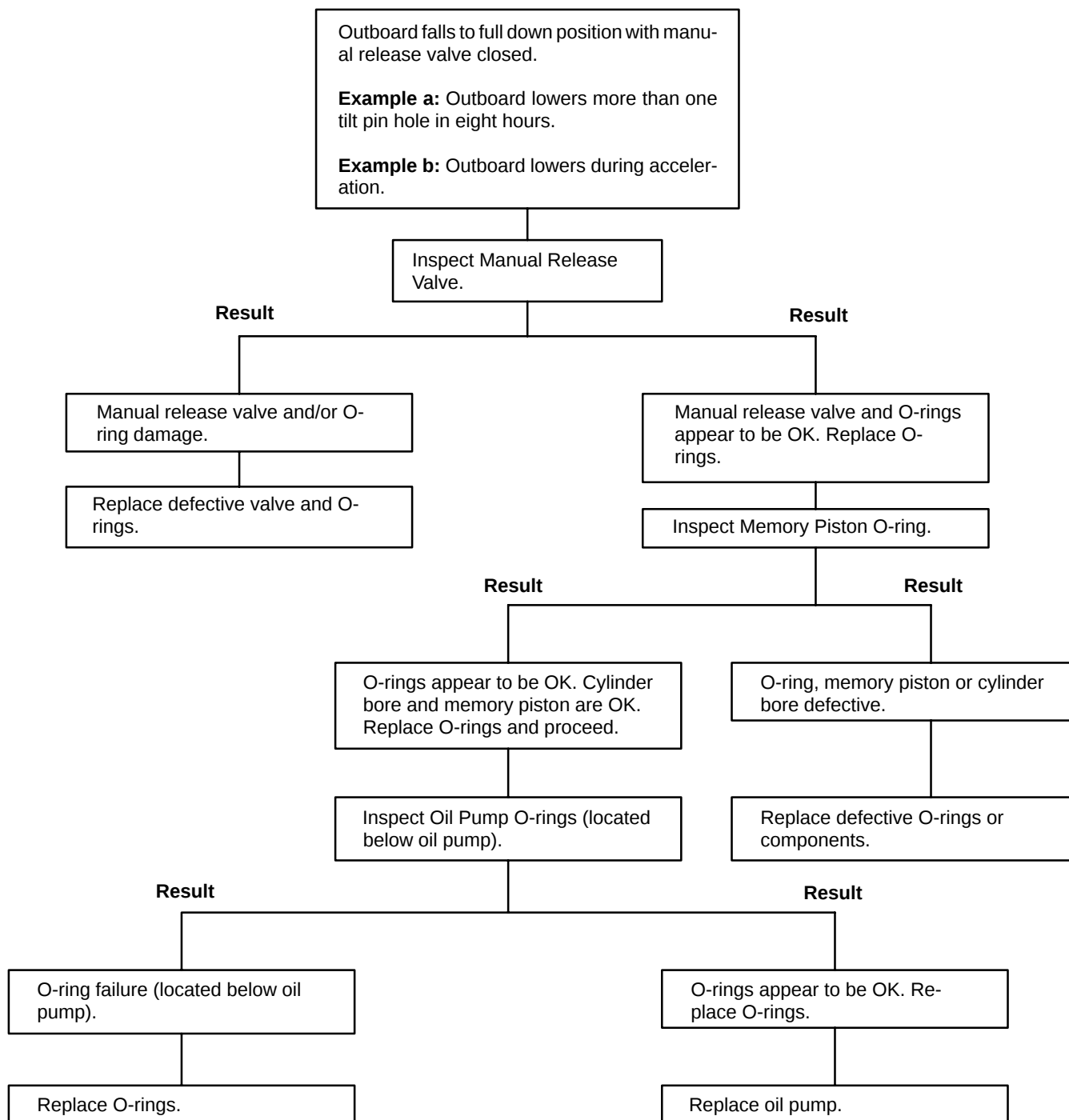


51143

a - Ball and Seat. Check for Debris or Damage

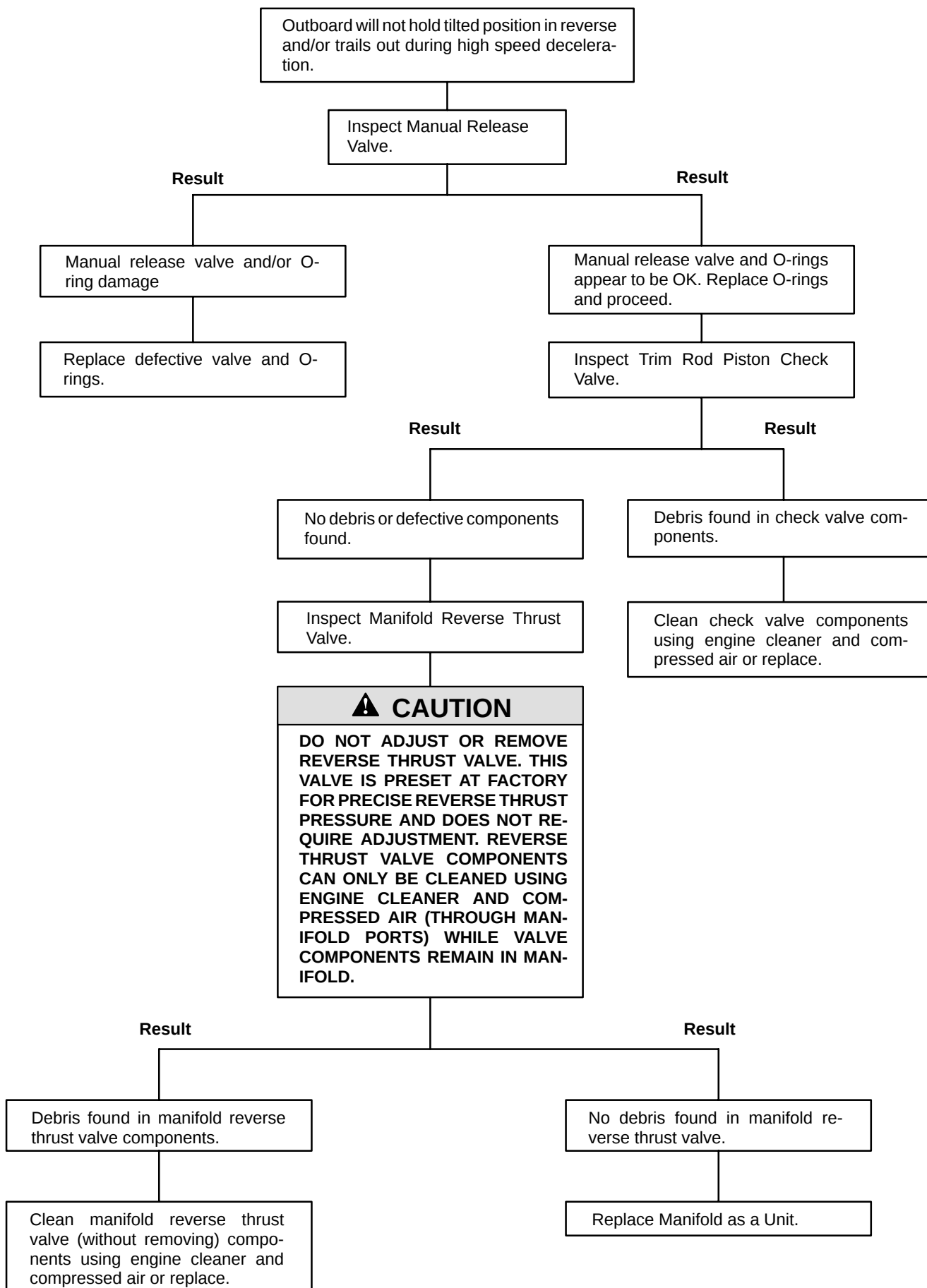


## Troubleshooting Flow Diagram





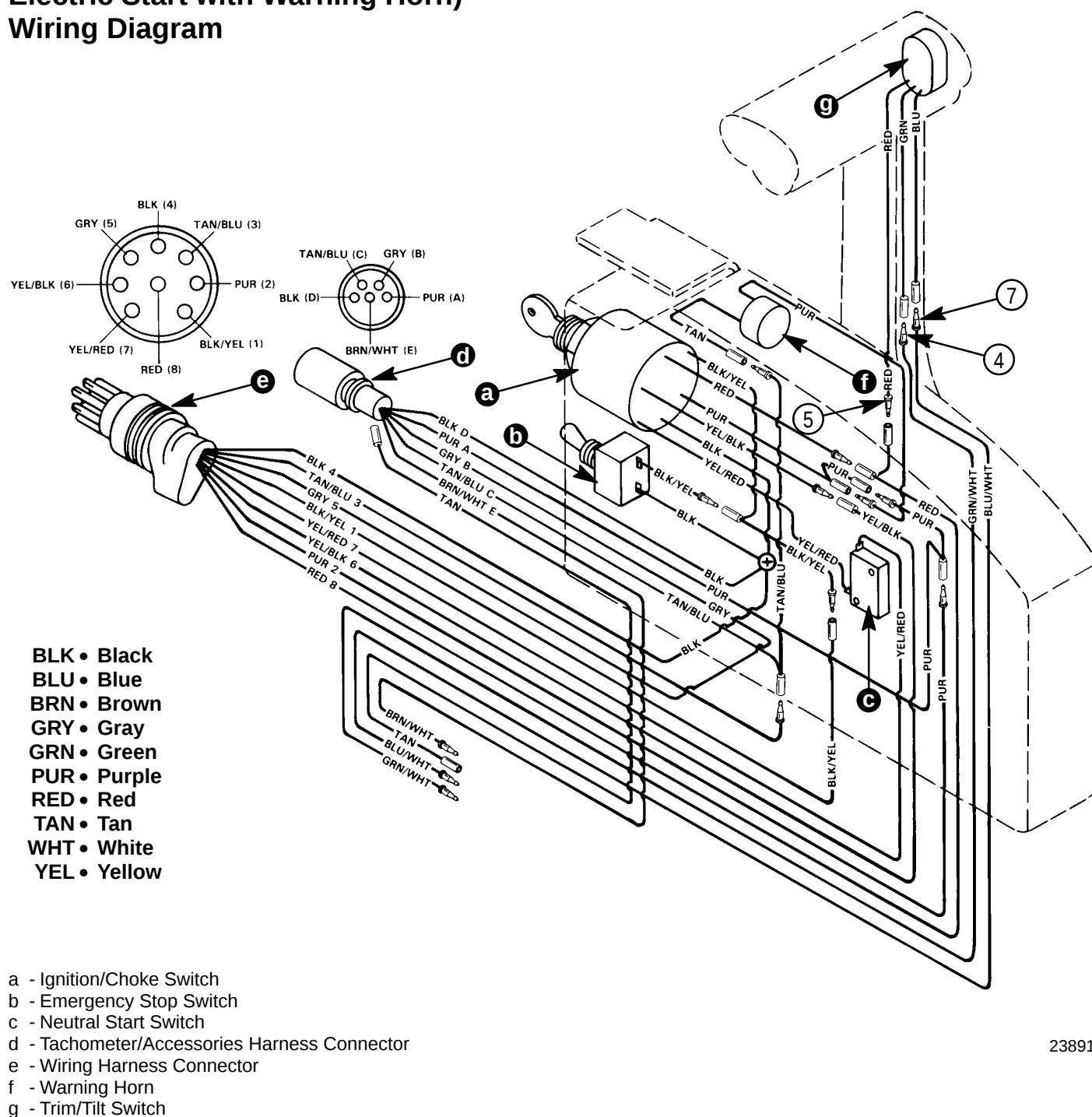
## Troubleshooting Flow Diagram





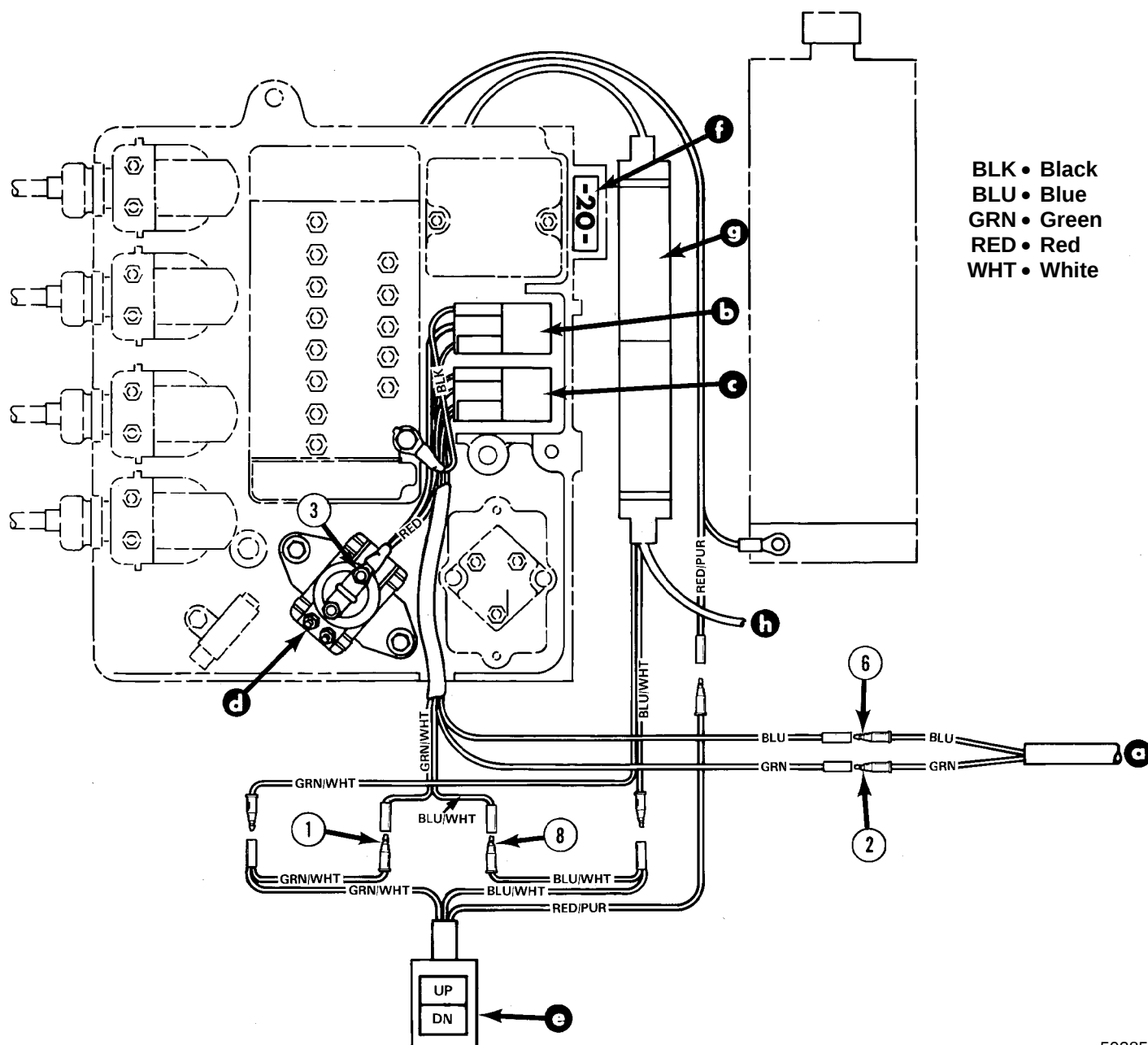
# Electrical System Troubleshooting

## COMMANDER 2000 Side Mount Remote Control (Power Trim/Tilt Electric Start with Warning Horn) Wiring Diagram





## Power Trim System Wiring Diagram



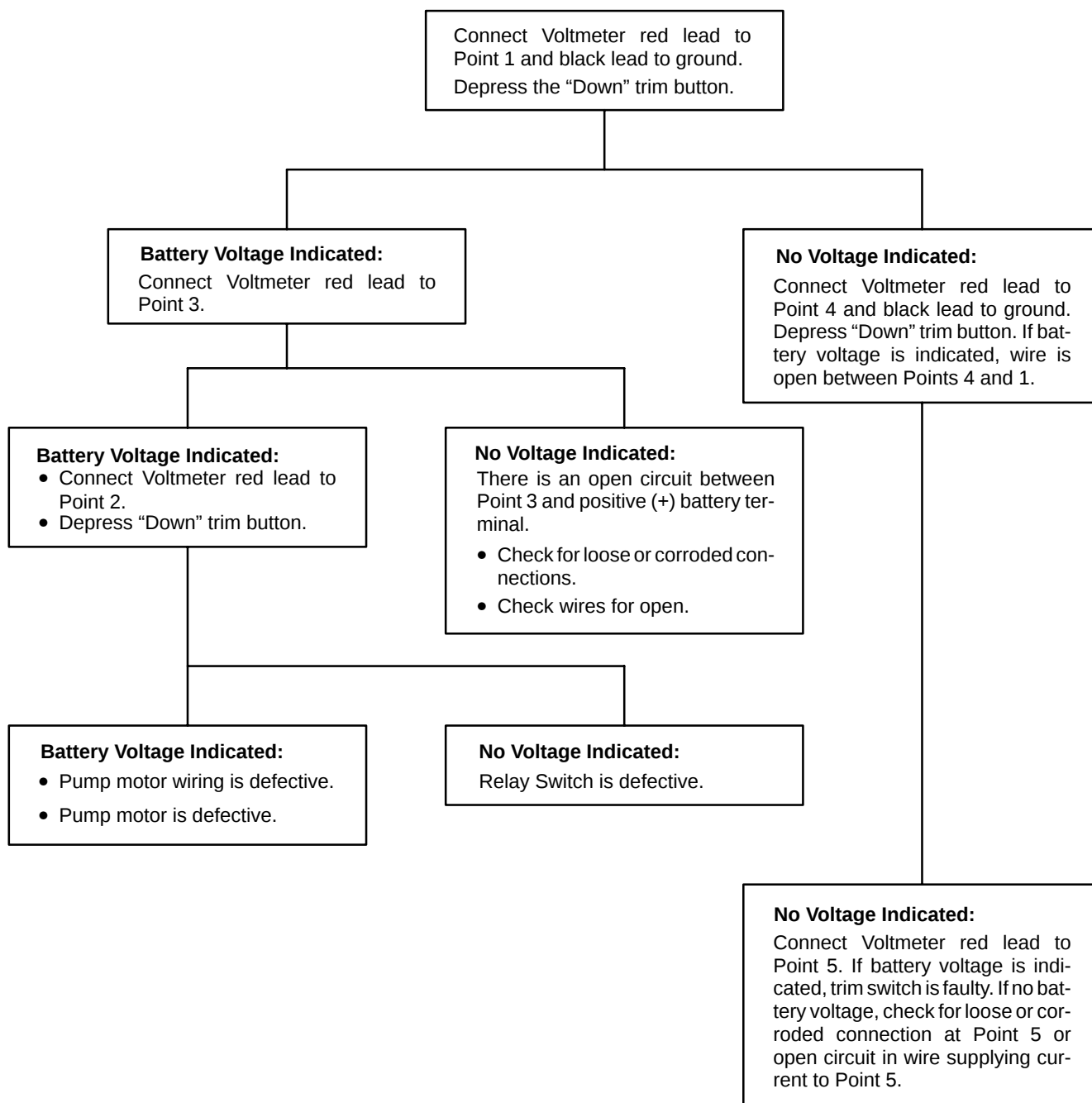
50285

- a - To Power Trim Pump Motor
- b - Relay Switch "UP"
- c - Relay Switch "DOWN"
- d - Engine Starter Motor Solenoid
- e - Cowl Trim Switch
- f - Fuse Holder (20 Amp Fuse)
- g - Engine Wiring Harness Connector
- h - Remote Control Wiring Harness



## Troubleshooting the “Down” Circuit\* (When “Up” Circuit is OK)

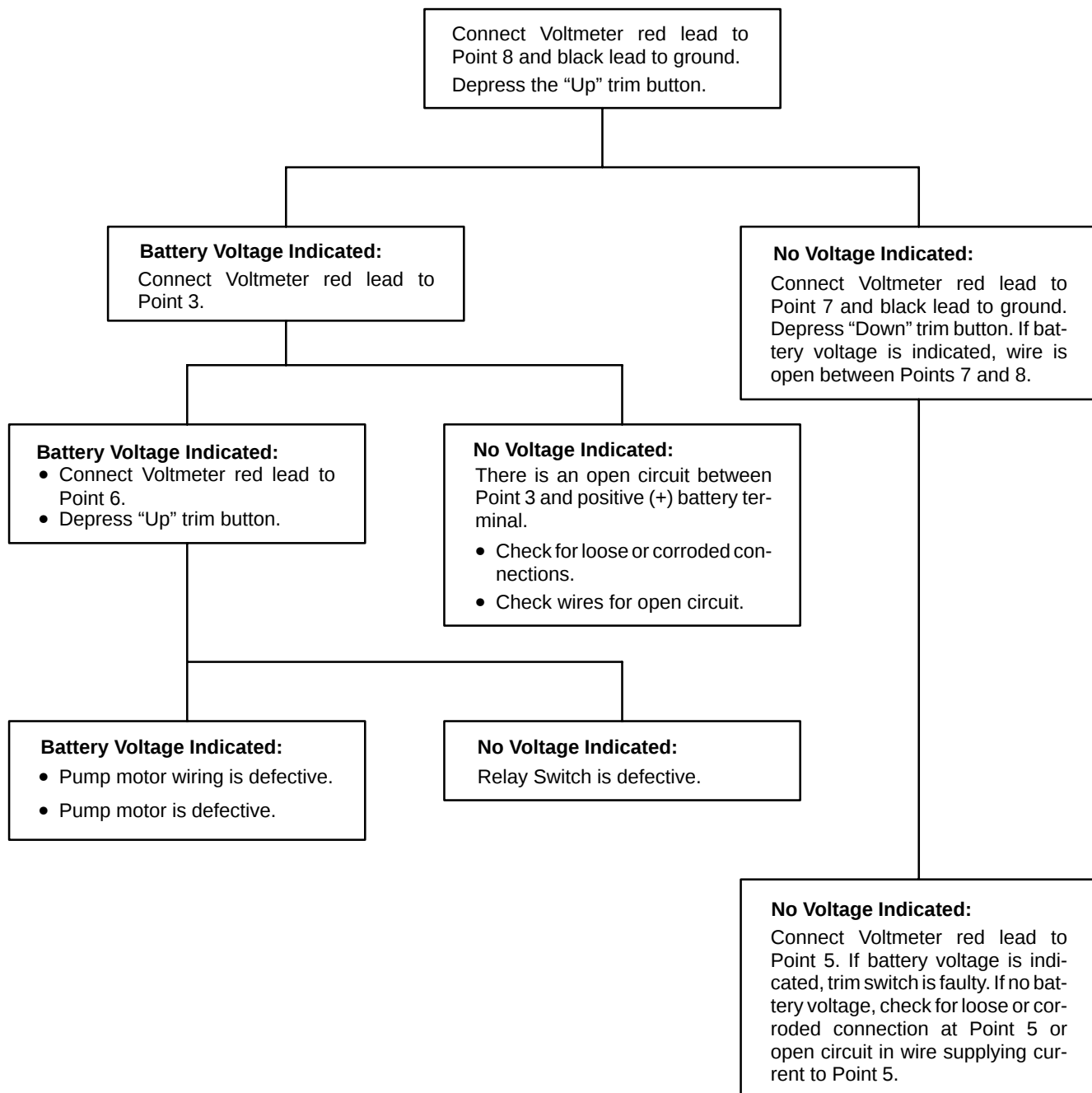
\*Remote Control Not Equipped with Trailer Button





## Troubleshooting the “Up” Circuit\* (When “Down” Circuit Is OK)

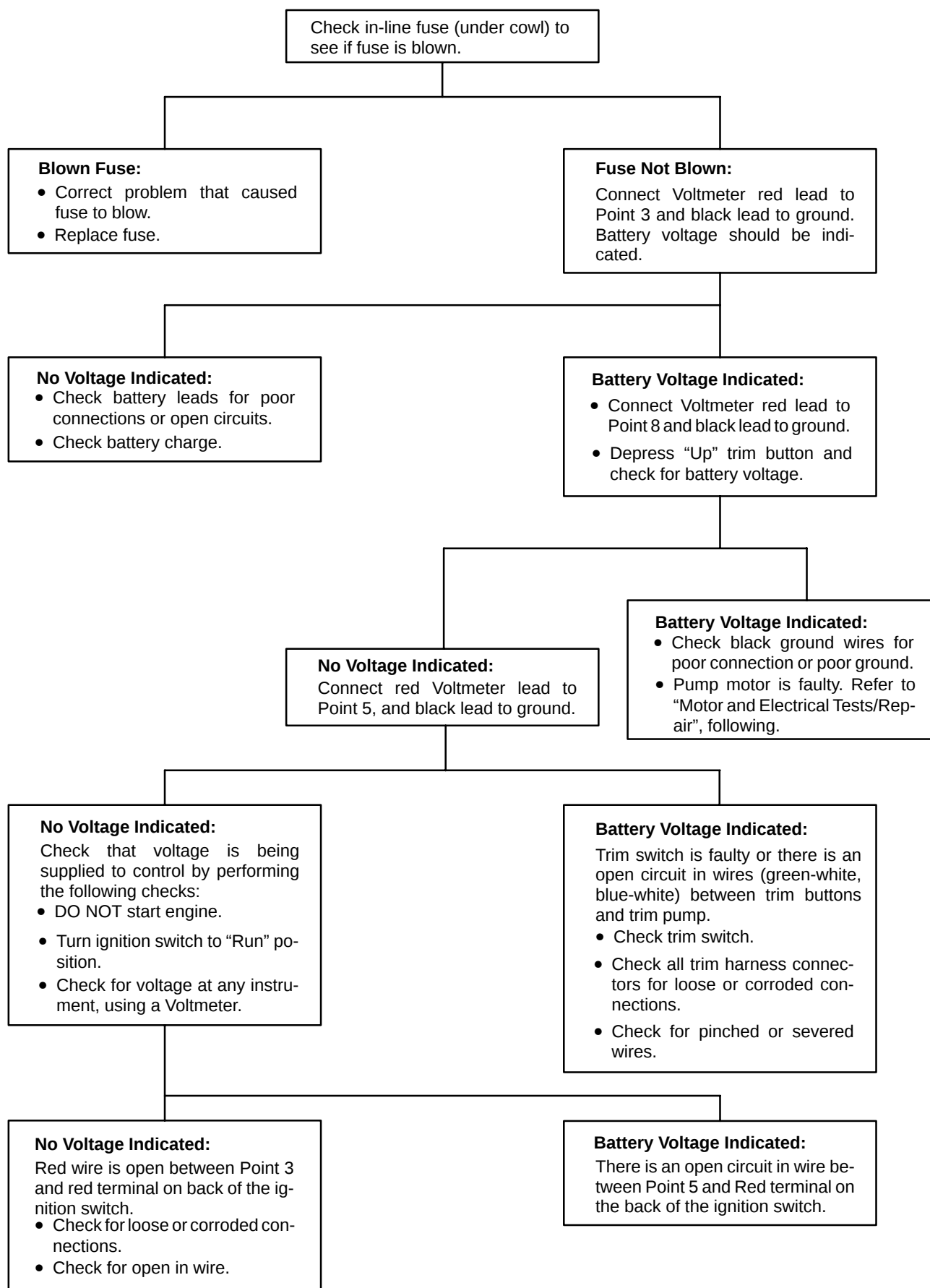
\*Remote Control NOT Equipped with Trailer Button





# Troubleshooting the “Down” and “Up” Circuits (All Circuits Inoperative)\*

\*Remote Control Not Equipped with Trailer Button

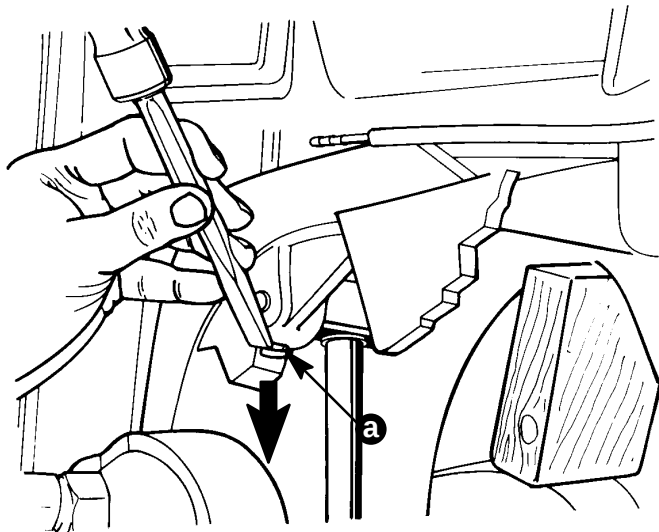




## Power Trim System Removal

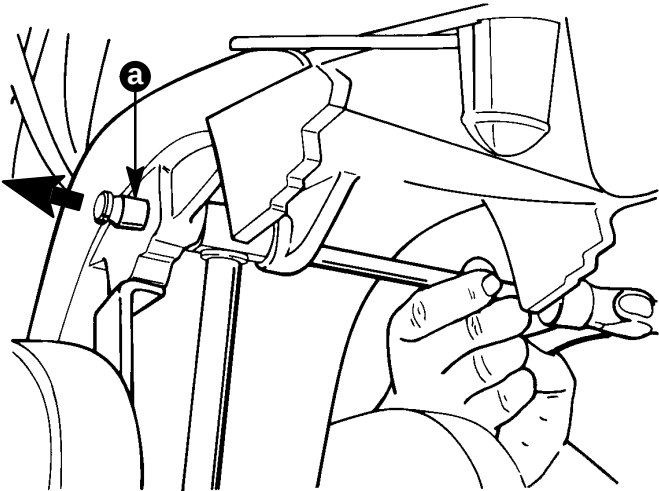
Support outboard with tilt lock lever when servicing power trim system.

1. Disconnect power trim harness from outboard wiring harness.
2. Remove screw and clip securing wiring harness to clamp bracket.
3. Use suitable tool to remove (DRIVE DOWN) upper dowel pin. Retain dowel pin.



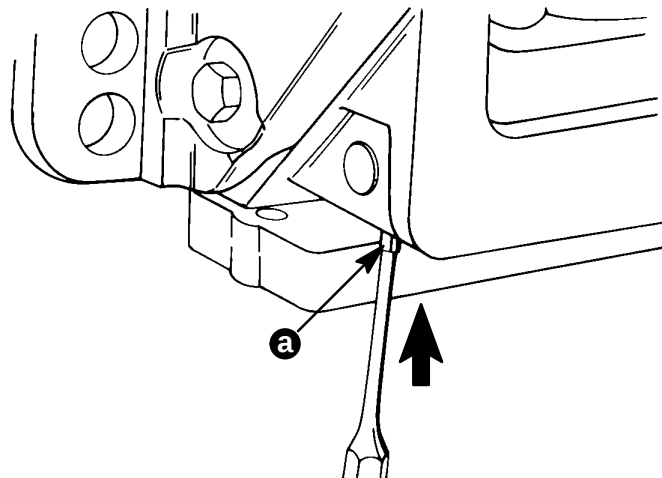
a - Dowel Pin

4. Use suitable punch to drive out upper pivot pin.



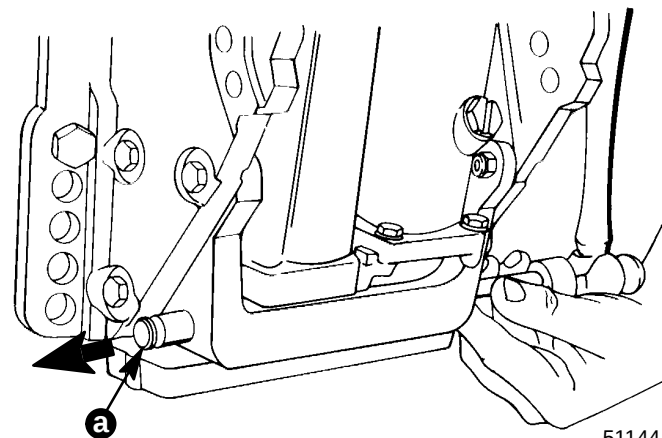
a - Pivot Pin

5. Use suitable punch to remove (DRIVE UP) lower dowel pin. Retain dowel pin.



a - Dowel Pin

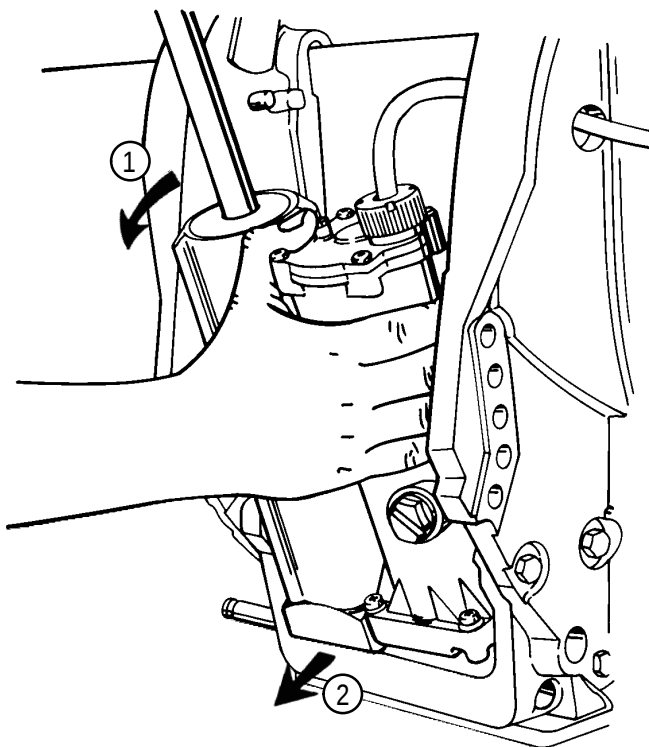
6. Use suitable punch to drive out lower pivot pin.



a - Pivot Pin

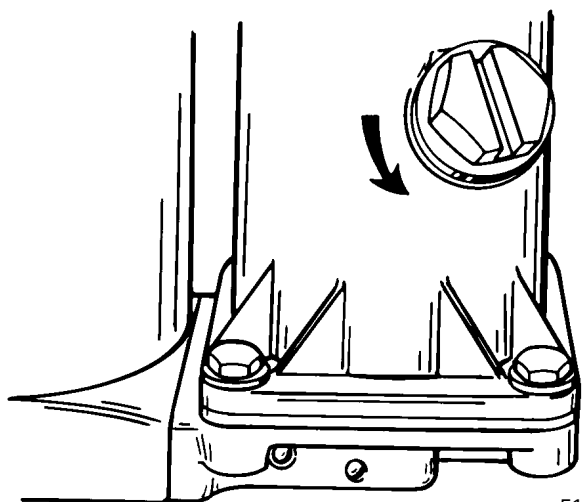


7. Tilt power trim assembly (top first) out from clamp bracket and remove assembly.



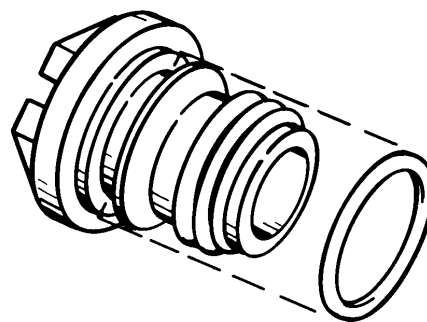
51195

8. Remove fill cap and drain unit.



51193

9. Remove O-ring from fill cap.

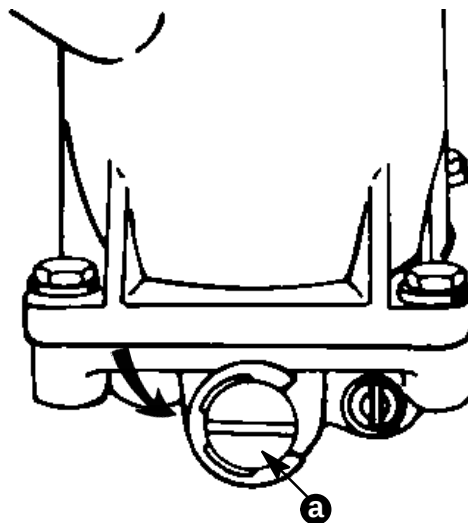


51194

## Power Trim System Disassembly

### Trim Rod Removal

1. Secure power trim assembly in soft jawed vise.
2. Open manual release valve three or four turns (counterclockwise) and position trim rod to full up position.
3. Remove cylinder end cap assembly from cylinder using spanner wrench (1/4 in. x 5/16 in. long pegs).

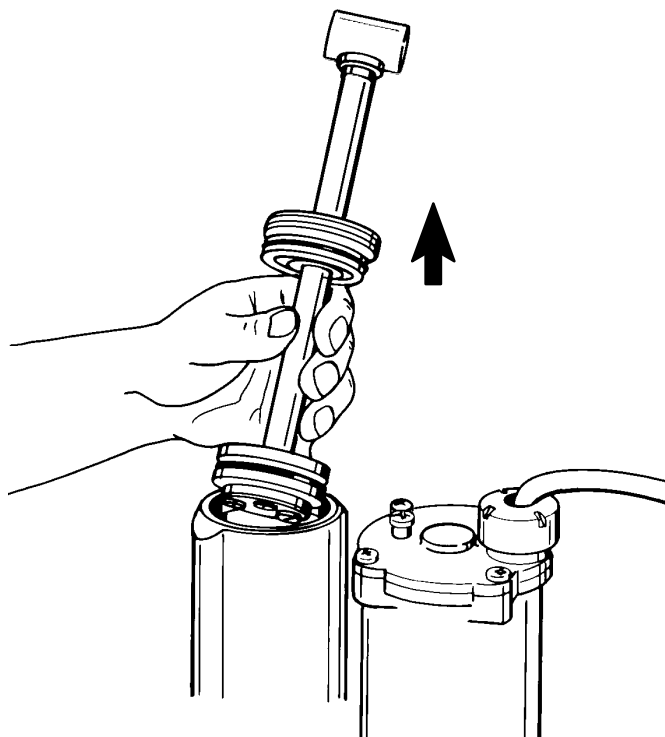


51194

a - Manual Release Valve

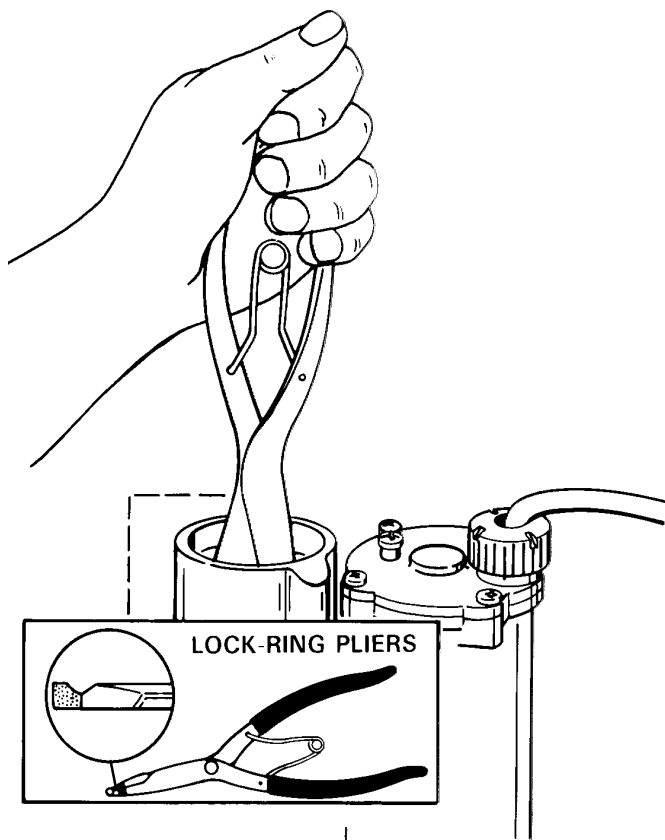


4. Remove trim rod assembly from cylinder.



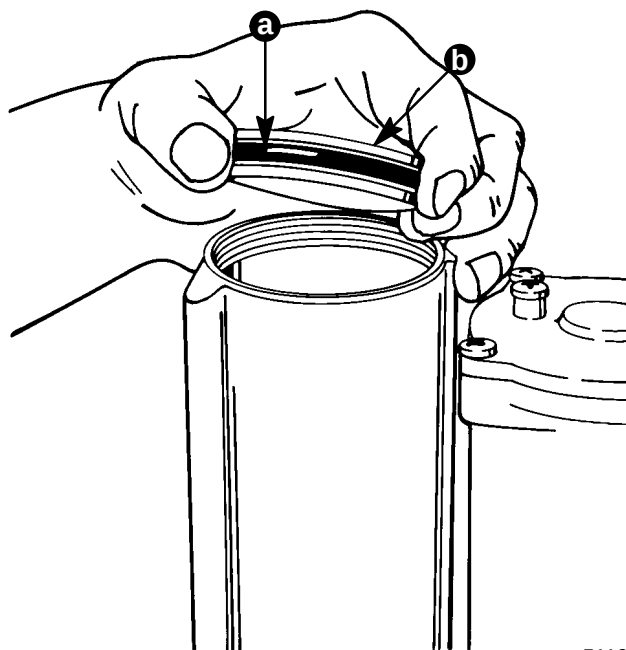
51196

5. Remove memory piston from cylinder using lock-ring pliers (shown) or suitable tool.



51193

6. Remove O-ring from memory piston.



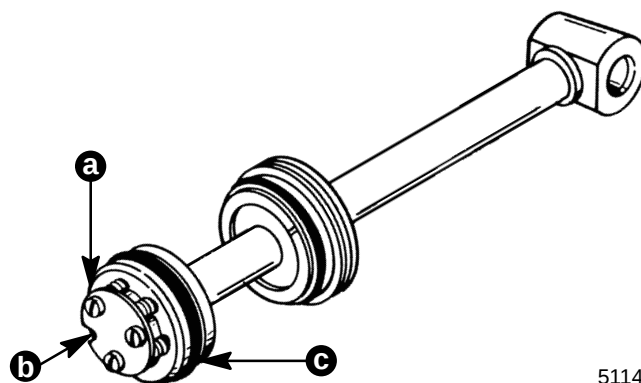
51196

a - O-ring  
b - Memory Piston

7. Remove trim system from vise and empty fluid into appropriate container.

## Trim Rod Disassembly

1. Place trim rod assembly on clean work surface.
2. Remove screws securing plate to trim rod piston and O-ring.
3. Remove check ball components from trim rod piston.



51143

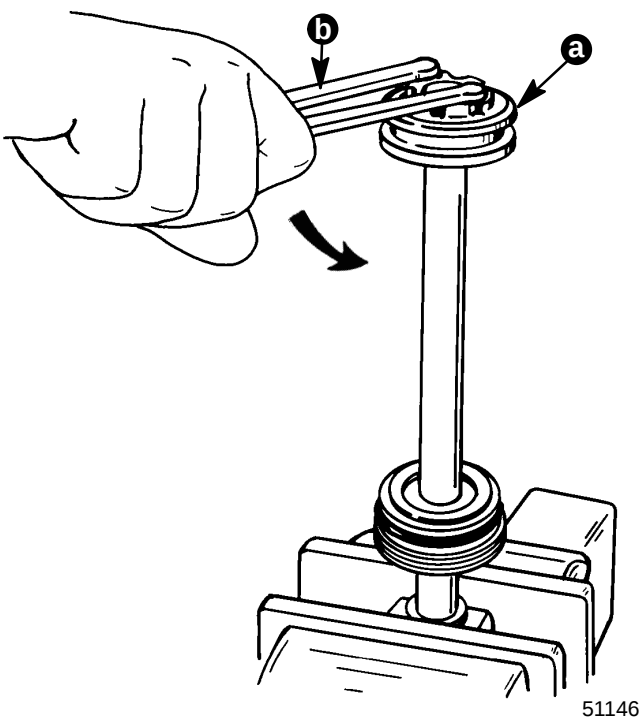
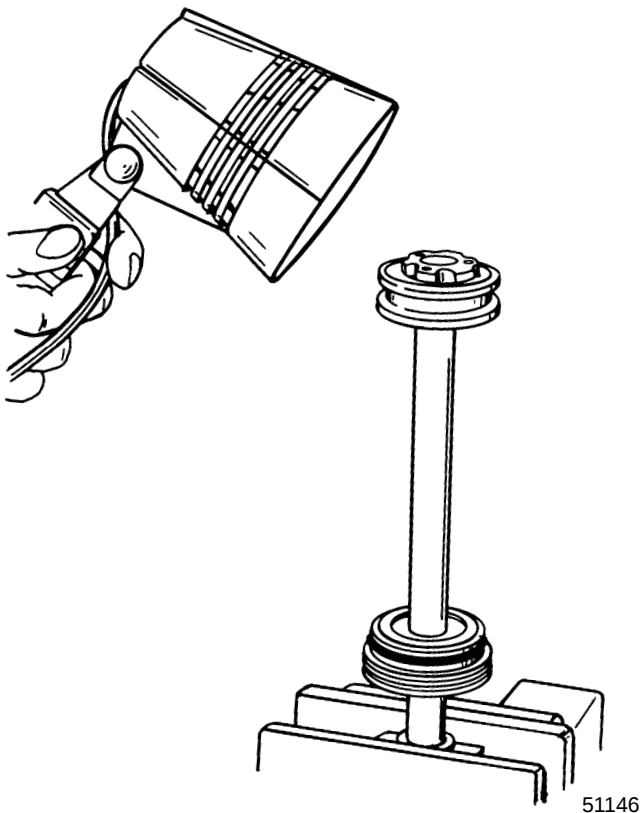
a - Screw  
b - Plate  
c - O-ring

## CAUTION

When removing Trim Rod piston, spanner wrench must have 1/4 in. x 5/16 in. long pegs to avoid damage to trim piston.



4. Place trim rod into soft jawed vise and apply heat to shock piston using torch lamp (P/N 91-63209).
5. Loosen trim rod piston using spanner wrench (1/4 in. x 5/16 in. long pegs).
6. Allow trim rod piston to cool, remove from trim rod.

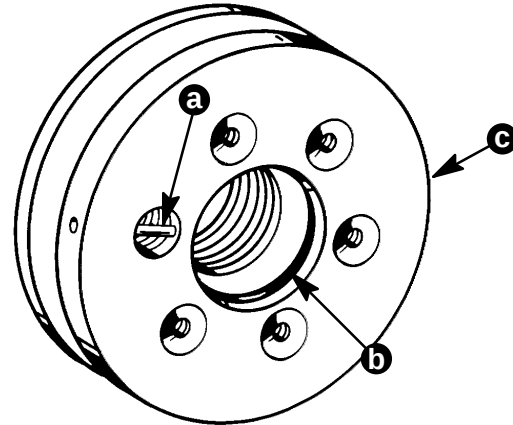


- a - Trim Rod Piston  
b - Spanner Wrench

## ⚠ CAUTION

**Do not remove check ball components from trim rod piston. Removal and reinstallation of check valve could result in improper operating pressure and possible power trim system damage. If check valve is defective, replace trim rod piston.**

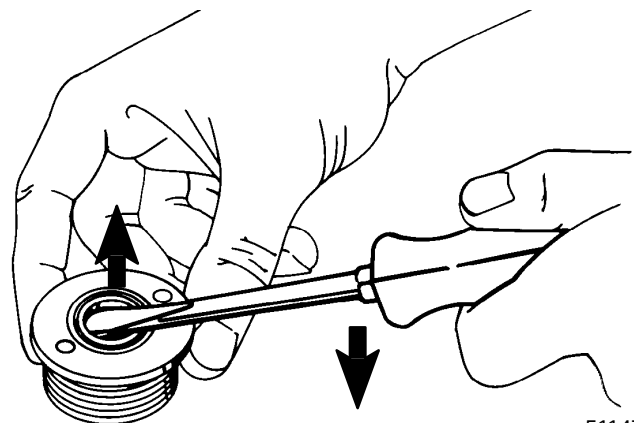
7. Remove inner O-ring from piston.



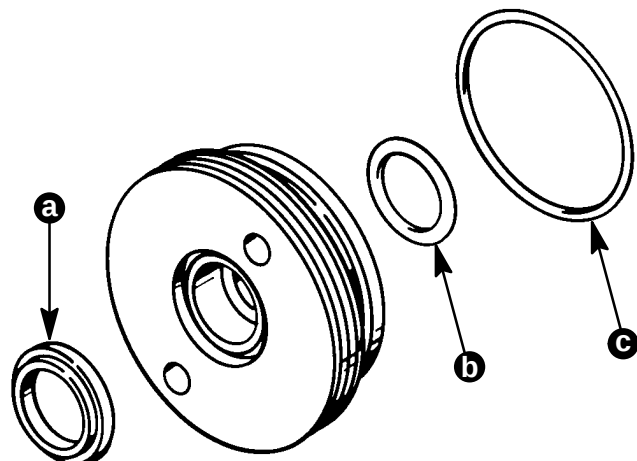
51199

- a - Check Ball Components  
b - O-ring  
c - Piston

8. Remove rod wiper, inner O-ring and outer O-ring.



51147



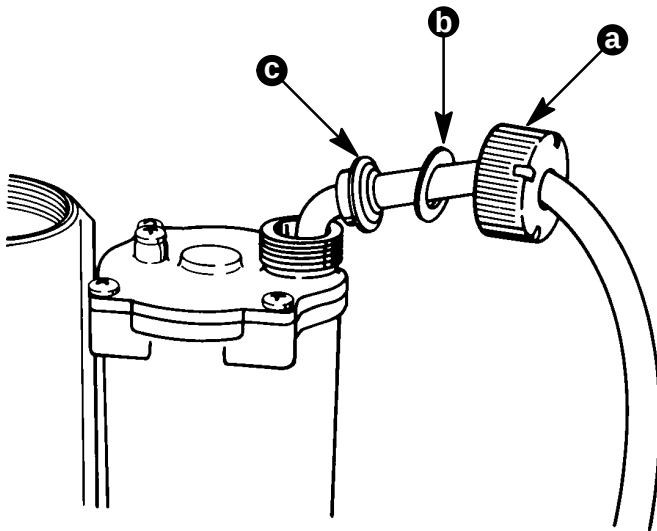
51145

- a - Rod Wiper  
b - Inner O-ring  
c - Outer O-ring



## Trim "Motor" Removal

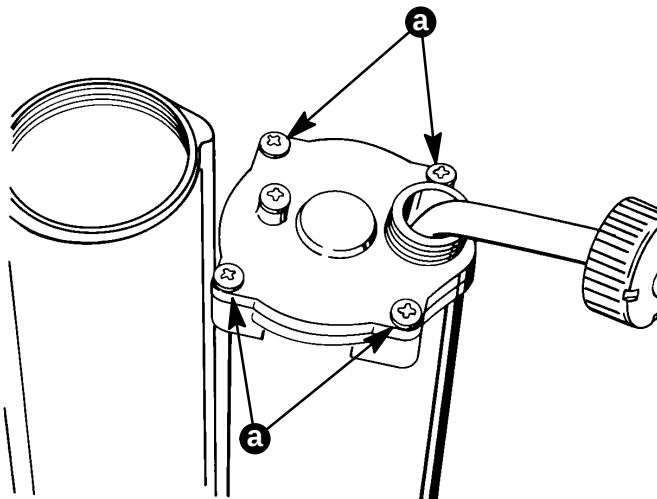
1. Secure power trim assembly in soft jawed vise.
2. Remove cap, washer and grommet from reservoir assembly.



51195

- a - Cap
- b - Washer
- c - Grommet

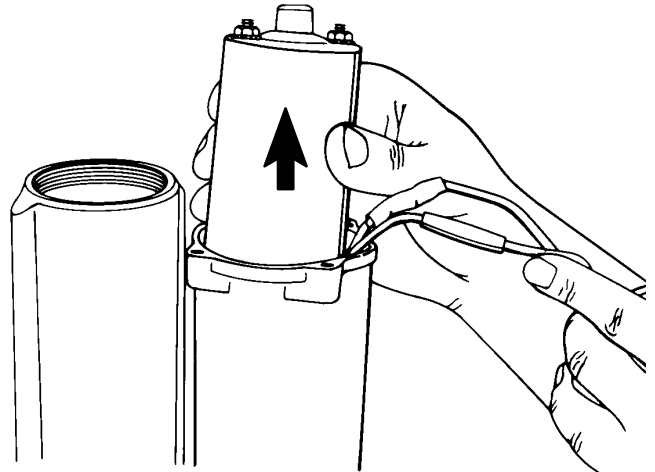
3. Remove screws securing reservoir cap to reservoir.



51193

- a - Screws

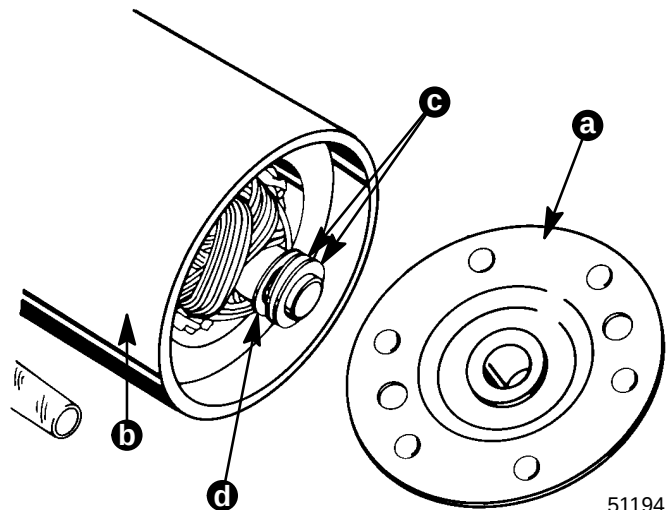
4. Remove motor and harness from reservoir.



51196

## Trim "Motor" Disassembly

1. Remove end cap from motor housing. Note position of washers on armature.

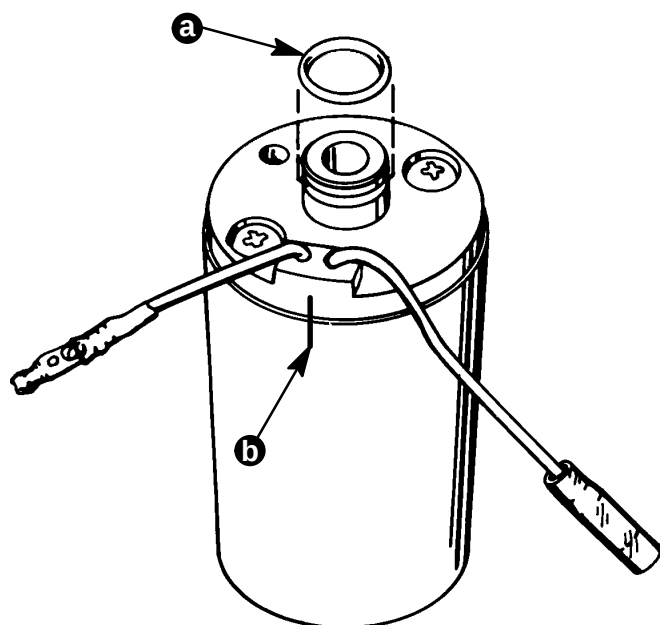


51194

- a - End Cap
- b - Motor Housing
- c - Wave Washer (2)
- d - Washer



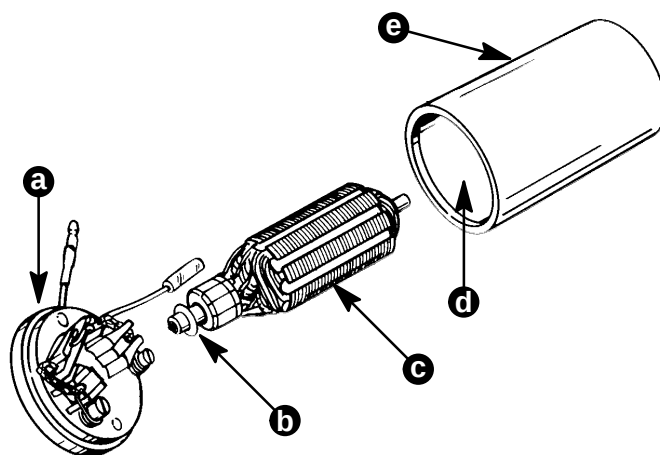
2. Remove O-ring from end frame.
3. Place scribe mark on motor housing and end frame as reassembly reference, as shown.



51194

- a - O-ring  
b - Scribe Mark

4. Remove end frame and armature from housing.



51194

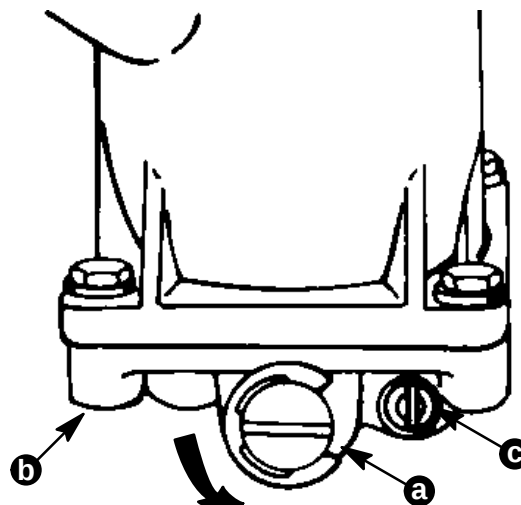
- a - End Frame  
b - Washer  
c - Armature  
d - Fiber Guard (Brush Wires)  
e - Housing

## Reservoir Assembly Removal

### ⚠ CAUTION

**DO NOT ADJUST OR REMOVE REVERSE THRUST VALVE. THIS VALVE IS PRESET AT FACTORY FOR PRECISE REVERSE THRUST PRESSURE AND DOES NOT REQUIRE ADJUSTMENT.**

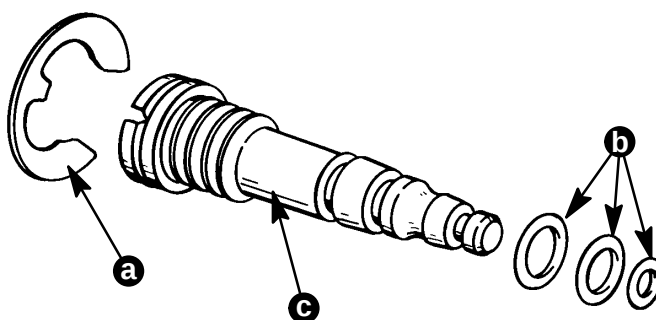
1. Remove manual release valve from manifold.  
**DO NOT** remove or adjust reverse thrust valve.



51194

- a - Manual Release Valve  
b - Manifold  
c - Reverse Thrust Valve

2. Remove "E" clip and O-rings from manual release valve.

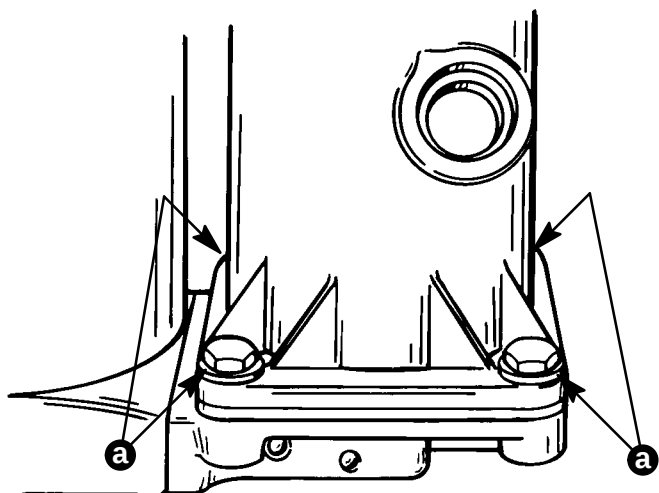


51196

- a - "E" Clip  
b - O-rings  
c - Manual Release Valve



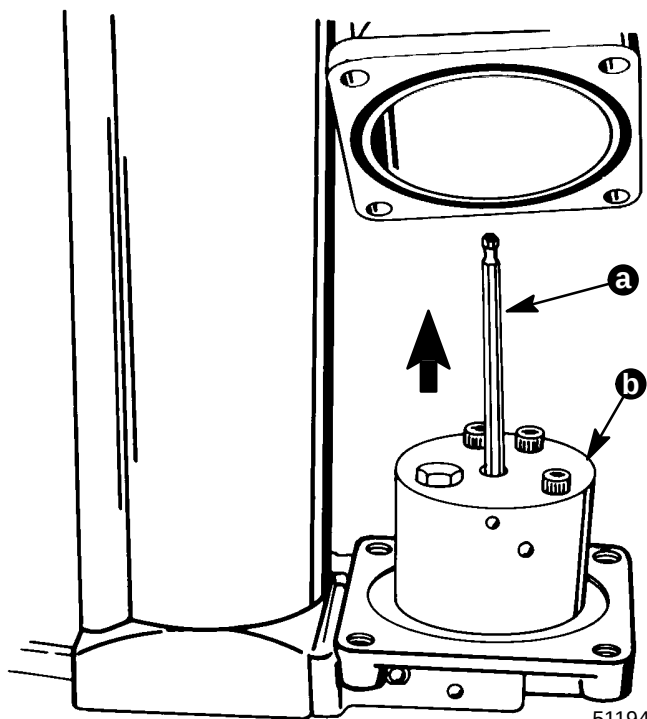
3. Remove four screws securing reservoir to manifold.



51193

a - Screw

4. Remove reservoir from manifold.
5. Remove drive shaft from oil pump.



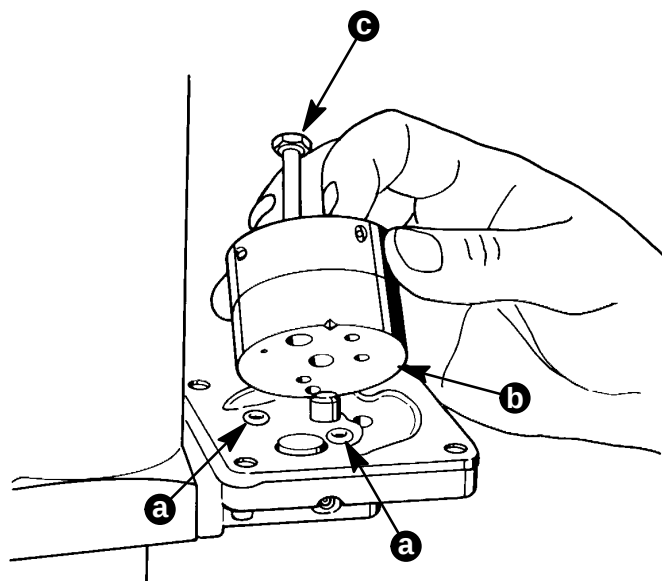
51194

a - Drive Shaft  
b - Oil Pump

## Oil Pump Removal

**IMPORTANT: The oil pump is not rebuildable. If oil pump is defective, replace as an assembly.**

1. Remove screw, oil pump and O-rings from manifold.

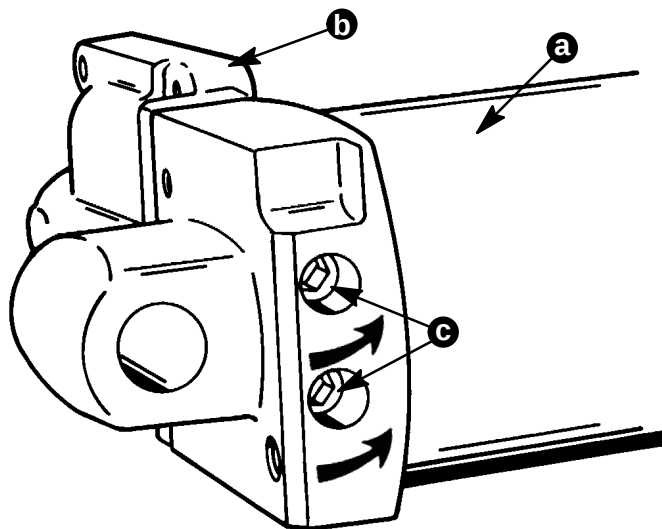


51007

a - O-ring  
b - Oil Pump  
c - Screw

## Manifold Removal

1. While holding trim cylinder to manifold, remove screws.

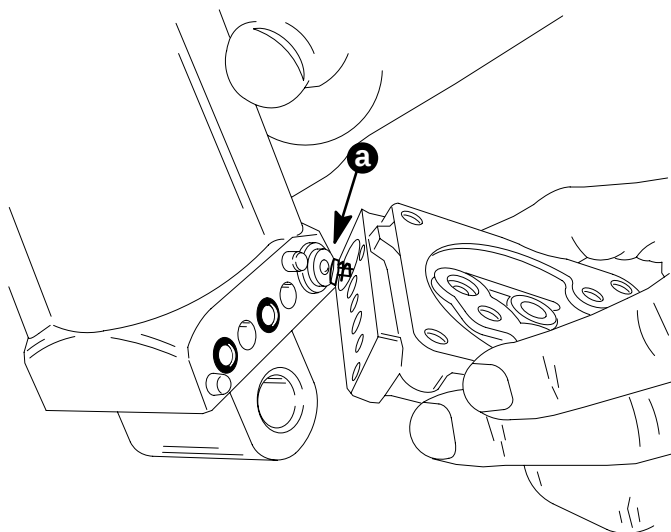


51007

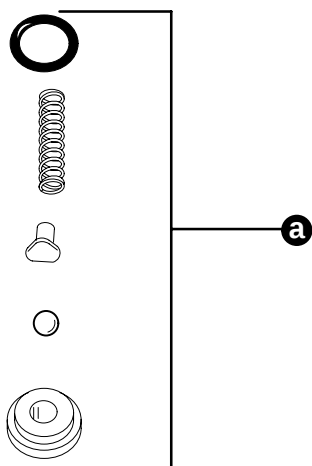
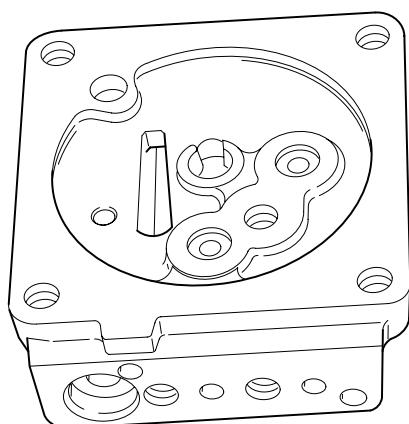
a - Trim Cylinder  
b - Manifold  
c - Screw



2. Slowly remove manifold from cylinder. Note position of above trim check ball assembly and remove.



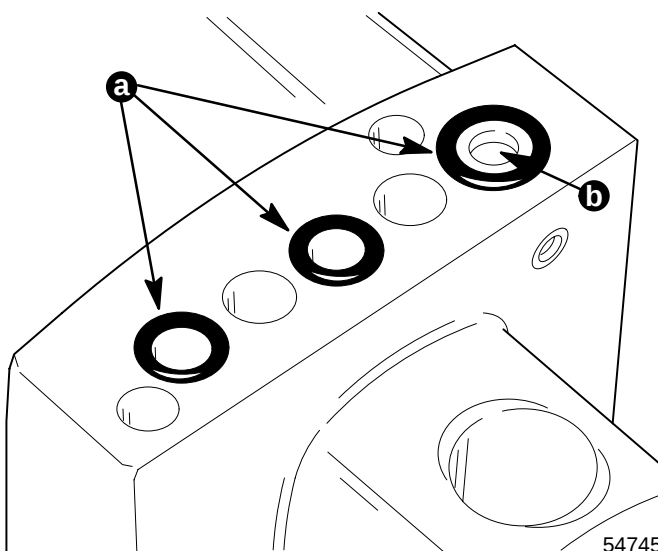
54743



54744

a - Above Trim Check Ball Components

3. Remove O-rings from cylinder.
4. Remove filter.



54745

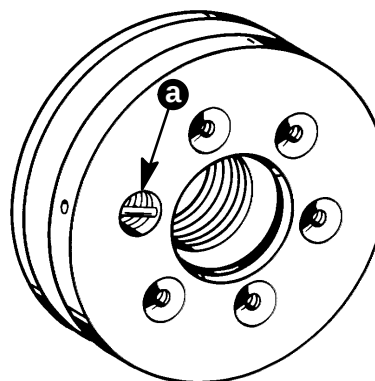
a - O-rings  
b - Filter

## Cleaning and Inspection of Trim Rod Components

**IMPORTANT:** Components must be dirt and lint free. Slightest amount of debris in Power Trim system could cause system to malfunction.

### ⚠ CAUTION

Do not remove check valve components from trim rod piston. Removal and reinstallation of check valve could result in improper operating pressure and possible power trim system damage.



51199

a - Check Ball Components



Inspect check valve for debris; clean debris from check valve if found. If debris cannot be cleaned from check valve, replace trim rod piston as an assembly.

Clean trim rod and components with parts cleaner and dry with compressed air.

It is recommended that all O-rings in trim system be replaced.

Inspect trim rod. If scraper (located in cap) has failed to keep rod clean, replace scraper.

Lubricate all O-rings using Quicksilver Power Trim and Steering Fluid or; (ATF) Type F, FA or Dexron II.

## Motor and Electrical Tests/Repair

### Trim Pump Motor Test

#### WARNING

**Do not perform this test near flammables (or explosives), as a spark may occur when making connections.**

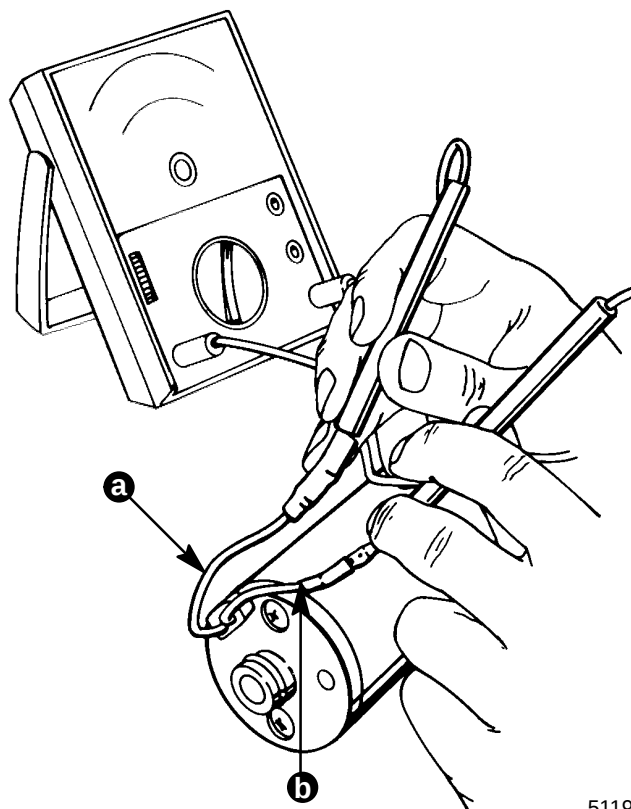
1. Disconnect orange (motor) wire and black (motor) wire from relay switch wiring harness.
2. Connect a 12 volt power supply to motor wires (positive to orange; negative to black results in motor up direction. Positive to black; negative to orange results in motor down direction). Motor should run.
3. If motor does not run, disassemble motor and check components.

### Thermal Overload Switch Test

**IMPORTANT:** If thermal overload switch has been activated, pump motor cannot be tested for a minimum of one minute. After this period switch should close (reset itself) and pump motor may be operated. Perform the following check(s) only if switch does not reset itself.

### MOTOR ASSEMBLED

Connect Ohmmeter (R x 1 scale) leads as shown. If switch is good, full continuity (zero ohms) will be indicated. If full continuity is not indicated, disassemble motor and recheck switch per instructions, following.

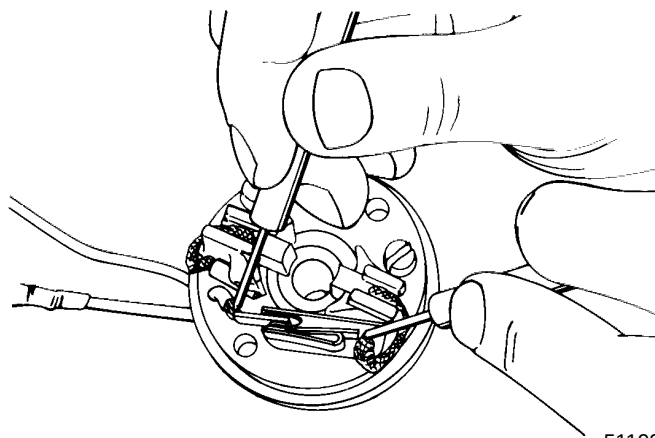


- a - Motor Wire (Black)  
b - Motor Wire (Orange)

51196

### MOTOR DISASSEMBLED

Connect Ohmmeter (R x 1 scale) leads as shown. If switch is good, full continuity (zero ohms) will be indicated.



51193

If full continuity is not indicated, clean switch contact surfaces, using an ignition point file.

Recheck switch; if full continuity is not indicated, replace end frame.



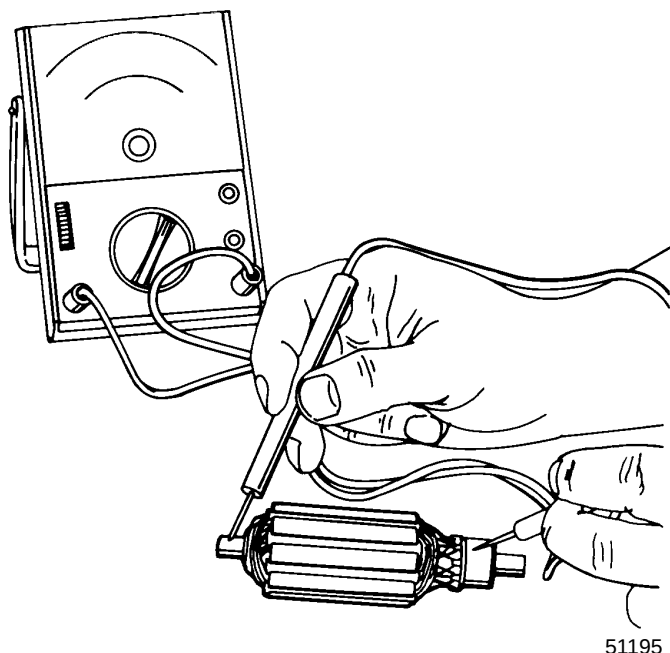
## Armature Tests

### TEST FOR SHORTS

Check armature on a Growler (follow Growler manufacturer's test instructions). Indication of a short requires replacement of armature.

### TEST FOR GROUND

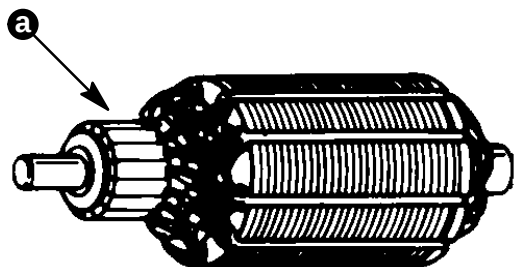
Use an Ohmmeter (R x 1 scale). Place one lead of Ohmmeter on armature shaft and other lead on commutator, as shown. If continuity is indicated, armature is grounded and must be replaced.



### CHECKING AND CLEANING COMMUTATOR

If commutator (a) is worn it can be turned down on an armature conditioner tool or on a lathe.

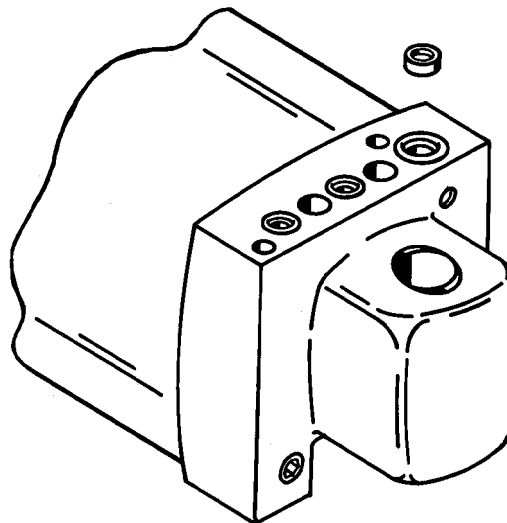
Clean commutator with "00" sandpaper.



## Power Trim System Reassembly

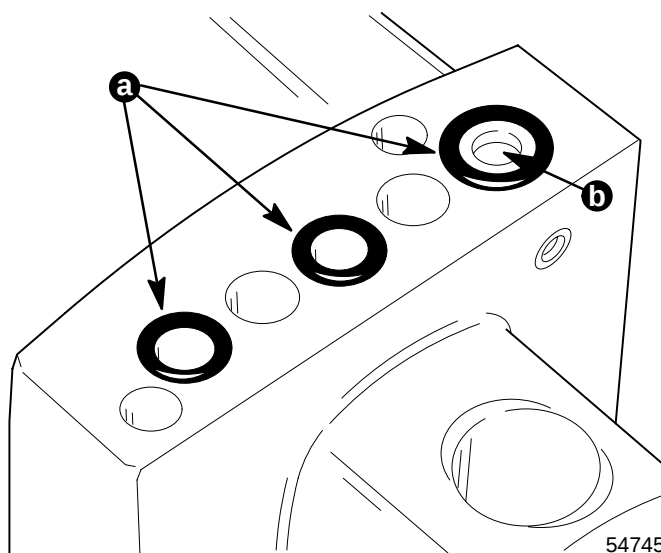
### Manifold Installation

**IMPORTANT:** Filter must be installed in trim cylinder with ridge of filter housing facing out.



50447

1. Install lubricated O-rings and filter, with housing ridge facing out, to trim cylinder.

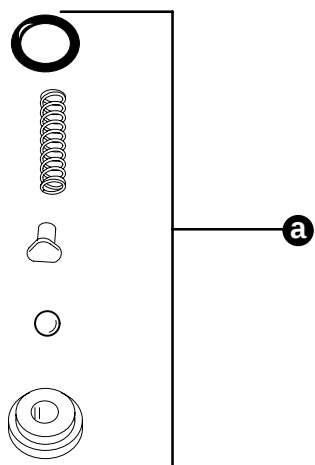
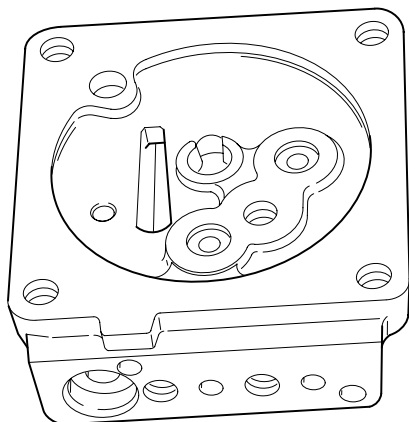


54745

a - O-ring  
b - Filter

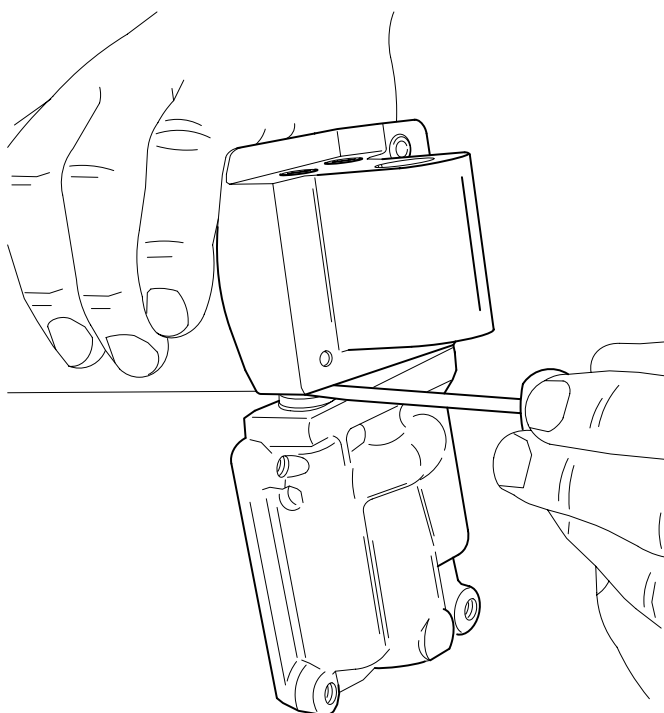


2. Install check ball components (a) into manifold.



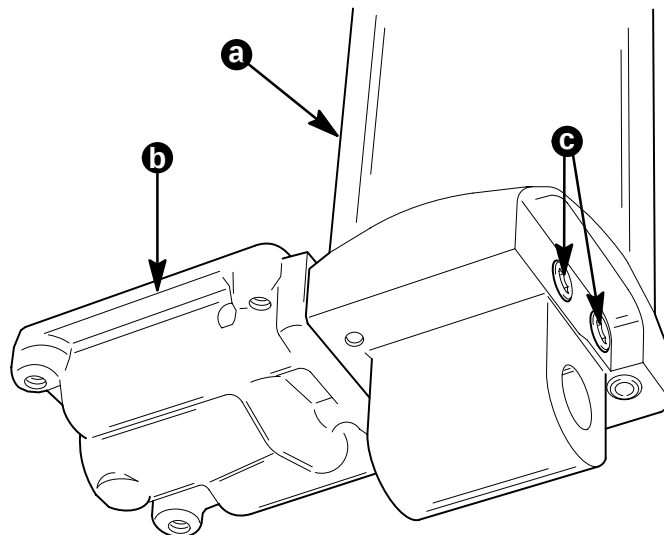
54744

3. Hold check ball components in place using screwdriver (as shown). Connect manifold to trim cylinder.



54748

4. Secure manifold to cylinder using screws, torque to 100 lb. in. (11.2 N·m).

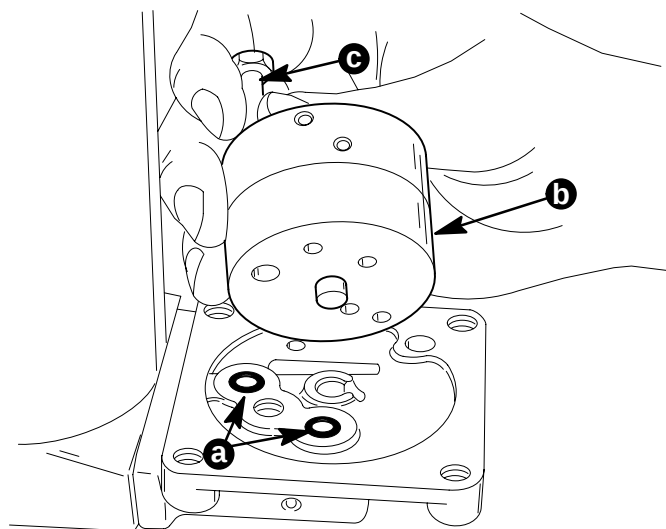


54746

a - Trim Cylinder  
b - Manifold  
c - Screw

## Oil Pump Installation

1. Secure power trim unit in soft jawed vise.
2. Install lubricated O-rings to manifold.
3. Install oil pump to manifold and secure using screw, torque to 90 lb. in. (10.2 N·m).



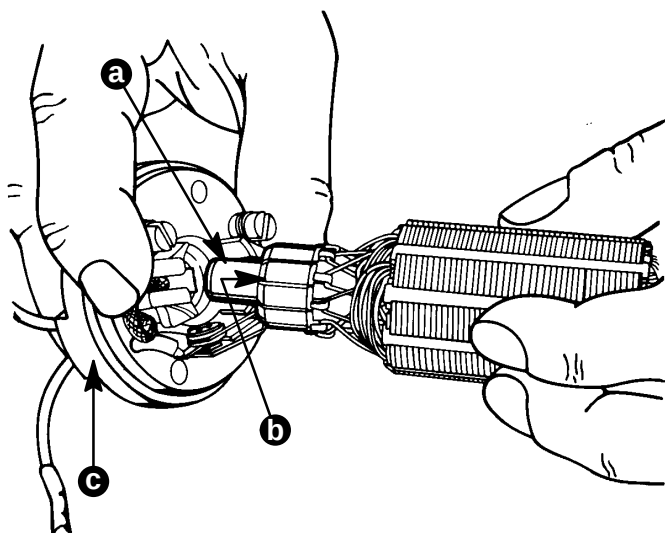
54747

a - O-ring  
b - Oil Pump  
c - Screw



## Trim Motor Reassembly

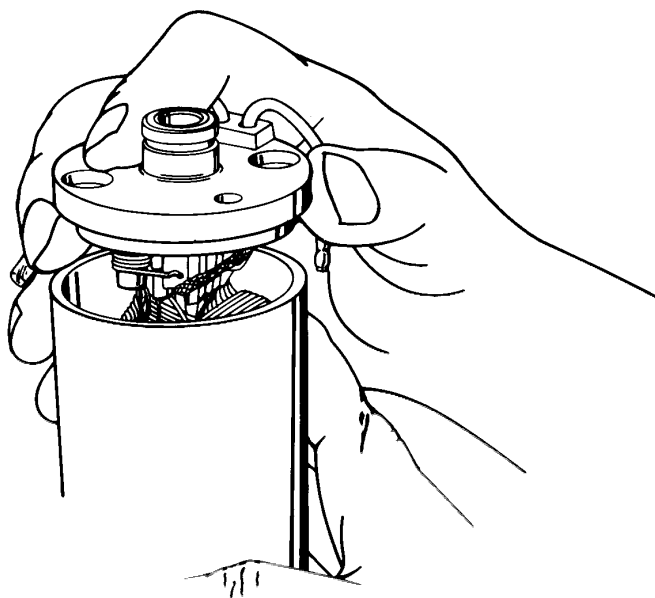
1. Apply Quicksilver Marine Lubricant (2-4-C) to armature shaft and insert into end frame.



51195

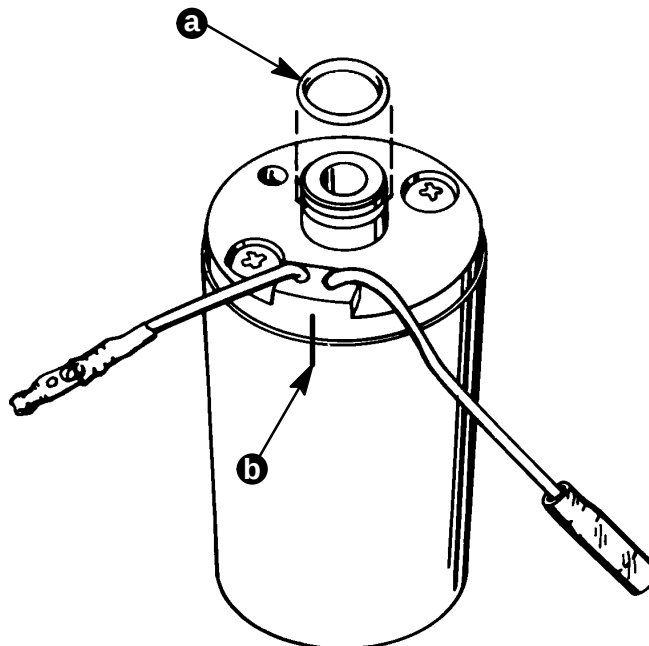
- a - Armature Shaft
- b - Washer
- c - End Frame

2. Guide armature and end frame into housing as shown.



51196

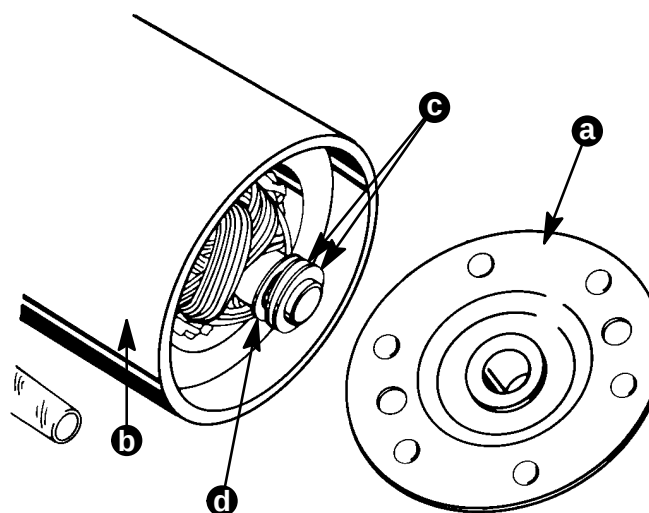
3. Align scribe mark on housing with mark on end frame.
4. Install lubricated O-ring to end frame.



51194

- a - O-ring
- b - Scribe Mark

5. Install washers to armature shaft as shown.
6. Install end cap to housing. Torque nuts to 25 lb. in. (2.8 N·m).

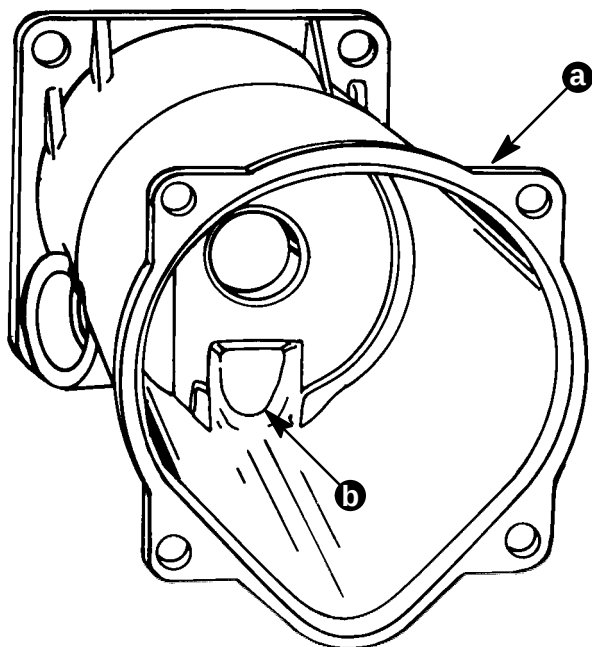


51194

- a - End Cap
- b - Motor Housing
- c - Wave Washer
- d - Washer



**IMPORTANT:** When installing motor, wires (black, orange) must rest in cavity of cylinder allowing motor to seat properly.

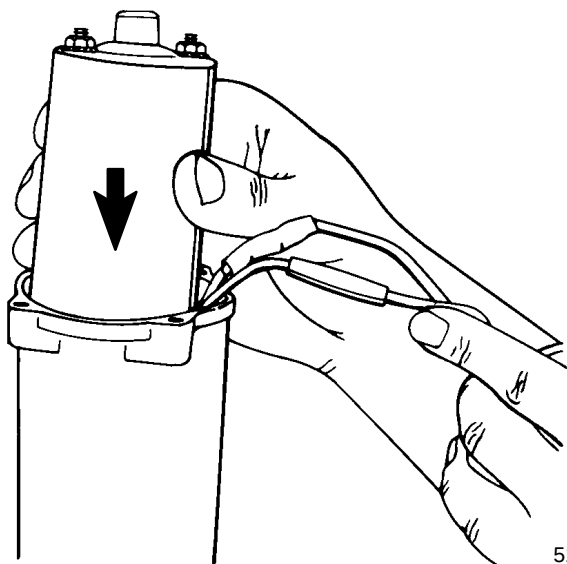


51194

a - Manifold  
b - Cavity

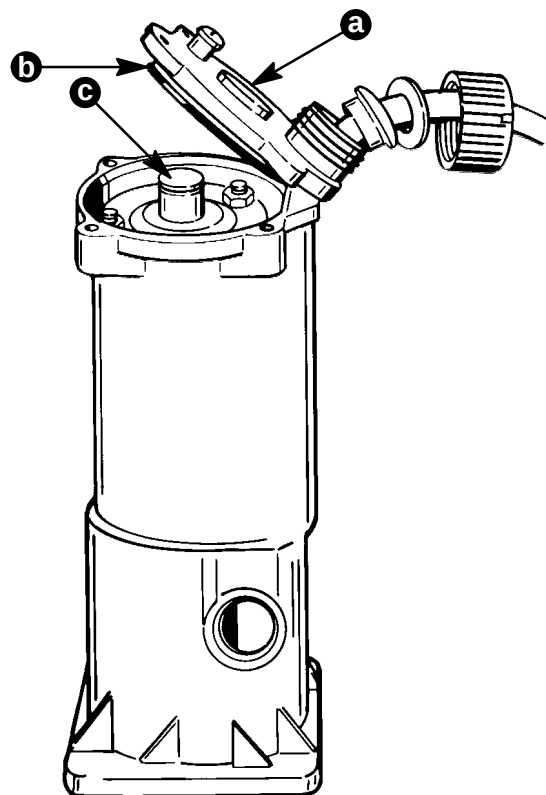
## Reservoir Installation

1. Connect trim motor wires to harness.
2. Insert motor into reservoir. Motor must be seated properly prior to end cap installation.



51196

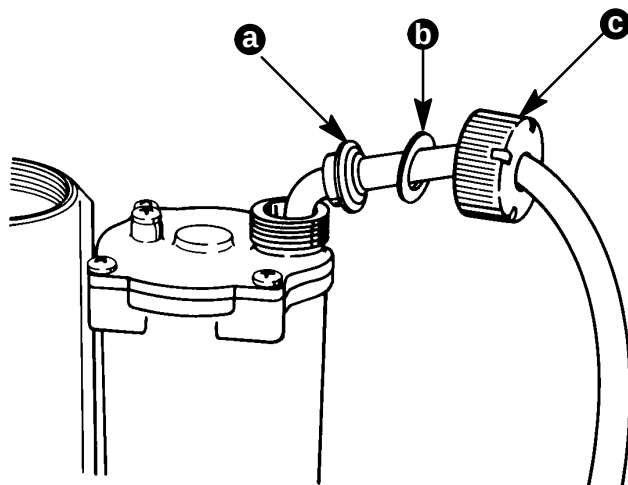
3. Install end cap, O-ring and foam pad to cylinder.
4. Torque screws to 13 lb. ft. (1.5 N·m).



51195

a - End Cap  
b - O-ring  
c - Foam Pad

5. Install grommet, washer and screw cap to cylinder end cap. Tighten screw securely.

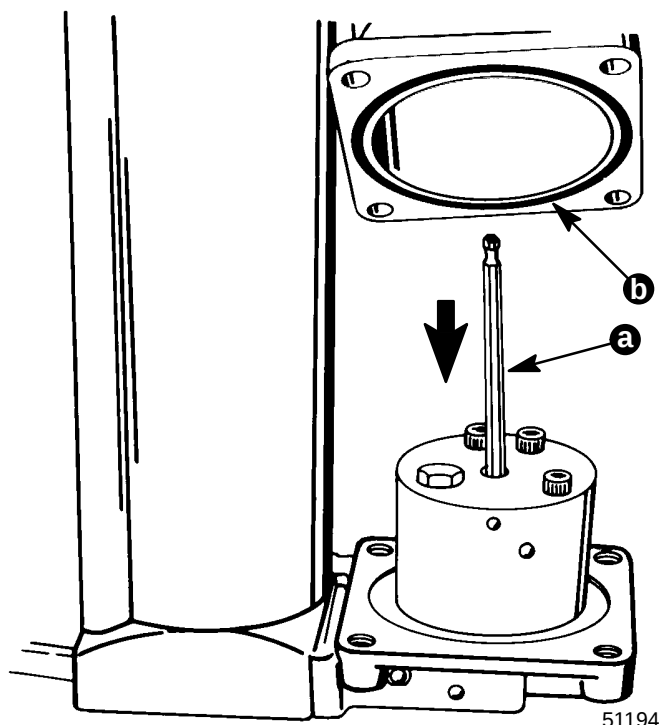


51195

a - Grommet  
b - Washer  
c - Screw Cap

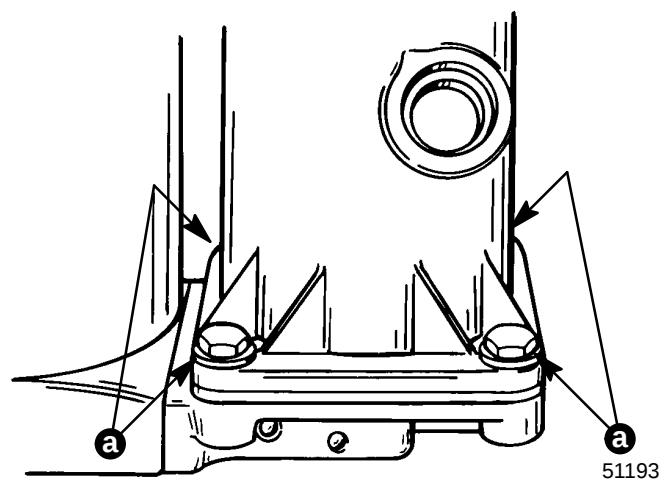


6. Place drive shaft into oil pump.
7. Install lubricated O-ring to base of reservoir.
8. Carefully guide reservoir (with motor) down onto drive shaft.



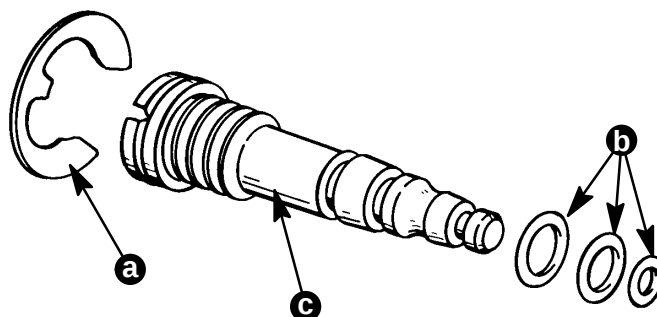
a - Drive Shaft  
b - O-ring

9. Secure reservoir to manifold using four screws. Torque screws to 70 lb. in. (7.9 N·m).



a - Screw

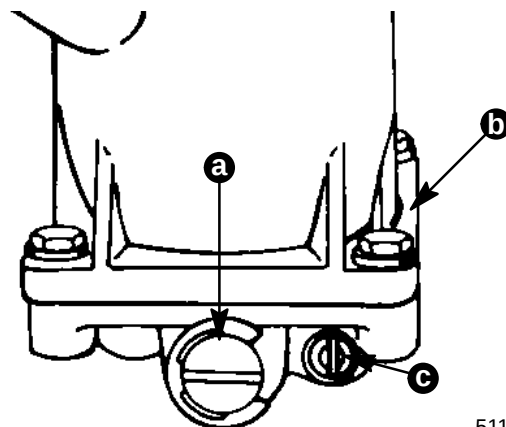
10. Install lubricated O-rings and "E" clip to manual release valve.



51196

a - "E" Clip  
b - O-ring  
c - Manual Release Valve

11. Insert manual release valve into manifold and tighten snugly. Back release valve out 3 or 4 turns allowing trim rod installation.



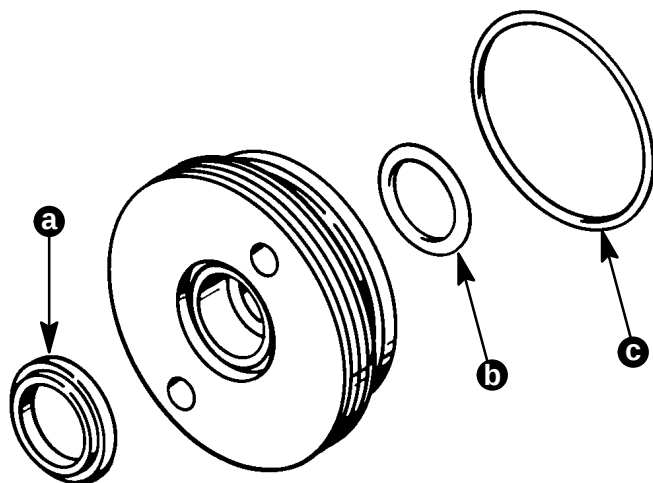
51194

a - Manual Release Valve  
b - Manifold  
c - Reverse Thrust Valve



## Trim Rod Reassembly

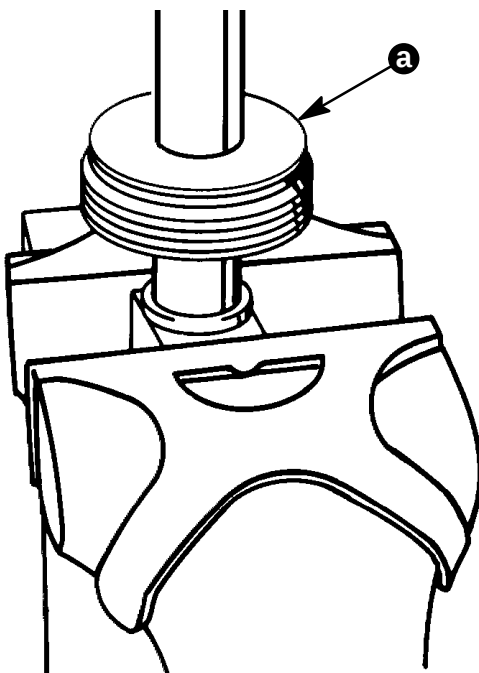
1. Install lubricated O-rings and rod wiper to end cap.



51145

- a - Rod Wiper
- b - Inner O-ring
- c - Outer O-ring

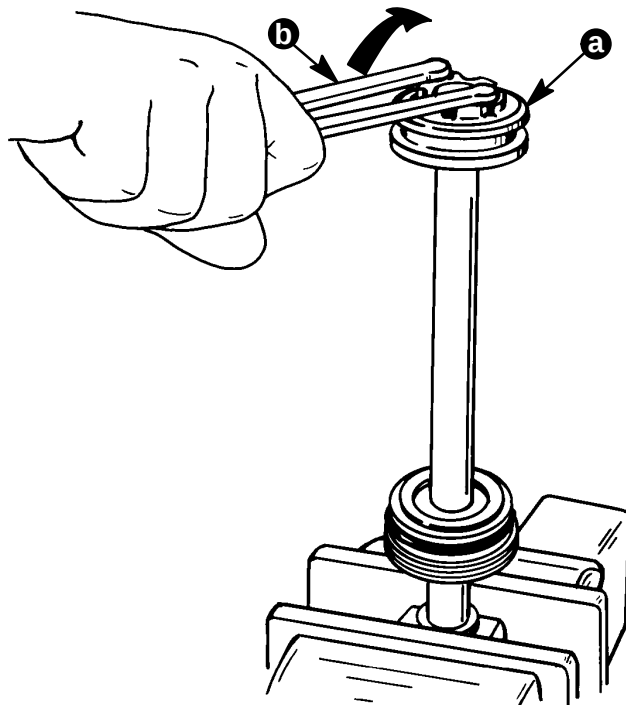
2. Secure trim rod in soft jawed vise as shown.
3. Slide end cap onto trim rod.



51146

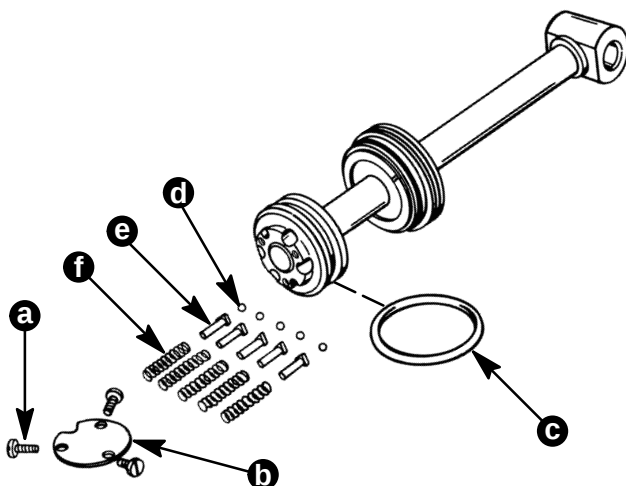
- a - End Cap

4. Apply Loctite Grade A (271) to threads of trim rod and install trim rod piston. Tighten piston securely using spanner wrench (1/4 in. x 5/16 in. long peg).



- a - Trim Rod Piston
- b - Spanner Wrench

5. Install lubricated O-ring to trim rod piston.
6. Install check ball components into its respective bore.
7. Secure components in place using plate and screws. Torque screws securely.



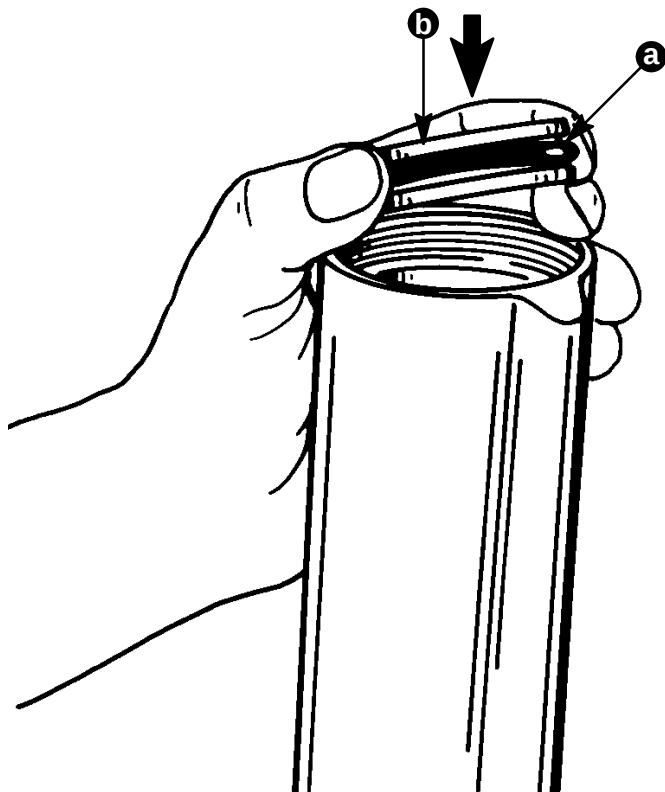
51147

- a - Screw
- b - Plate
- c - O-ring
- d - Ball
- e - Seat, Spring
- f - Spring



## Trim Rod Installation

1. Place trim cylinder in soft jawed vise.
2. Fill trim cylinder three inches (76.2mm) from top of cylinder using Quicksilver Power Trim and Steering Fluid or; (ATF) Type F, FA or Dexron II.
3. Install lubricated O-ring to memory piston and place into cylinder. Push piston down to level of oil.

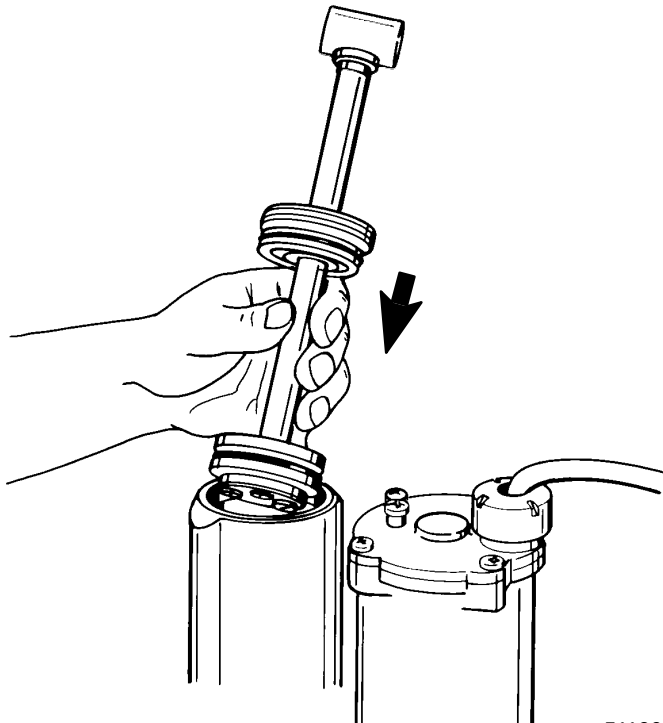


51144

a - O-ring  
b - Memory Piston

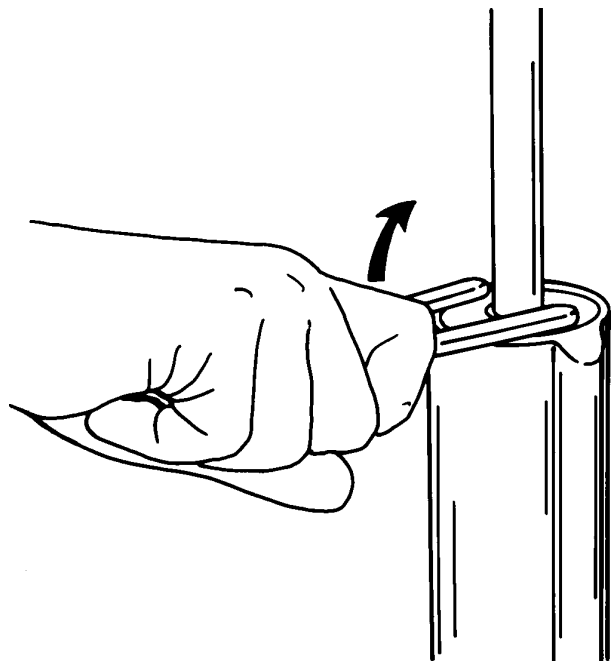
**IMPORTANT:** Memory piston must not come in contact with trim rod end cap during end cap/trim rod installation.

4. Install trim rod into cylinder.



51196

5. Tighten end cap assembly to cylinder securely using spanner wrench (1/4 in. x 5/16 in. long pegs).



51145

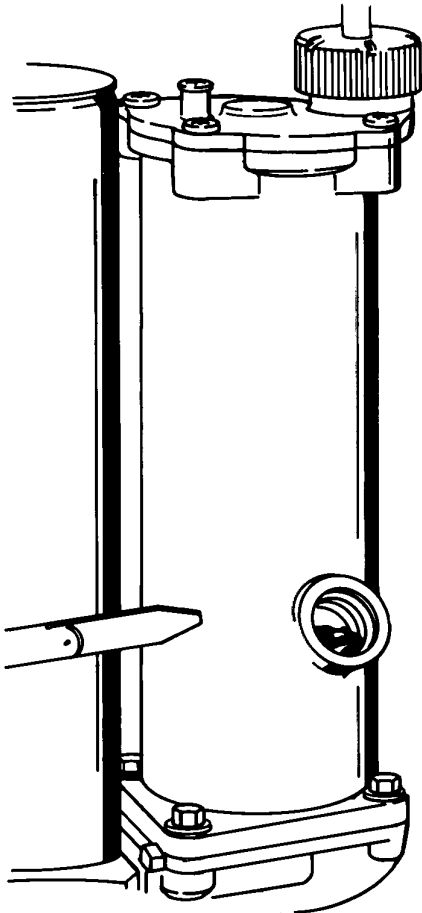
6. Tighten manual release valve snugly following end cap installation.



## Bleeding Power Trim Unit

**IMPORTANT:** Manual release valve must be in the closed position during power trim bleeding and operation.

1. Secure power trim unit in soft jawed vise.
2. Remove fill screw. Add Quicksilver Power Trim and Steering Fluid (92-90100A12) or Automatic Transmission Fluid (ATF) Type F, FA or Dexron II up to threads of reservoir.

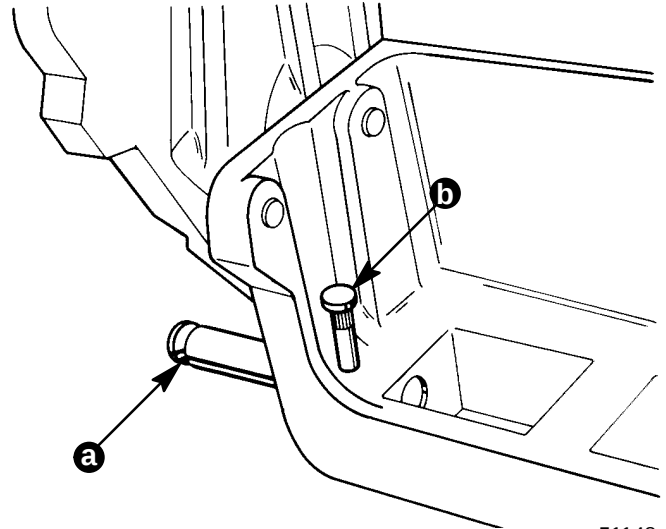


50241

3. Using a 12 volt power supply connect positive lead to green wire, negative lead to blue wire and drive trim rod to the down position. Connect positive lead to blue wire and negative lead to green wire and drive trim rod to the up position. Re-check fluid level, add fluid if required and repeat cycle until fluid level remains at lower portion of threads.
4. Install fill plug.

## Power Trim Unit Installation

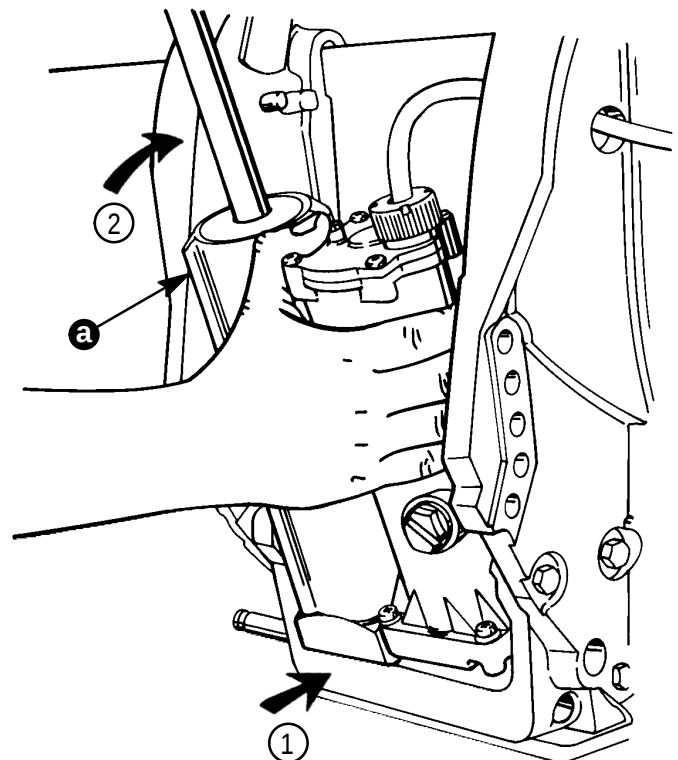
1. Apply Special Lubricant 101 (92-13872A1) to lower pivot pin hole and pivot pin surface.
2. Start lower pivot pin into pivot pin bore and position lower dowel pin (RETAINED) in its respective hole.



51148

- a - Lower Pivot Pin  
b - Lower Dowel Pin

3. Position trim cylinder assembly (BOTTOM FIRST) between clamp brackets and route trim pump electrical harness through access hole in starboard clamp bracket.

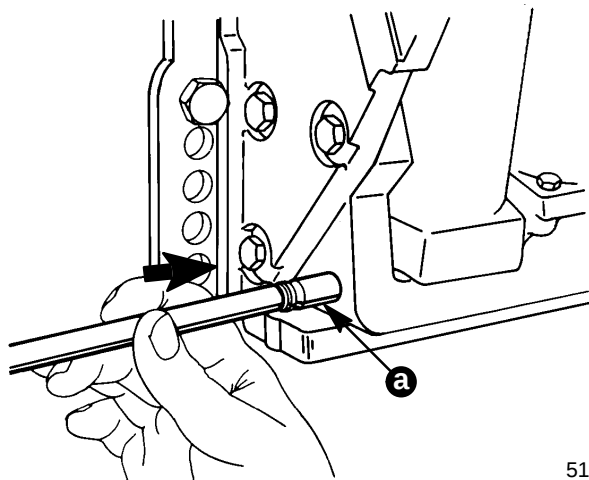


51195

- a - Trim Cylinder Assembly



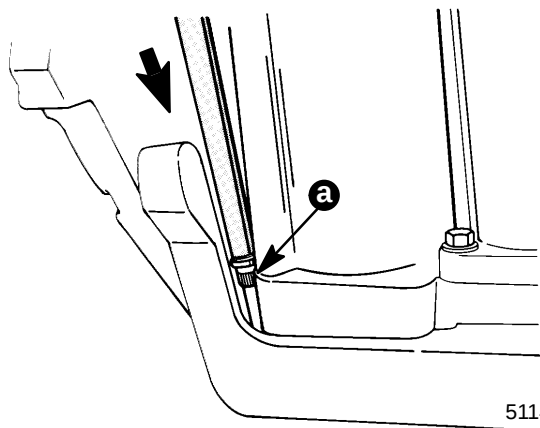
4. Using a suitable punch, drive lower pivot pin into clamp bracket and trim cylinder assembly until pivot pin is flush with outside surface.



51147

a - Lower Pivot Pin

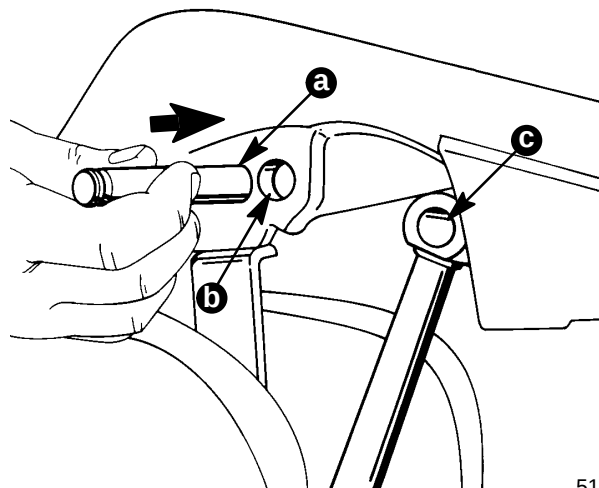
5. Using a suitable punch, drive lower dowel pin into its respective bore until seated.



51148

a - Lower Dowel Pin

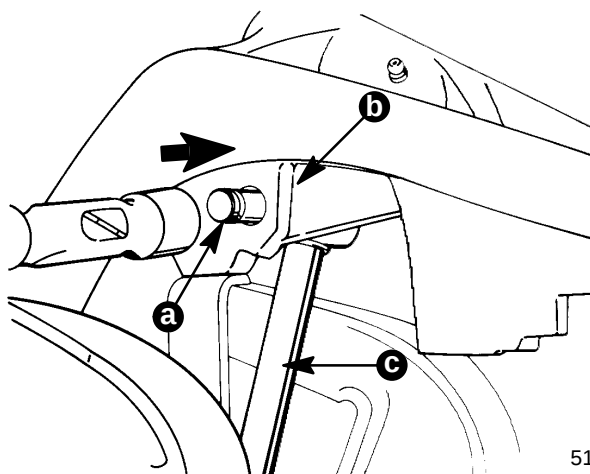
6. Apply 2-4-C Marine Lubricant (92-90018A12) to surface of upper pivot pin, pivot pin bore and trim ram bore.



51148

a - Pivot Pin  
b - Pivot Pin Bore  
c - Trim Ram Bore

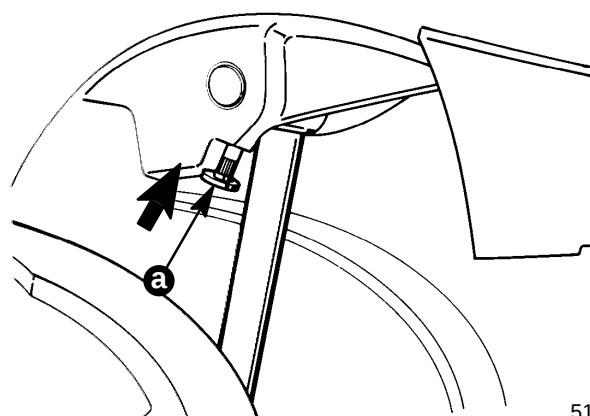
7. Using a suitable mallet, drive upper pivot pin into swivel bracket and through trim ram until pivot pin is flushed with swivel bracket.



51148

a - Pivot Pin  
b - Swivel Bracket  
c - Trim Ram

8. Drive upper dowel pin (RETAINED) into its respective hole until seated.



51147

a - Dowel Pin

9. Remove trim fluid fill screw. Fluid level should be to bottom of threads. Add Quicksilver Power Trim and Steering Fluid (92-90100A12) or Automatic Transmission Fluid (ATF) Type F, FA or Dexron II to trim system, if necessary.

10. Reinstall fill screw.

11. Power trim may now be operated to lower out-board to desired position. Trim system is self bleeding.

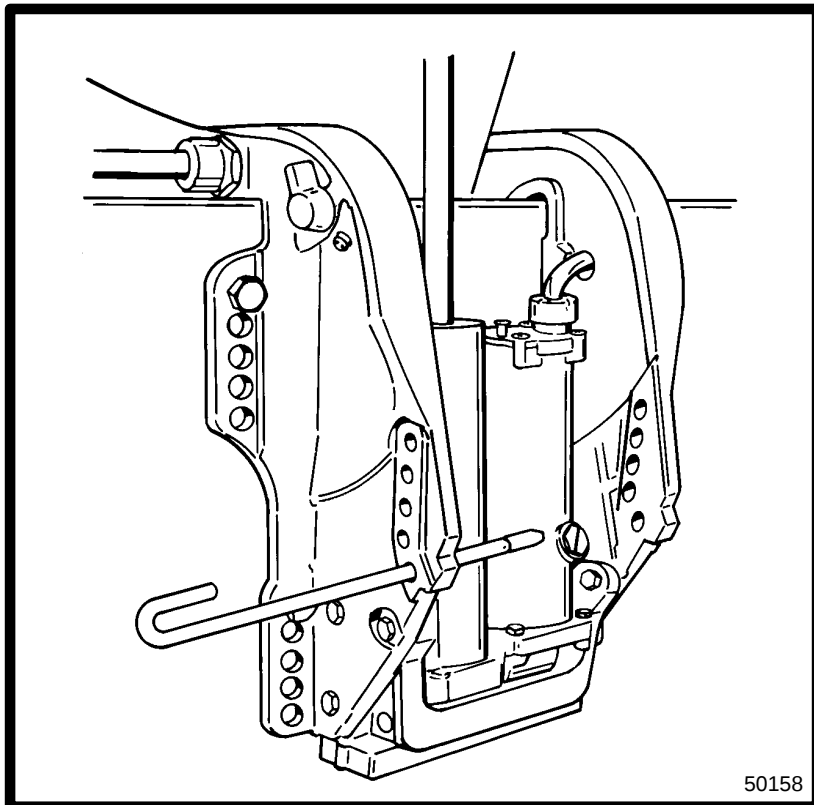
12. Reconnect spark plug leads to spark plugs.

13. Reinstall top cowl.

14. Connect battery leads to battery terminals.



# MID-SECTION



5

C

## POWER TRIM (DESIGN II)



# Table of Contents

|                                              | Page  |
|----------------------------------------------|-------|
| Power Trim General Information .....         | 5C-1  |
| Description .....                            | 5C-1  |
| Trimming Characteristics .....               | 5C-1  |
| Trimming Outboard "Up" ("Out") .....         | 5C-1  |
| Trimming Outboard "Down" ("In") .....        | 5C-1  |
| Trailing Outboard .....                      | 5C-2  |
| Tilting Outboard Up and Down Manually ..     | 5C-2  |
| Trim "In" Angle Adjustment .....             | 5C-2  |
| Power Trim System Components .....           | 5C-3  |
| Torque Specifications .....                  | 5C-3  |
| Quicksilver Lubricant/Sealant Application    |       |
| Points .....                                 | 5C-3  |
| Power Trim Flow Diagrams Design II .....     | 5C-4  |
| Design II .....                              | 5C-5  |
| Design II .....                              | 5C-6  |
| Design II .....                              | 5C-7  |
| Design II .....                              | 5C-8  |
| Design II .....                              | 5C-9  |
| Design II .....                              | 5C-10 |
| Troubleshooting .....                        | 5C-11 |
| Determining if Problem is Electrical or      |       |
| Hydraulic .....                              | 5C-11 |
| Trouble Chart .....                          | 5C-11 |
| Hydraulic System Troubleshooting .....       | 5C-12 |
| Preliminary Checks .....                     | 5C-12 |
| Leak Down Check – Pump and Manifold          |       |
| Assembly .....                               | 5C-12 |
| Leak Down Check – Pilot Valve                |       |
| Assembly .....                               | 5C-13 |
| Leak Down Check – Manual Release             |       |
| Valve .....                                  | 5C-13 |
| Leakage Past Ball and Seat – Piston          |       |
| Assembly .....                               | 5C-13 |
| Troubleshooting Flow Diagram .....           | 5C-14 |
| Troubleshooting Flow Diagram .....           | 5C-15 |
| Electrical System Troubleshooting .....      | 5C-16 |
| COMMANDER 2000 Side Mount Remote             |       |
| Control (Power Trim/Tilt Electric Start with |       |
| Warning Horn) Wiring Diagram .....           | 5C-16 |
| Power Trim System Wiring Diagram .....       | 5C-17 |
| Troubleshooting the "Down" Circuit*          |       |
| (When "Up" Circuit is OK) .....              | 5C-18 |
| Troubleshooting the "Up" Circuit*            |       |
| (When "Down" Circuit Is OK) .....            | 5C-19 |
| Troubleshooting the "Down" and "Up" Circuits |       |
| (All Circuits Inoperative)* .....            | 5C-20 |

|                                         | Page  |
|-----------------------------------------|-------|
| Power Trim System Removal .....         | 5C-21 |
| Power Trim System Disassembly .....     | 5C-22 |
| Trim Rod Removal .....                  | 5C-22 |
| Trim Rod Disassembly .....              | 5C-23 |
| Trim "Motor" Removal .....              | 5C-25 |
| Trim Motor Disassembly .....            | 5C-25 |
| Reservoir Assembly Removal .....        | 5C-26 |
| Oil Pump/Manifold Removal .....         | 5C-27 |
| Cleaning and Inspection of Trim Rod     |       |
| Components .....                        | 5C-28 |
| Motor and Electrical Tests/Repair ..... | 5C-29 |
| Trim Pump Motor Test .....              | 5C-29 |
| Thermal Overload Switch Test .....      | 5C-29 |
| Motor Assembled .....                   | 5C-29 |
| Motor Disassembled .....                | 5C-29 |
| Armature Tests .....                    | 5C-30 |
| Test for Shorts .....                   | 5C-30 |
| Test for Ground .....                   | 5C-30 |
| Checking and Cleaning Commutator ..     | 5C-30 |
| Power Trim System Re-assembly .....     | 5C-30 |
| Manifold/Oil Pump Installation .....    | 5C-30 |
| Trim Motor Re-assembly .....            | 5C-31 |
| Reservoir Installation .....            | 5C-33 |
| Trim Rod Re-assembly .....              | 5C-34 |
| Trim Rod Installation .....             | 5C-35 |
| Bleeding Power Trim Unit .....          | 5C-36 |
| Power Trim Unit Installation .....      | 5C-37 |



# Power Trim General Information

## Description

The Power Trim system consists of an electric motor, pressurized fluid reservoir, pump and trim cylinder.

The remote control (or trim panel) is equipped with a switch that is used for trimming the outboard “up” and “down”, and for tilting the outboard for shallow water operation (at slow speed) or for “trailing”. The outboard can be trimmed “up” or “down” while engine is under power or when engine is not running.

## Trimming Characteristics

**NOTE:** *Because varying hull designs react differently in various degrees of rough water, it is recommended to experiment with trim positions to determine whether trimming “up” or “down” will improve the ride in rough water.*

When trimming your outboard from a mid-trim position (trim tab in neutral, straight fore-and-aft, position), you can expect the following results:

### TRIMMING OUTBOARD “UP” (“OUT”)

#### ⚠ WARNING

Excessive trim “out” may reduce the stability of some high speed hulls. To correct instability at high speed, reduce the power gradually and trim the motor “In” slightly before resuming high speed operation. (Rapid reduction in power will cause a sudden change of steering torque and may cause additional momentary boat instability.)

Will lift bow of boat, generally increasing top speed.

Transfers steering torque harder to left on installations below 23 in. transom height.

Increases clearance over submerged objects.

In excess, can cause porpoising and/or ventilation.

In excess, can cause insufficient water supply to water pump resulting in serious water pump and/or powerhead overheating damage.

#### ⚠ WARNING

Excessive engine trim angle will result in insufficient water supply to water pump causing water pump and/or powerhead overheating damage. Make sure that water level is above gear housing water intake holes whenever engine is running.

Operating “Up” circuit will actuate the “up” solenoid (located under engine cowl) and close the electric motor circuit. The electric motor will drive the pump, thus forcing automatic transmission fluid thru internal passageways into the “up” side of the trim ram.

The trim cylinder/trim ram will position the engine at the desired trim angle within the 20° maximum trim range. The Power Trim system is designed so the engine cannot be trimmed beyond the 20° maximum trim angle as long as engine RPM is above approximately 2000 RPM.

The engine can be raised beyond the 20° maximum trim angle for shallow water operation, etc., by keeping the engine RPM below 2000 RPM. If engine speed increases above 2000 RPM, the thrust created by the propeller (if deep enough in the water) should cause the trim system to automatically lower the engine back to the 20° maximum trim angle.

### TRIMMING OUTBOARD “DOWN” (“IN”)

#### ⚠ WARNING

Excessive speed at minimum trim “In” may cause undesirable and/or unsafe steering conditions. Each boat should be tested for handling characteristics after any adjustment is made to the tilt angle (tilt pin relocation).

Will help planing off, particularly with a heavy load.

Usually improves ride in choppy water.

In excess, can cause boat to veer to the left or right (bow steer).

Transfers steering torque harder to right (or less to the left).

Improves planing speed acceleration (by moving tilt pin one hole closer to transom).

Operating “Down” circuit will actuate the “down” solenoid (located under engine cowl) and close the electric motor circuit (motor will run in opposite direction of the “Up” circuit). The electric motor will drive the pump, thus forcing automatic transmission fluid thru internal passageways into the “down” side of the tilt ram. The tilt ram will move the engine downward to the desired angle.



## Trailing Outboard

### ⚠ WARNING

Excessive engine trim angle will result in insufficient water supply to water pump causing water pump and/or powerhead overheating damage. Make sure that water level is above gear housing water intake holes whenever engine is running.

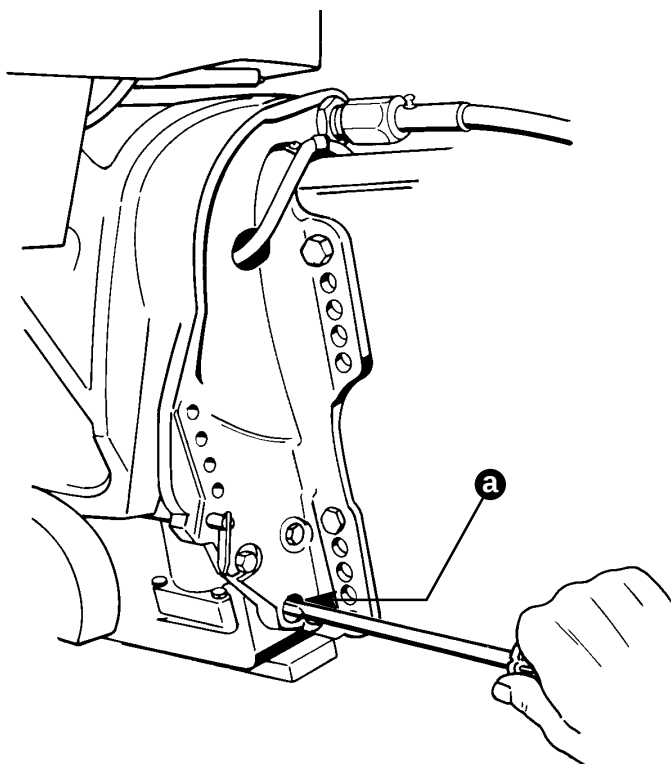
While operating “up” circuit, tilt ram will continue to tilt outboard to full up position for trailering.

## Tilting Outboard Up and Down Manually

### ⚠ WARNING

Before loosening the manual release valve, make sure all persons are clear of engine as engine will drop to full “down” position when valve is loosened.

With power trim installed, the outboard can be raised or lowered manually by opening the manual release valve 3 to 4 turns (counterclockwise).



50146

a - Manual Release Valve

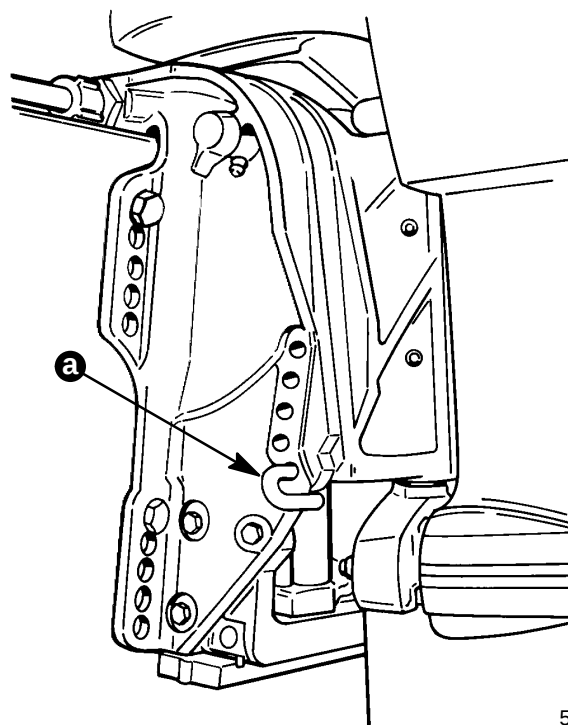
## Trim “In” Angle Adjustment

### ⚠ WARNING

Operating some boats with engine trimmed to the full “in” trim angle [not using trim adjustment pin (a)] at planing speed will cause undesirable and/or unsafe steering conditions. Each boat must be water tested for handling characteristics after engine installation and after any trim adjustments.

**IMPORTANT:** Some boat/motor combinations, that do not use the trim adjustment pin (a) and are trimmed to the full “in” trim angle, will not experience any undesirable and/or unsafe steering conditions during planing speed. Thus, not using trim adjustment pin may be desired. However, some boats with engine trimmed to the full “in” trim angle at planing speed will cause undesirable and/or unsafe steering conditions. If these steering conditions are experienced, under no circumstances should the engine be operated without the trim adjustment pin and without the pin adjusted in the proper holes to prevent unsafe handling characteristics.

Water test the boat not using the trim adjustment pin. If undesirable and/or unsafe steering conditions are experienced (boat runs with nose down), install trim adjustment pin in proper hole to prevent unsafe handling characteristics.



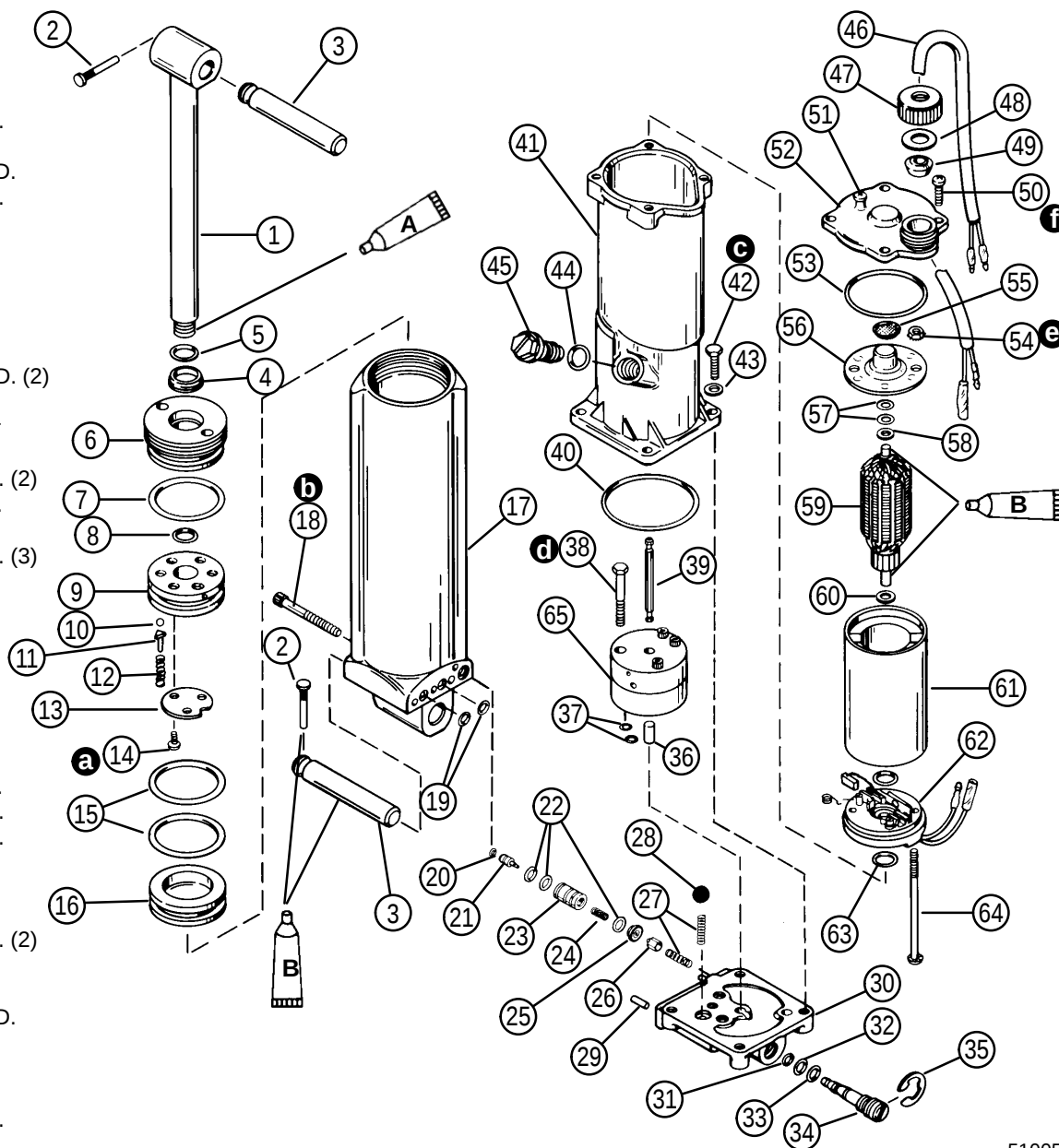
51057



# Power Trim System Components

**NOTE:** It is recommended that "ALL" O-rings be replaced when servicing tilt system.

- 1 - Trim Rod
- 2 - Dowel Pin
- 3 - Pivot Pin
- 4 - Rod Wiper
- 5 - O-ring .671 in. I.D.
- 6 - Cylinder Cap
- 7 - O-ring 1.864 in. I.D.
- 8 - O-ring .614 in. I.D.
- 9 - Trim Rod Piston
- 10 - Ball (5)
- 11 - Seat Spring (5)
- 12 - Spring (5)
- 13 - Retainer Plate
- 14 - Screw (3)
- 15 - O-ring 1.600 in. I.D. (2)
- 16 - Memory Piston
- 17 - Trim Rod Cylinder
- 18 - Screw (2)
- 19 - O-ring .208 in. I.D. (2)
- 20 - O-ring .114 in. I.D.
- 21 - Spool
- 22 - O-ring .301 in. I.D. (3)
- 23 - Sleeve
- 24 - Spring
- 25 - Valve Seat
- 26 - Valve
- 27 - Spring (2)
- 28 - Ball
- 29 - Dowel Pin (2)
- 30 - Manifold
- 31 - O-ring .114 in. I.D.
- 32 - O-ring .208 in. I.D.
- 33 - O-ring .239 in. I.D.
- 34 - Relief Valve
- 35 - "E" Clip
- 36 - Dowel Pin
- 37 - O-ring .176 in. I.D. (2)
- 38 - Bolt
- 39 - Drive Shaft
- 40 - O-ring 2.364 in. I.D.
- 41 - Reservoir
- 42 - Bolt (4)
- 43 - Washer (4)
- 44 - O-ring .538 in. I.D.
- 45 - Fill Screw
- 46 - Wire Harness
- 47 - Cap
- 48 - Washer
- 49 - Grommet
- 50 - Screw (4)
- 51 - Screw
- 52 - Reservoir Cap
- 53 - O-ring 2.634 in. I.D.
- 54 - Nut (2)
- 55 - Disk Foam Pad
- 56 - End Cap
- 57 - Washer (2; .030 in. Thick)
- 58 - Thrust Washer
- 59 - Armature
- 60 - Washer (.010 in. Thick)
- 61 - Housing
- 62 - End Frame
- 63 - O-ring .489 in. I.D.
- 64 - Bolt (2)
- 65 - Trim Pump



51005

## Torque Specifications

- a** 35 lb. in. (4.0 N·m)
- b** 100 lb. in. (11.3 N·m)
- c** 70 lb. in. (7.9 N·m)
- d** 90 lb. in. (10.2 N·m)
- e** 25 lb. in. (2.8 N·m)
- f** 13 lb. in. (1.5 N·m)

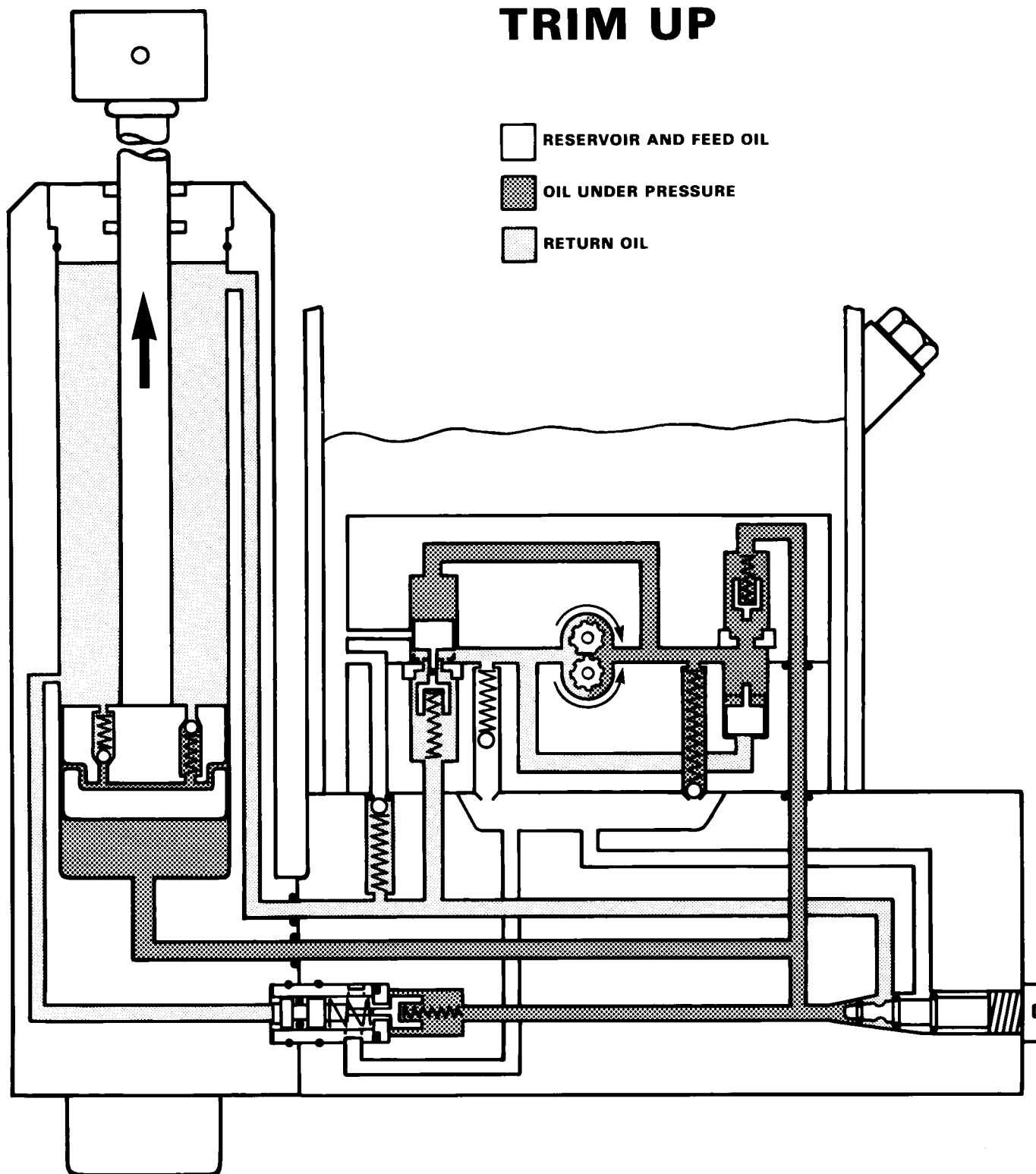
## Quicksilver Lubricant/Sealant Application Points

- A** Loctite Grade "A" (271)
- B** Special Lubricant 101



# Power Trim Flow Diagrams Design II

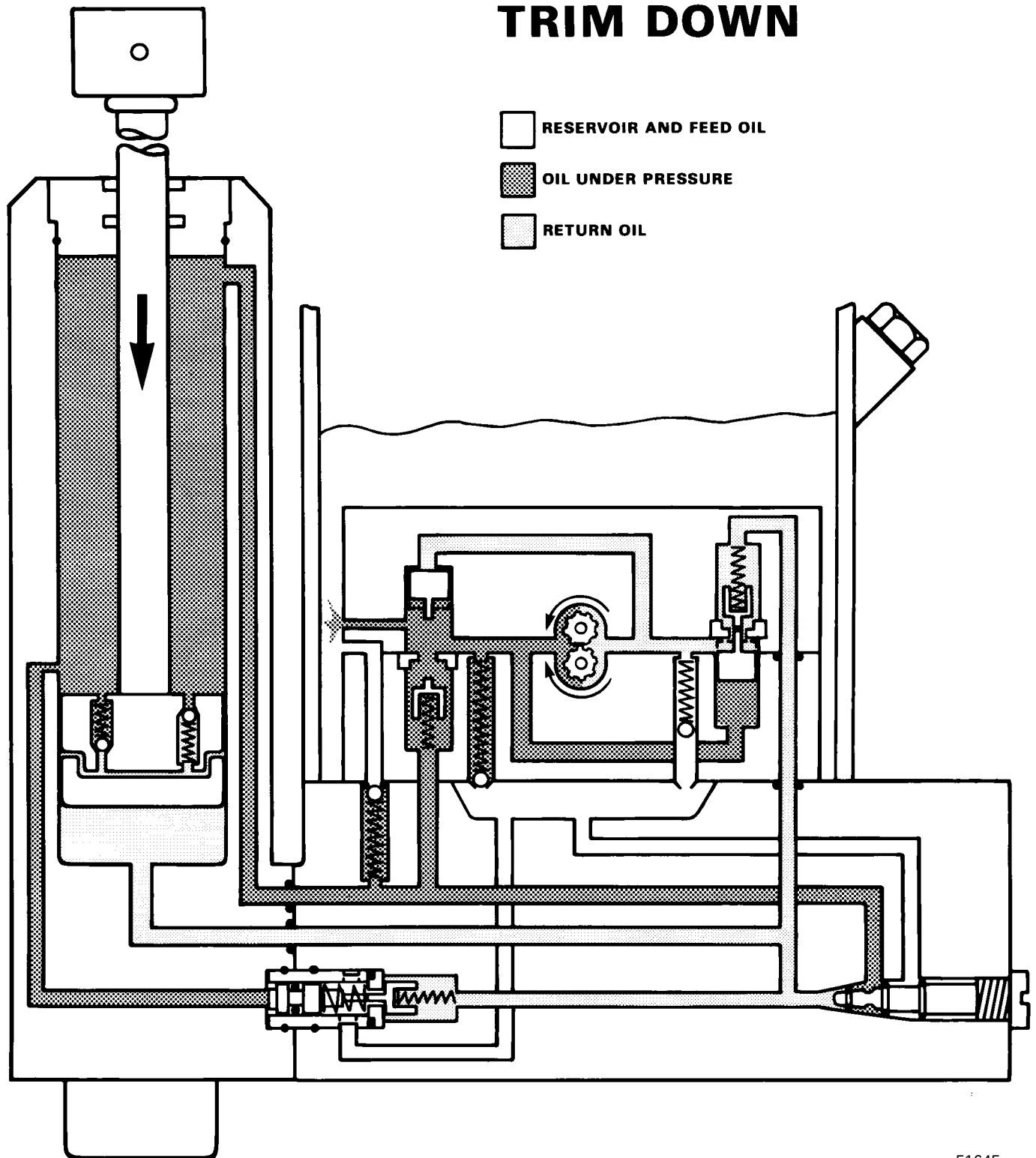
## TRIM UP



51644



## TRIM DOWN

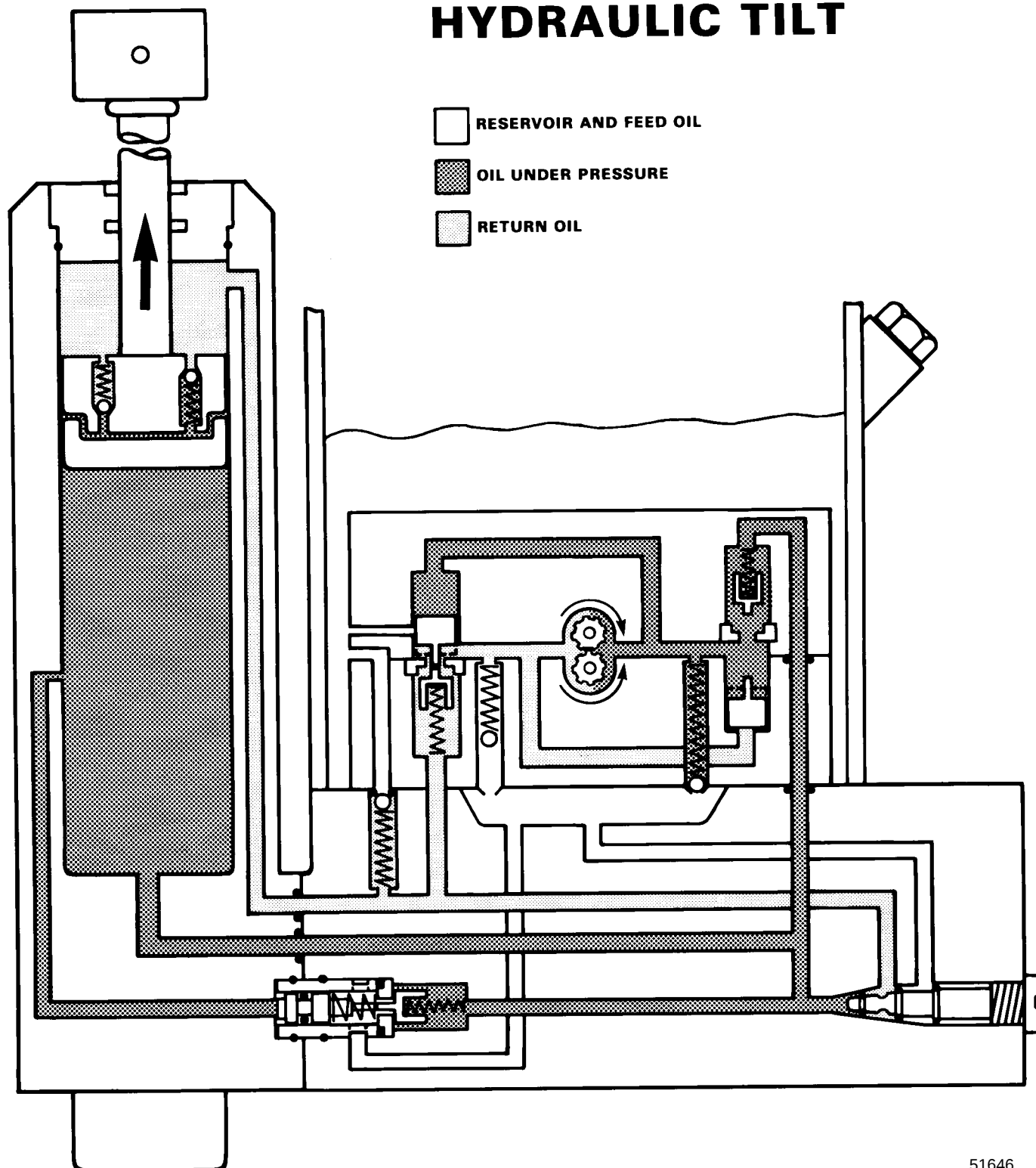


51645



## Design II

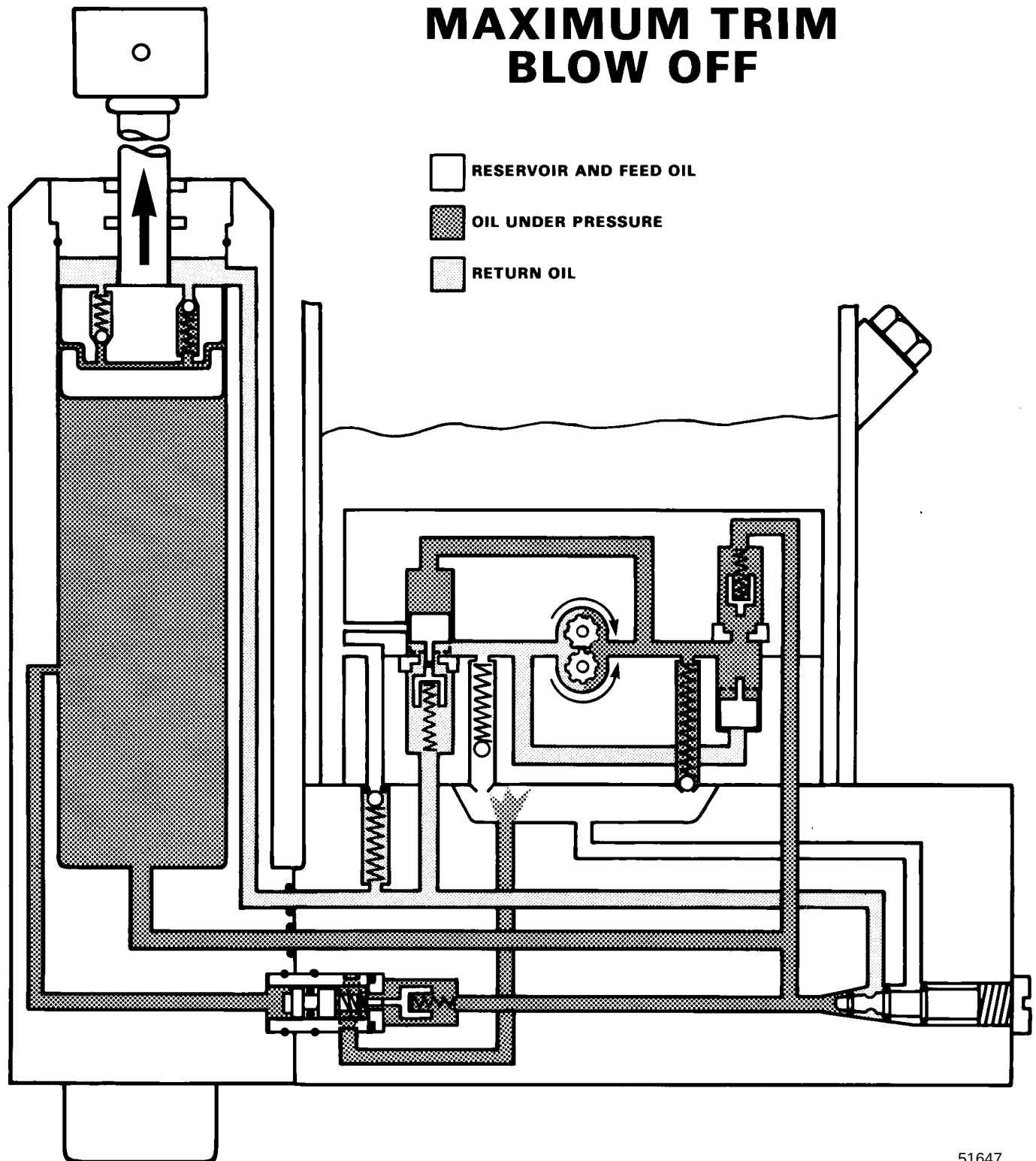
### HYDRAULIC TILT



51646



## MAXIMUM TRIM BLOW OFF

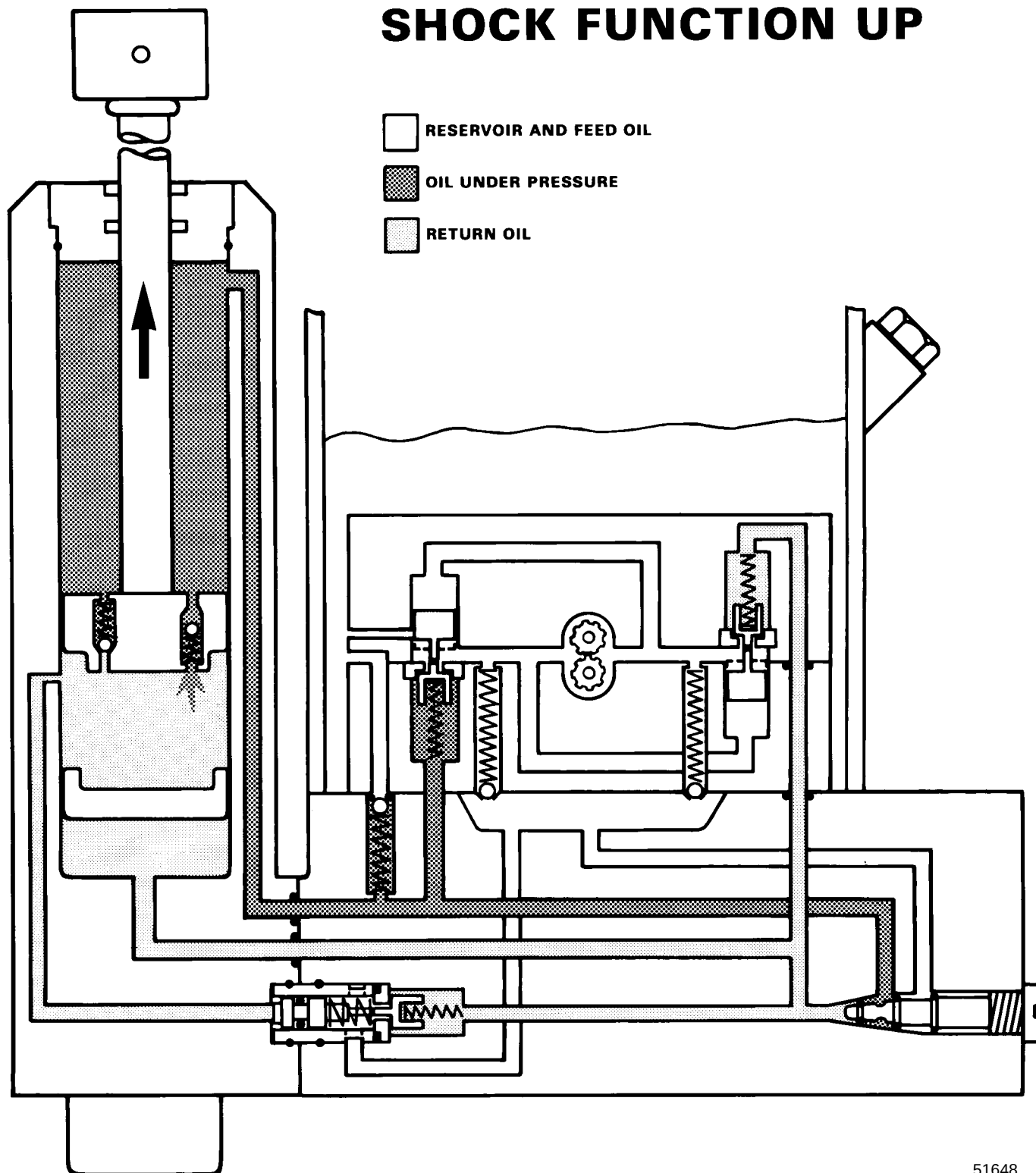


51647



## Design II

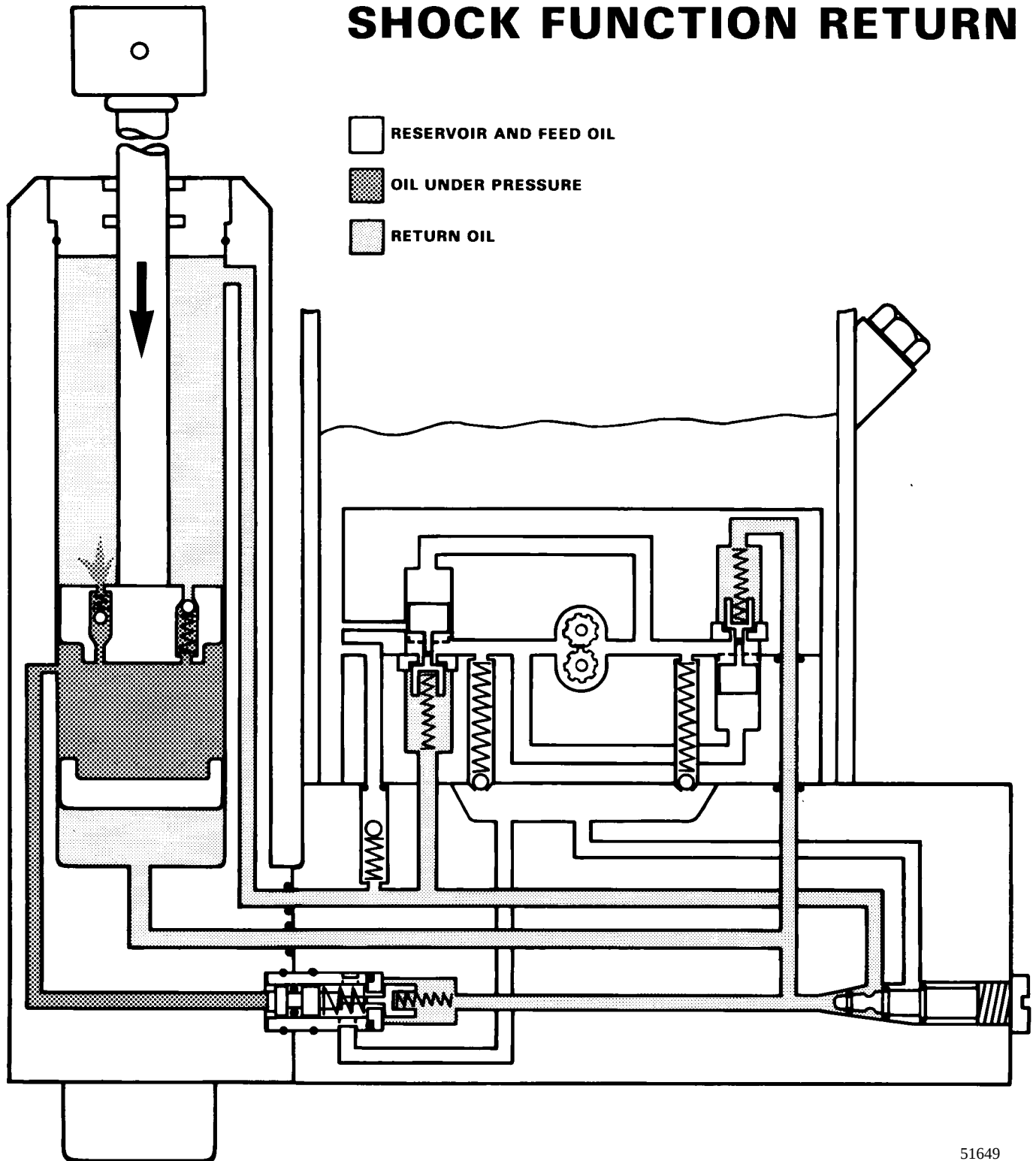
### SHOCK FUNCTION UP



51648



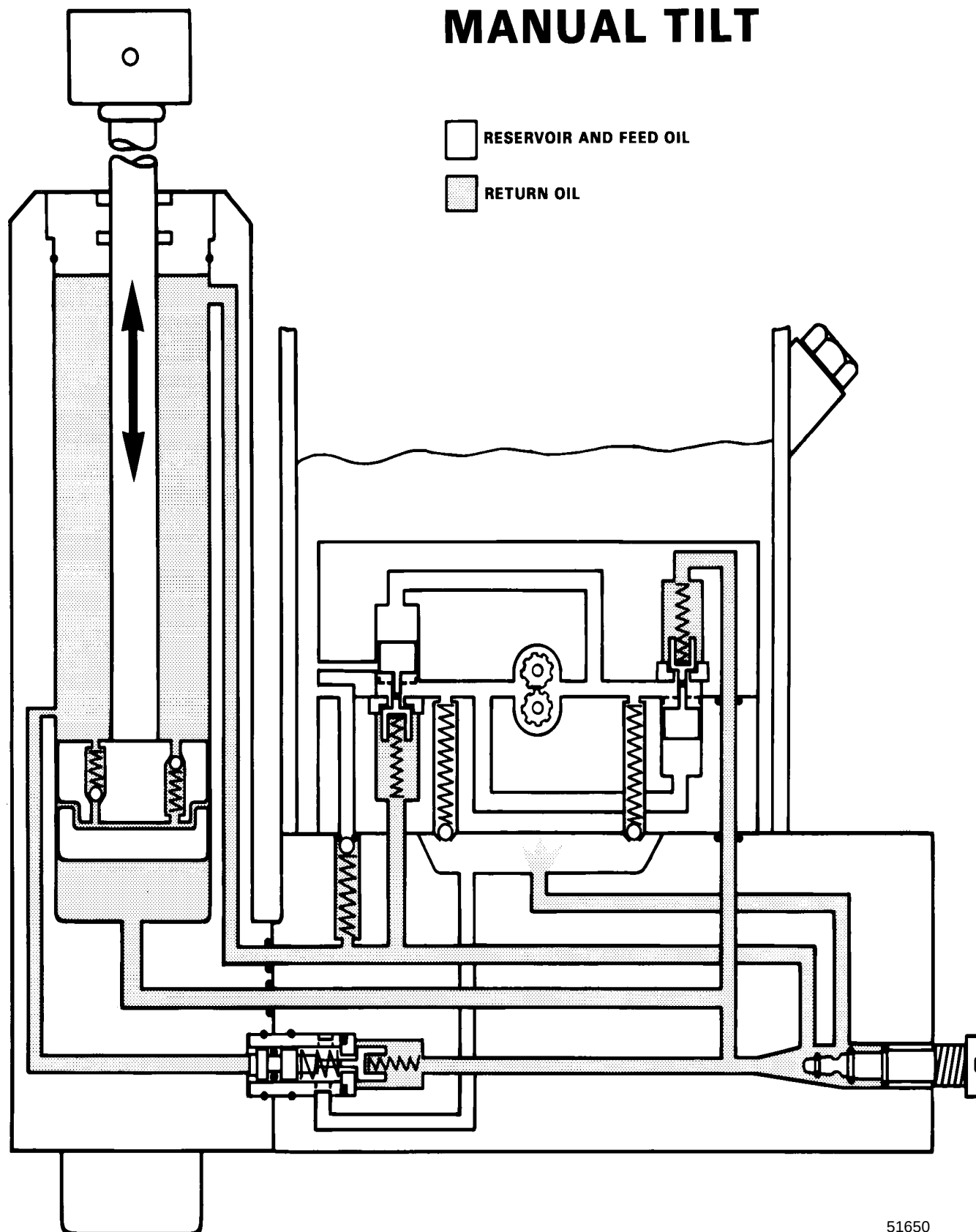
## SHOCK FUNCTION RETURN





## Design II

### MANUAL TILT



51650

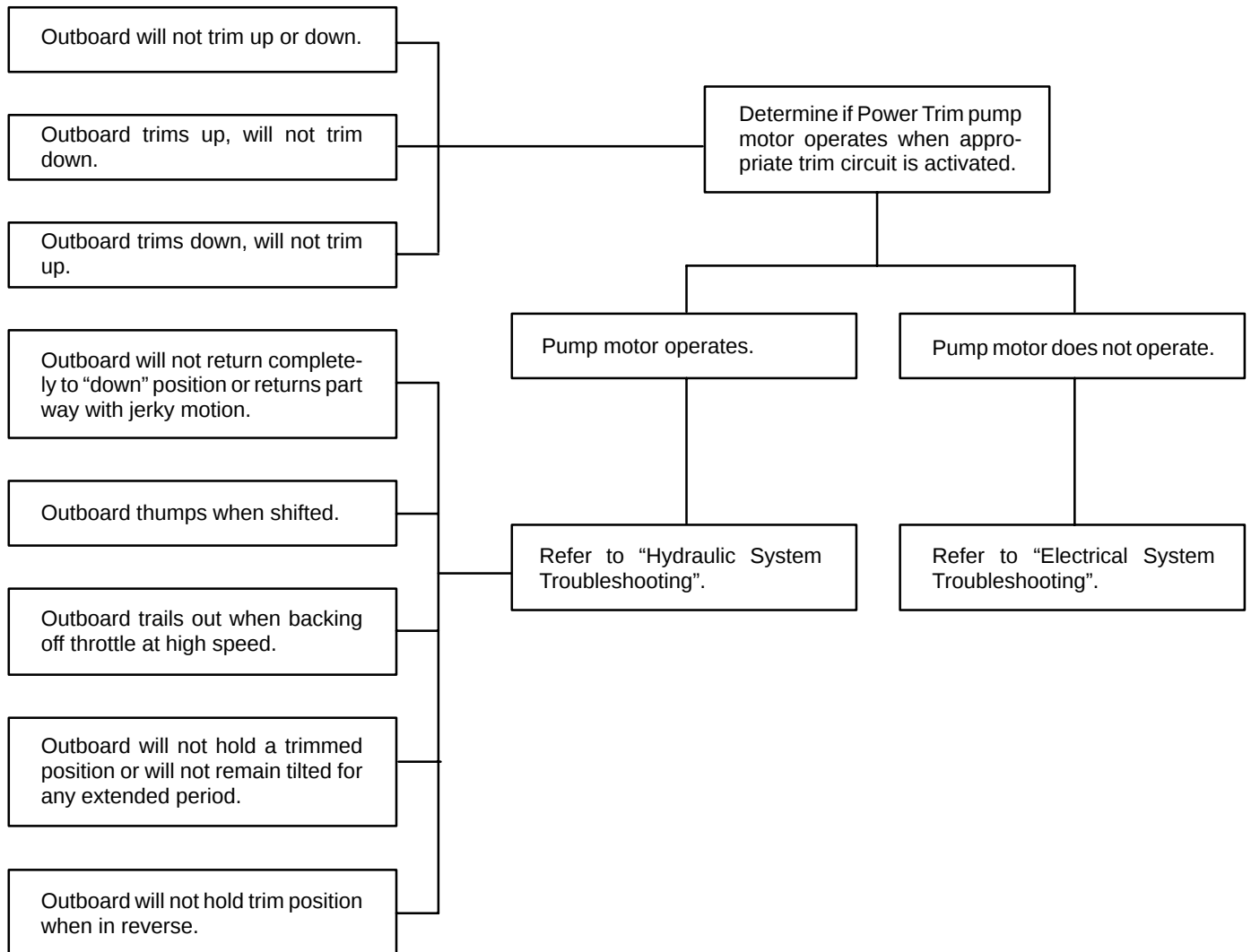


# Troubleshooting

## Determining if Problem is Electrical or Hydraulic

Refer to the following chart to determine which system is at fault.

### Trouble Chart





## Hydraulic System Troubleshooting

Support outboard with tilt lock lever when servicing power trim system.

**IMPORTANT:** After debris or failed components have been found (during troubleshooting procedure) it is recommended that unit be disassembled completely and ALL O-rings be replaced. Check ball valve components and castings must be cleaned using engine cleaner and compressed air or replaced prior to reassembly.

**IMPORTANT:** Power trim system is pressurized. Outboard must be in the full "UP" position (trim rod fully extended) prior to fill/drain plug, or manual release valve removal.

Refer to instructions following if disassembly is required when servicing.

Follow preliminary checks before proceeding to troubleshooting flow diagrams (following).

### Preliminary Checks

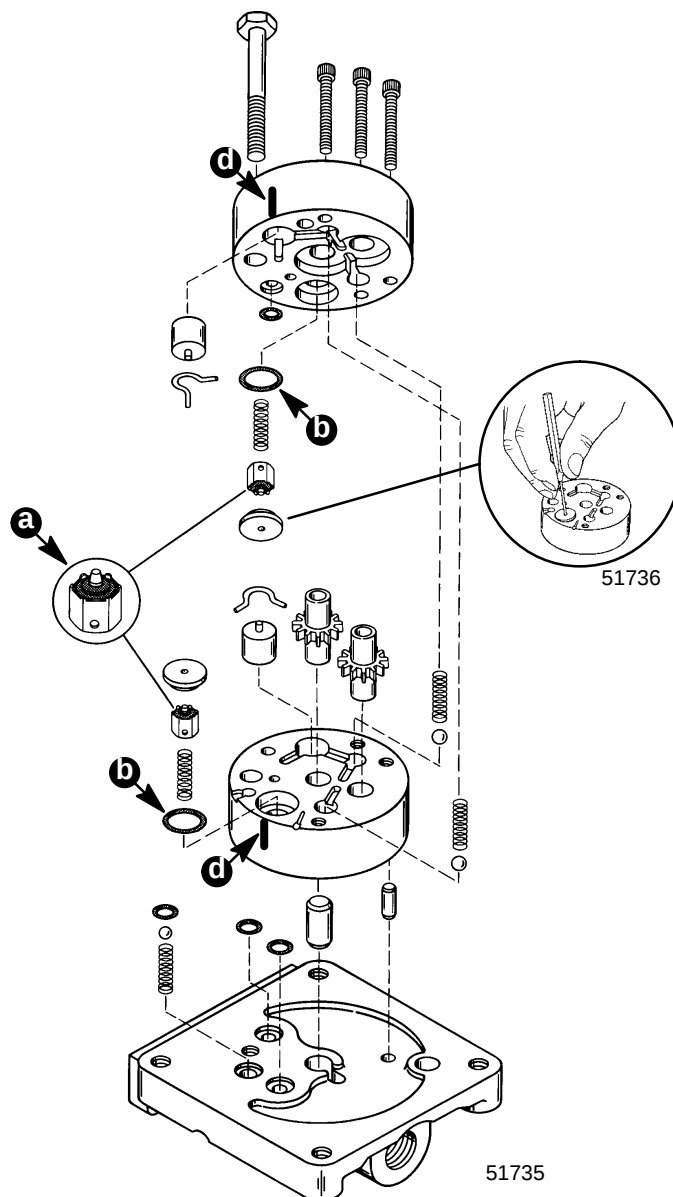
**IMPORTANT:** Operate Power Trim system after each check to see if problem has been corrected. If problem has not been corrected proceed to next check.

1. Check that manual release valve is tightened to full right (clockwise) position.
2. Check trim pump fluid level with outboard in full "UP" position and fill if necessary. Refer to "Bleeding Power Trim Unit".
3. Check for external leaks in Power Trim system. Replace defective part(s) if leak is found.
4. Outboard not holding tilted position (falls down to trim position) indicates debris or defective components in trim valve assembly. Clean or replace components as required.
5. Check manual release valve for broken stem and one O-ring remaining in the release valve passage. (Separate the manifold assembly from the cylinder to dislodge broken stem.) Install new release valve and test system.
6. Check for nicked, deteriorated or misplaced O-rings throughout trim system.

## Leak Down Check – Pump and Manifold Assembly

**NOTE:** Scribe (d) pump housing halves before disassembly. Check pump for problems as follows:

1. Debris or chips between valve and seat (a). Usually imbedded in rubber valve seat.
2. Nicked or deteriorated O-ring (b).
3. Nicked, deteriorated or misplaced O-ring between manifold and trim cylinder. Refer to "Manifold Removal" for O-ring location.



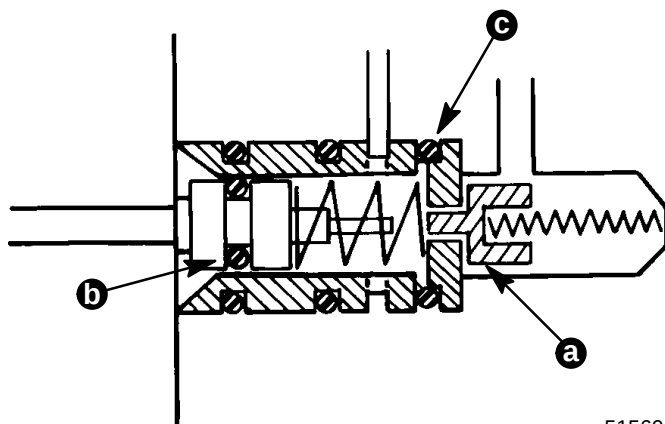
4. After reassembly, insert drive shaft and check pump rotation resistance to turning – housing halves can shift/turn during reassembly. Align scribe marks (d) carefully.



## Leak Down Check – Pilot Valve Assembly

1. Debris or chips between valve and seat (a), usually imbedded in rubber valve seat.
2. Pilot valve installed from non-chamfered end of spool results in nicked or damaged O-ring (b).
3. Nicked or deteriorated O-ring (c).

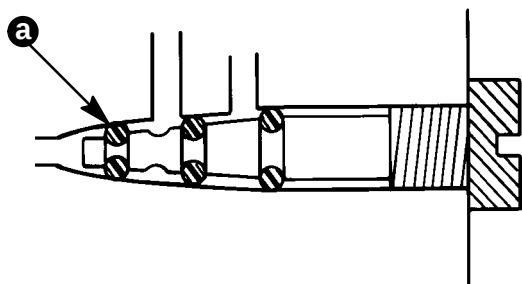
A leak path is created between the UP side of the cylinder and the reservoir. The trim system will leak DOWN until the trim port in cylinder is covered.



- a - Valve and Seat  
b - Pilot Valve O-ring  
c - O-ring

## Leak Down Check – Manual Release Valve

1. Debris or chips under O-ring (a).
2. Flash from valve molding causing O-ring (a) to not seal.
3. Nicked O-ring (a).



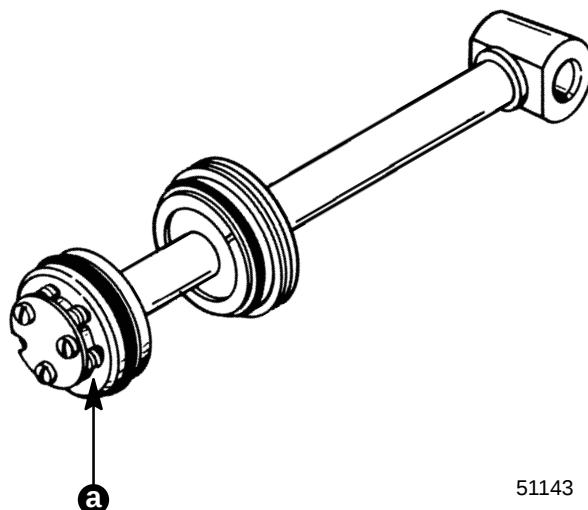
- a - O-ring

## Leakage Past Ball and Seat – Piston Assembly

Unit will trim to full or near full DOWN position and then will begin to trim UP while trim switch is held in "DOWN" mode.

If trim switch is released, outboard can be pushed (by hand) DOWN to the point where trim UP started.

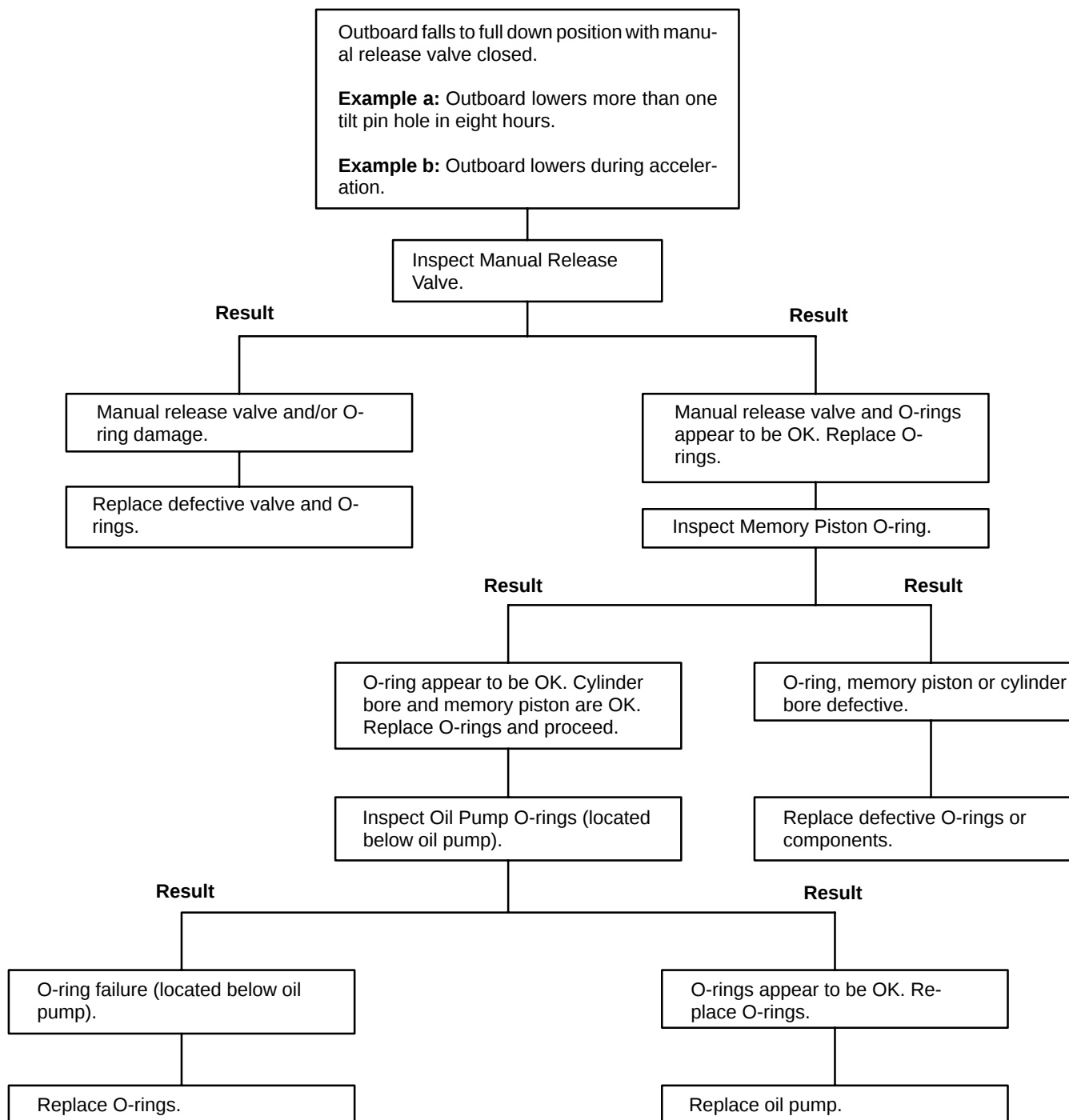
1. Inspect balls and seats in piston assembly for debris or damage. Repair or replace balls/seats.



- a - Ball and Seat. Check for Debris or Damage

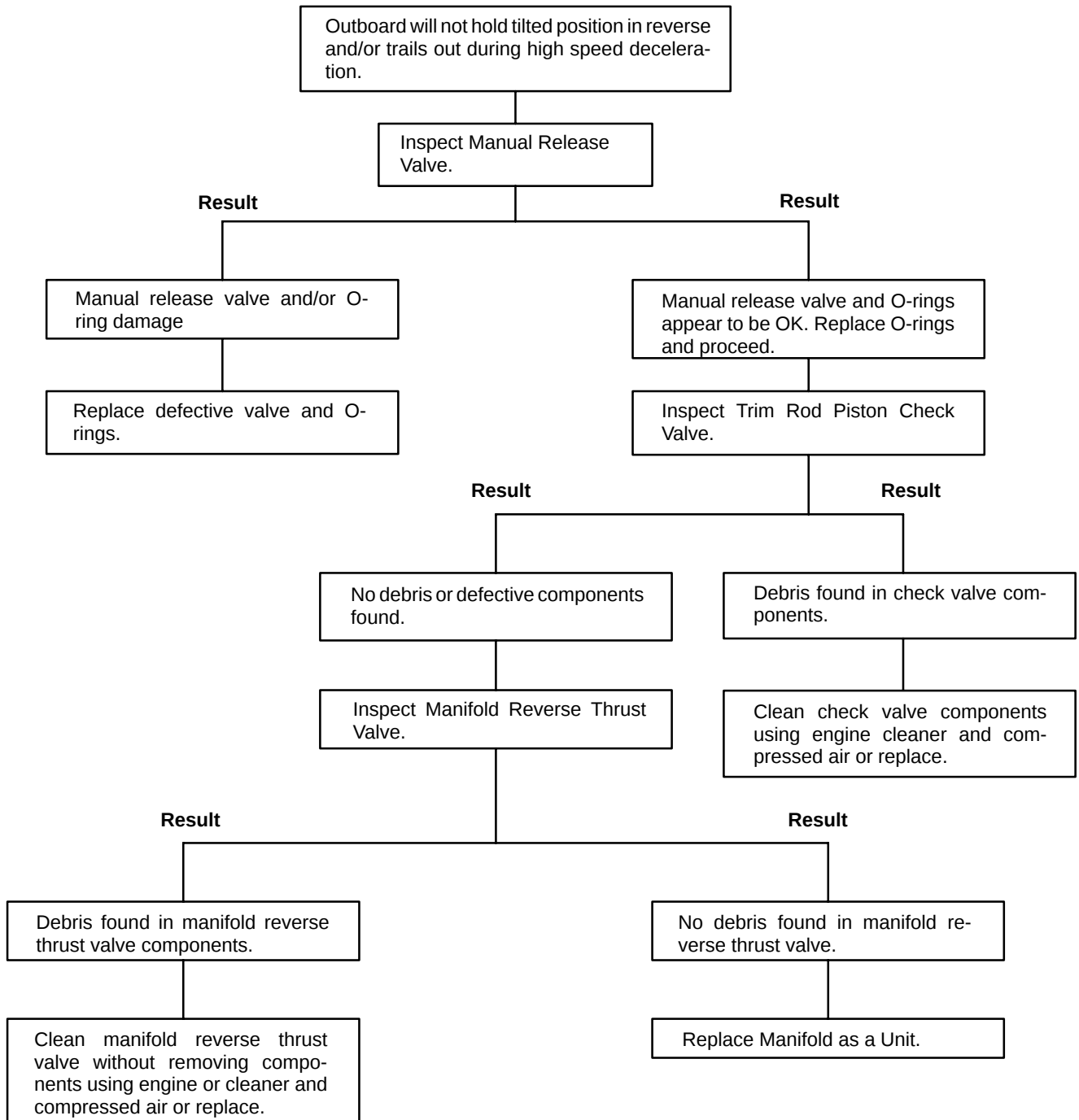


## Troubleshooting Flow Diagram





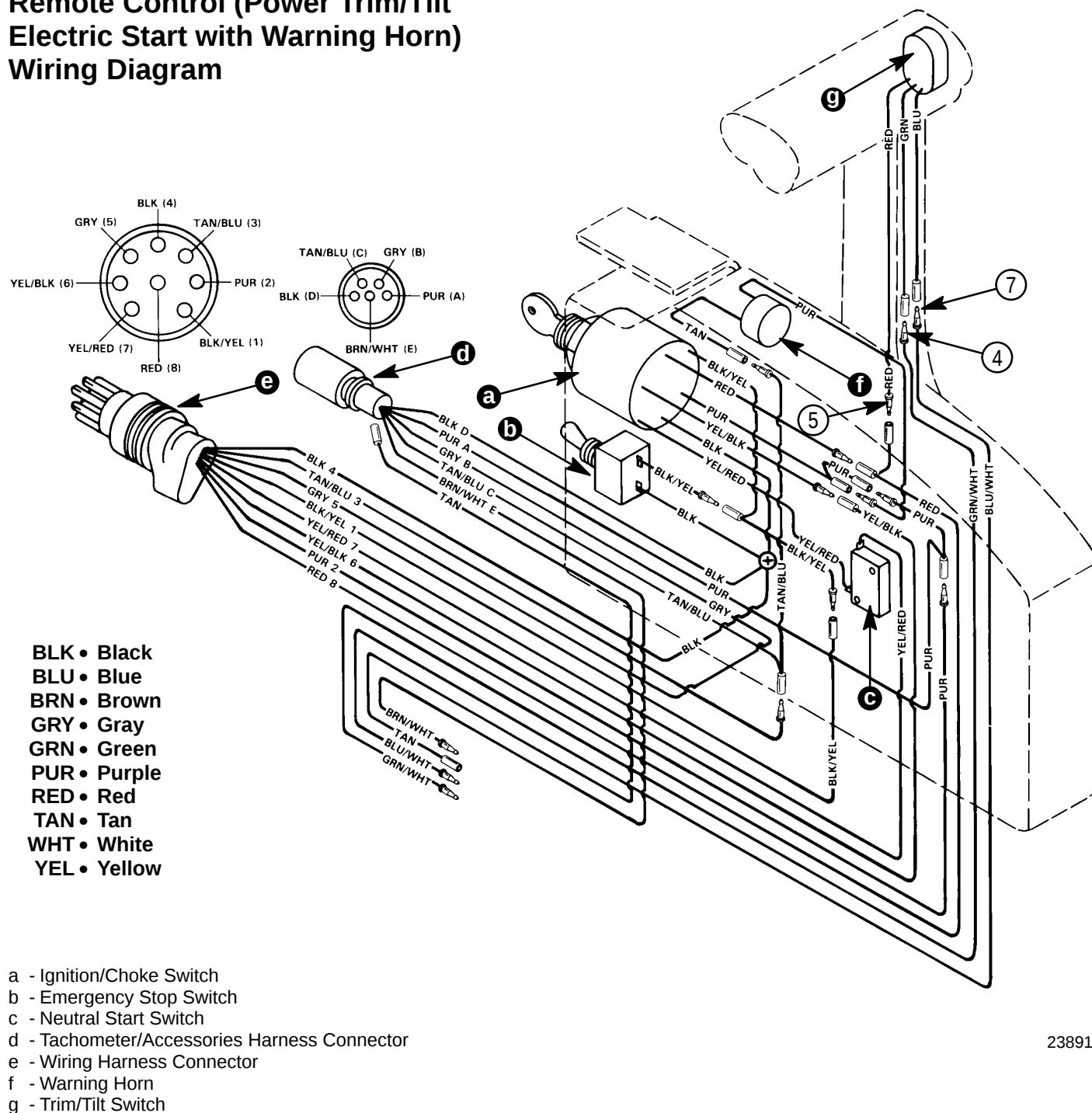
## Troubleshooting Flow Diagram





# Electrical System Troubleshooting

## COMMANDER 2000 Side Mount Remote Control (Power Trim/Tilt Electric Start with Warning Horn) Wiring Diagram

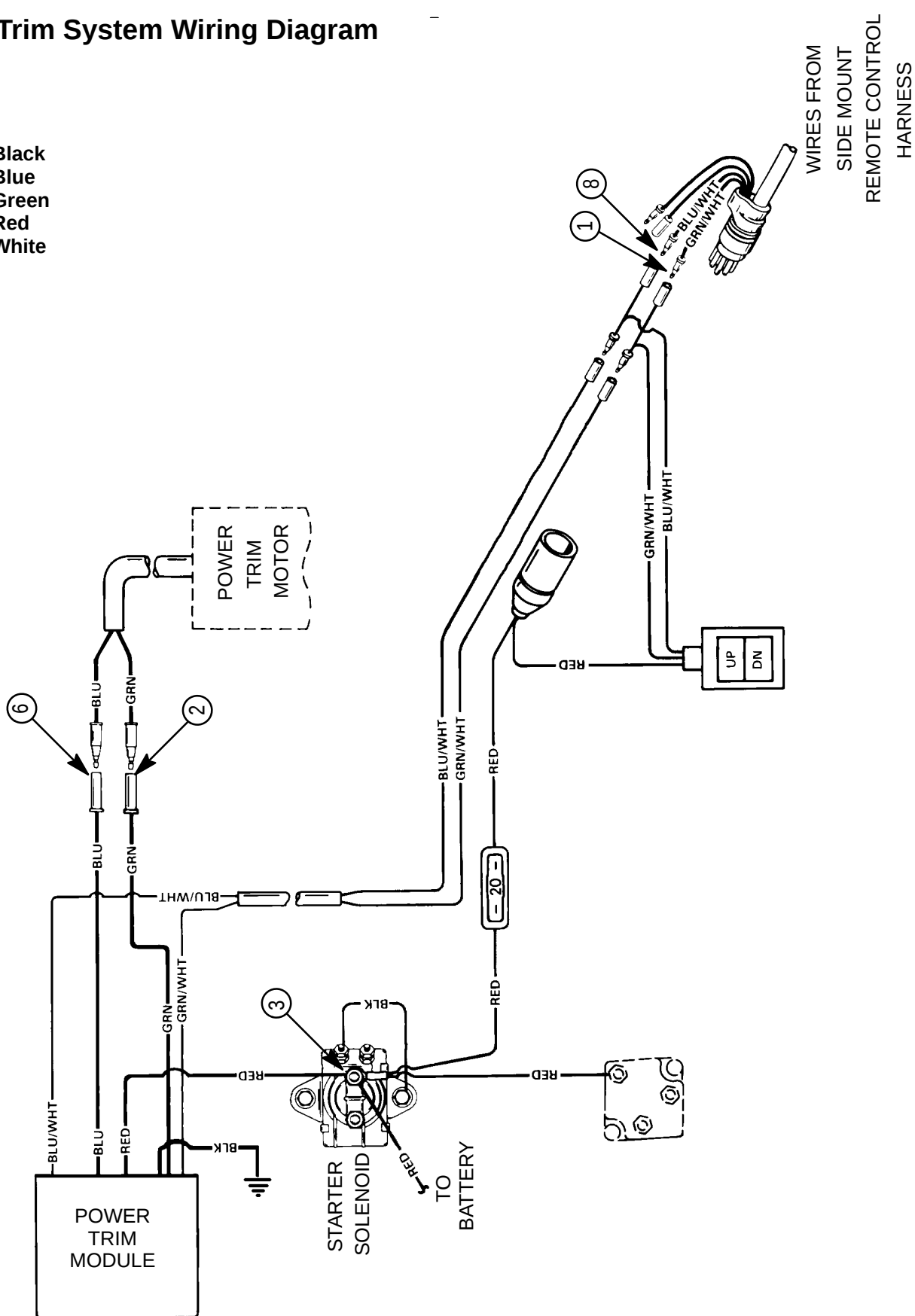


23891



# Power Trim System Wiring Diagram

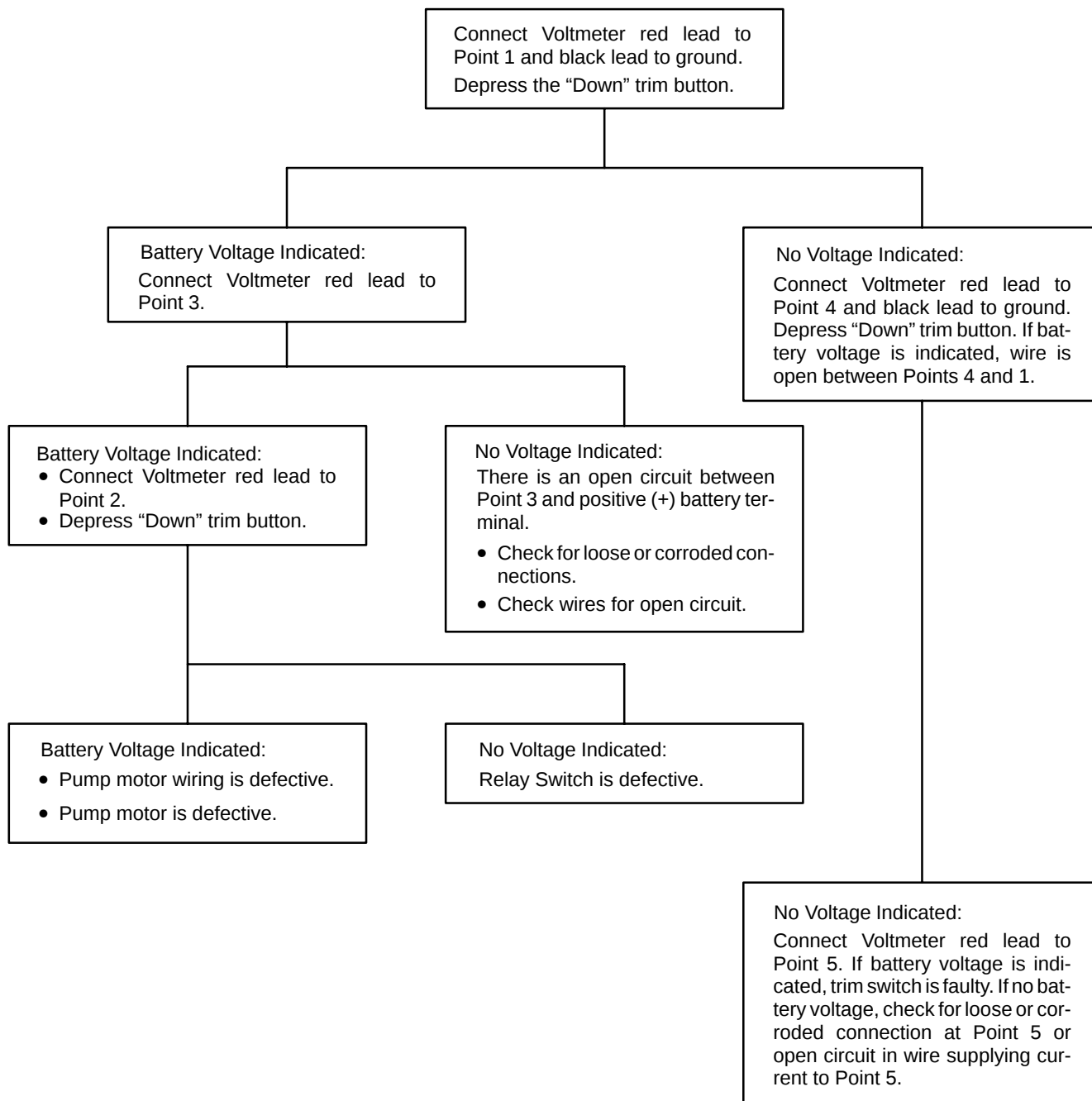
BLK • Black  
BLU • Blue  
GRN • Green  
RED • Red  
WHT • White



WIRES FROM  
SIDE MOUNT  
REMOTE CONTROL  
HARNESS

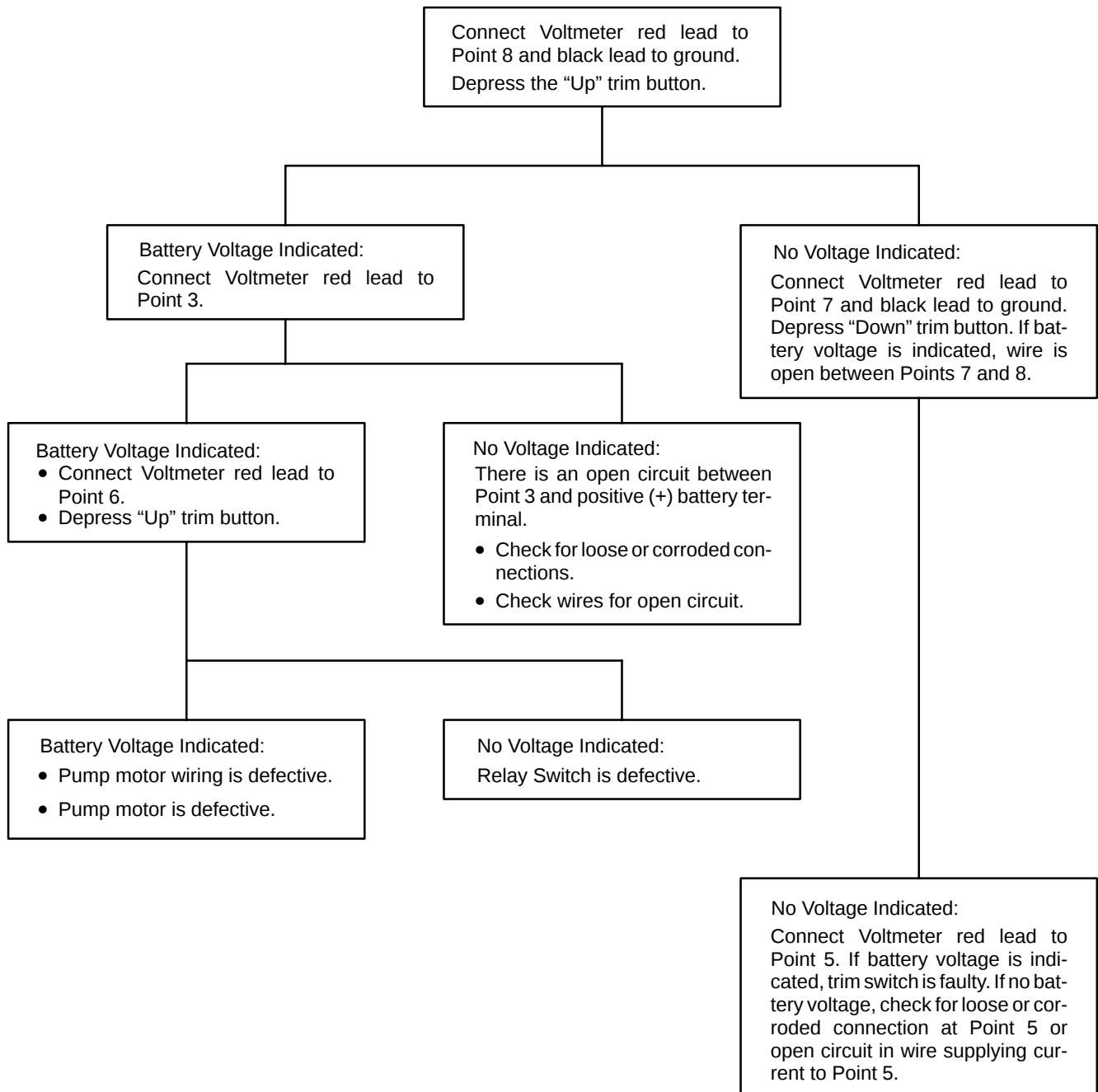


## Troubleshooting the “Down” Circuit\* (When “Up” Circuit is OK)



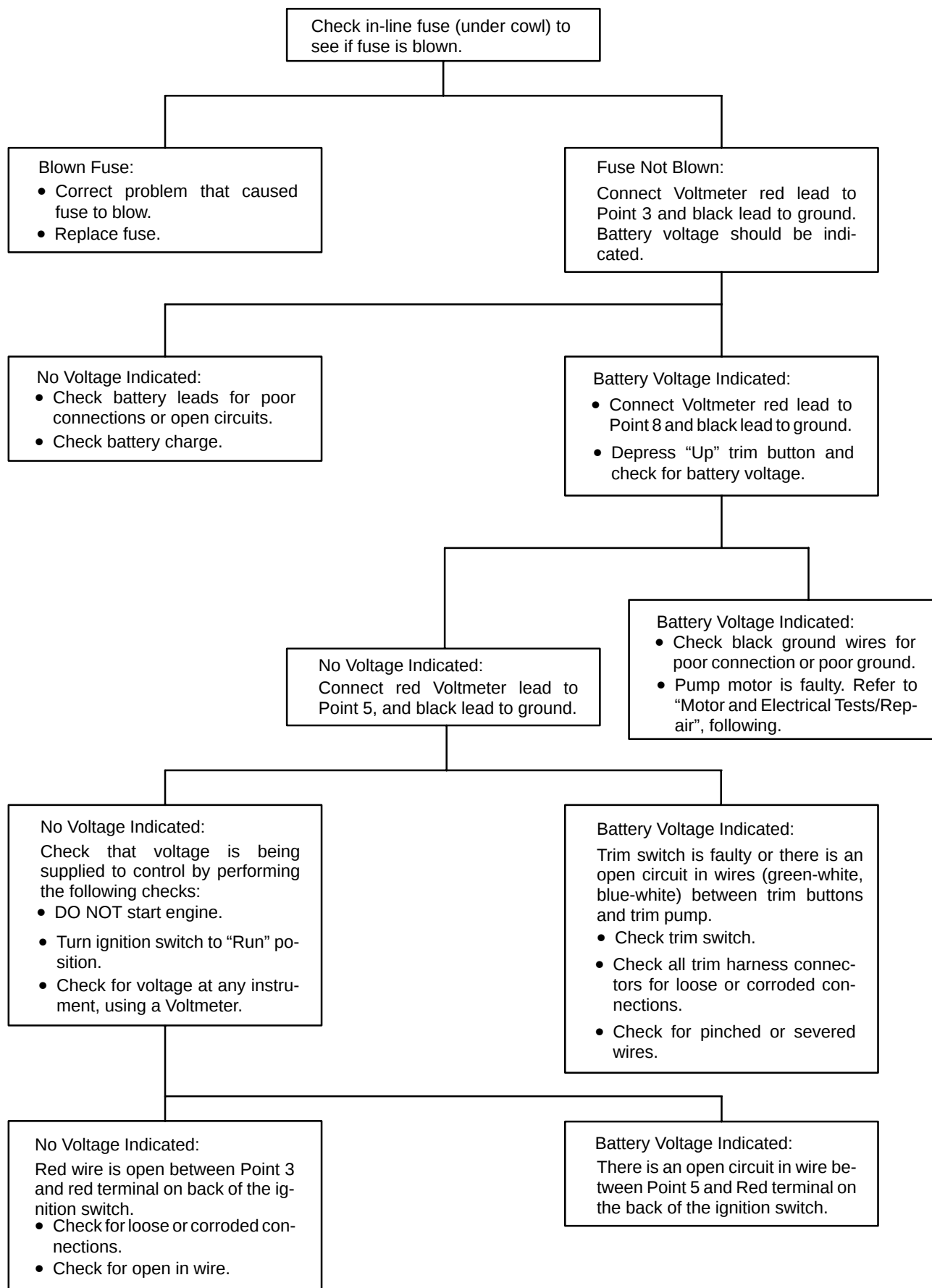


## Troubleshooting the “Up” Circuit\* (When “Down” Circuit Is OK)





## Troubleshooting the “Down” and “Up” Circuits (All Circuits Inoperative)\*

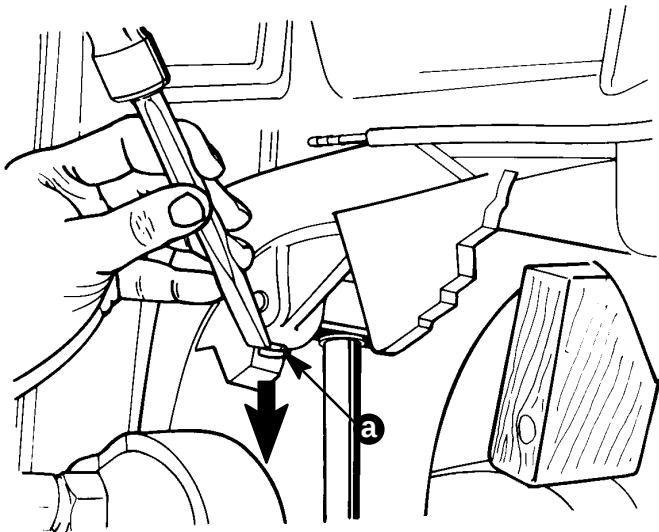




## Power Trim System Removal

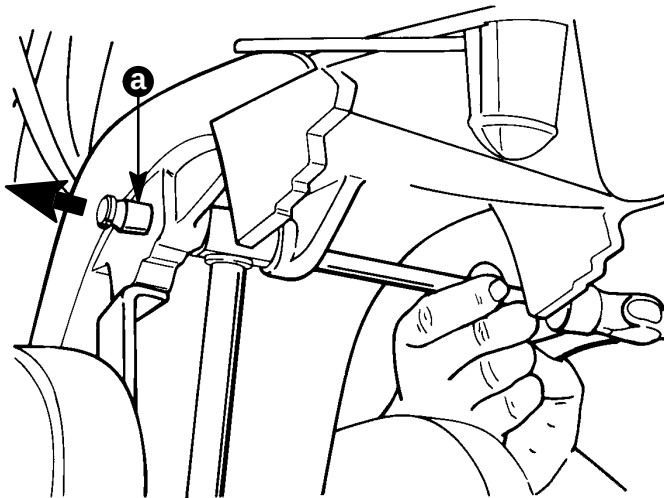
Support outboard with tilt lock lever when servicing power trim system.

1. Disconnect power trim harness form outboard wiring harness.
2. Remove screw and clip securing wiring harness to clamp bracket.
3. Use suitable tool to remove (DRIVE DOWN) upper dowel pin. Retain pin.



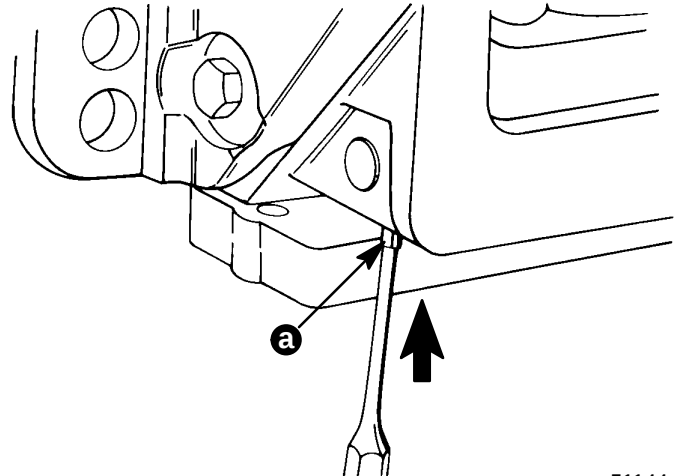
a - Dowel Pin

4. Use suitable punch to drive out upper pivot pin.



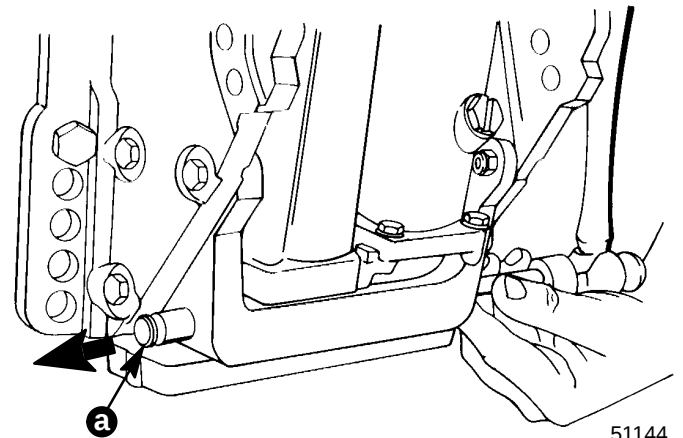
a - Pivot Pin

5. Use suitable punch to remove (DRIVE UP) lower dowel pin. Retain dowel pin.



a - Dowel Pin

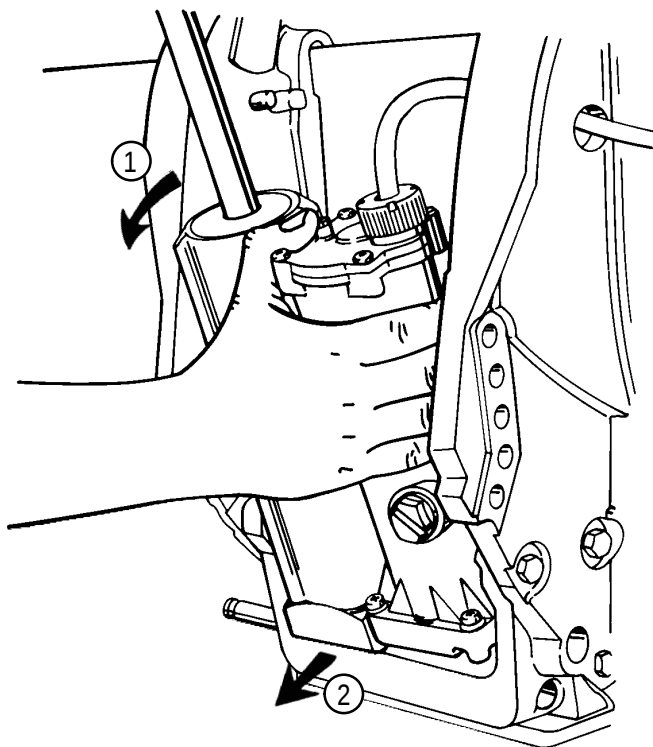
6. Use suitable punch to drive out lower pivot pin.



a - Pivot Pin

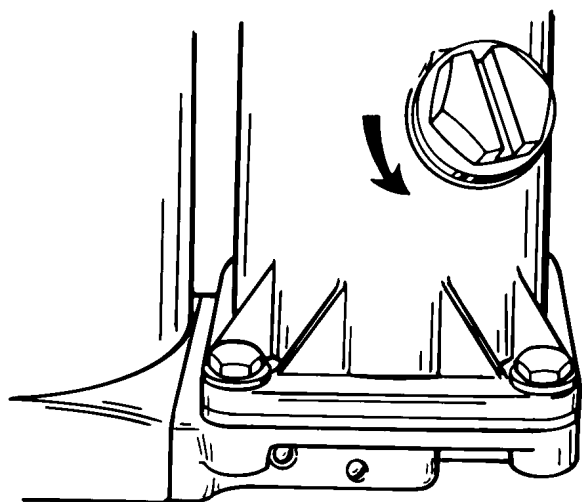


7. Tilt power trim assembly (top first) out from clamp bracket and remove assembly.



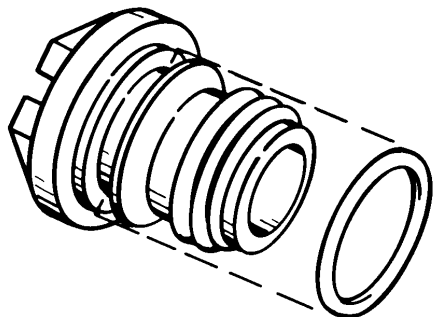
51195

8. Remove fill cap and drain unit.



51193

9. Remove O-ring from fill cap.



51194

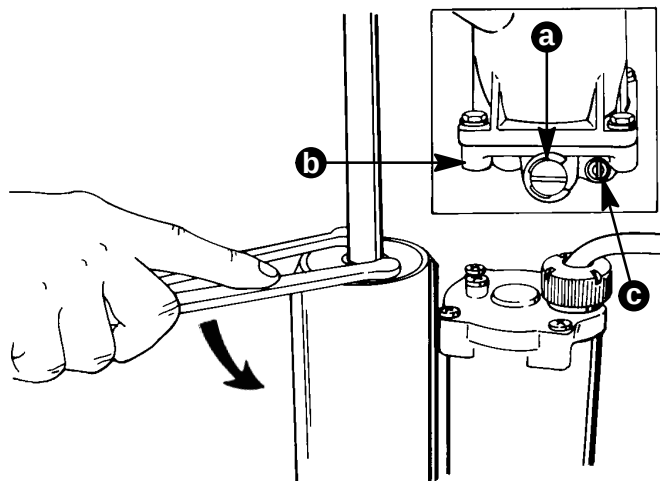
## Power Trim System Disassembly

### Trim Rod Removal

#### ⚠ CAUTION

**DO NOT ADJUST OR REMOVE REVERSE THRUST VALVE. THIS VALVE IS PRESET AT FACTORY FOR PRECISE REVERSE THRUST PRESSURE AND DOES NOT REQUIRE ADJUSTMENT.**

1. Secure power trim assembly in soft jawed vise.
2. Open manual release valve three or four turns (counterclockwise) and position trim rod to full up position.
3. Remove cylinder end cap assembly from cylinder using trim cylinder spanner wrench (1/4 in. x 5/16 in. long pegs).

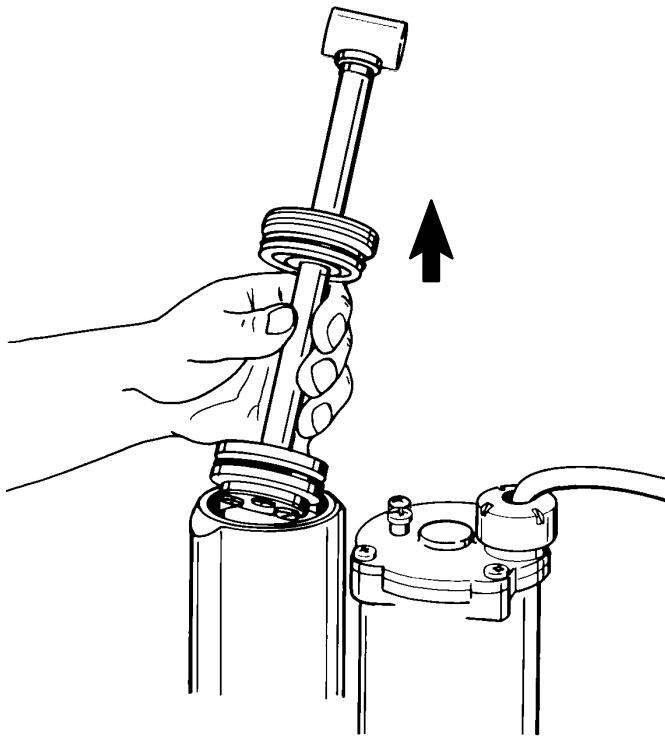


51194

- a - Manual Release Valve  
b - Manifold  
c - Reverse Thrust Valve (Do Not Remove, or Adjust)

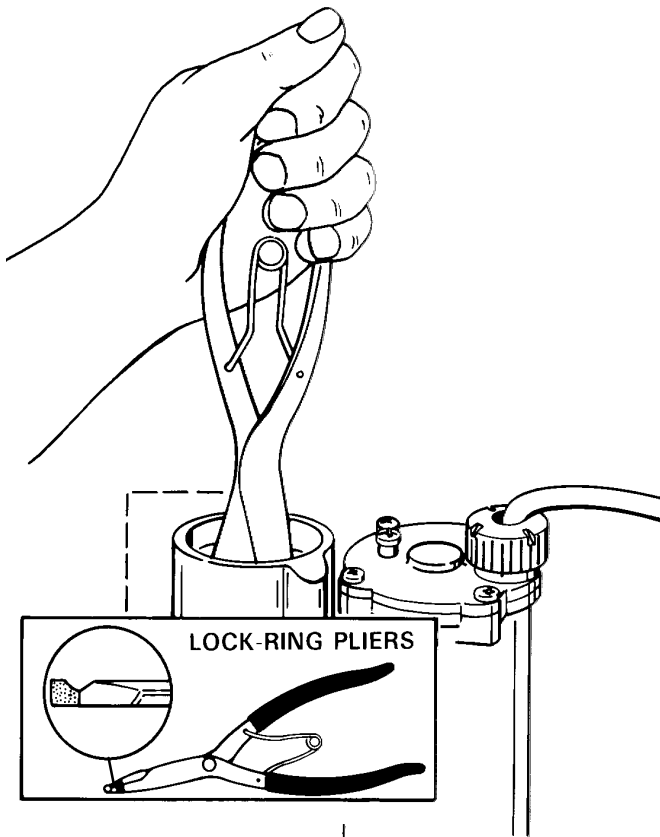


4. Remove trim rod assembly from cylinder.



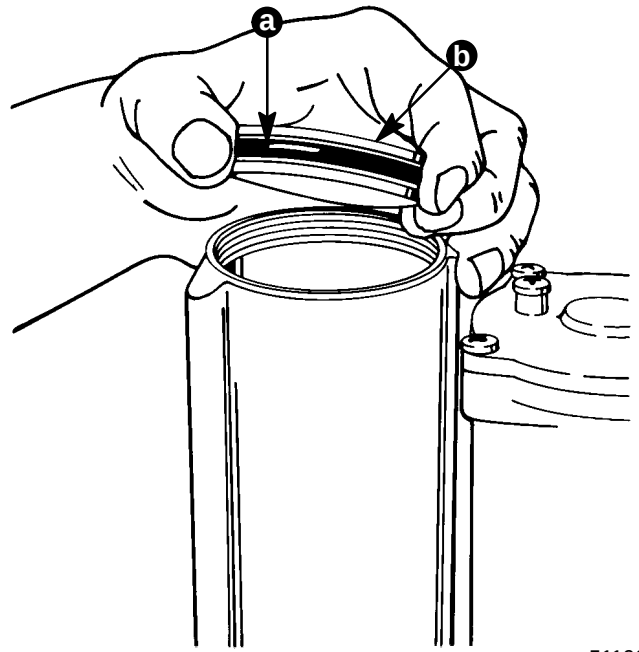
51196

5. Remove memory piston from cylinder using lock-ring pliers (Craftsman P/N 4735) or suitable tool.



51193

6. Remove O-ring from memory piston.



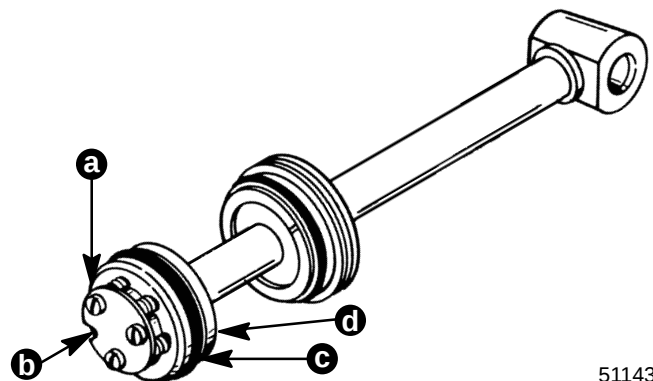
51196

a - O-ring  
b - Memory Piston

7. Remove trim system from vise and empty fluid into appropriate container.

## Trim Rod Disassembly

1. Place trim rod assembly on clean work surface.
2. Remove screws securing plate to trim rod piston and O-ring.
3. Remove check valve components from trim rod piston.



51143

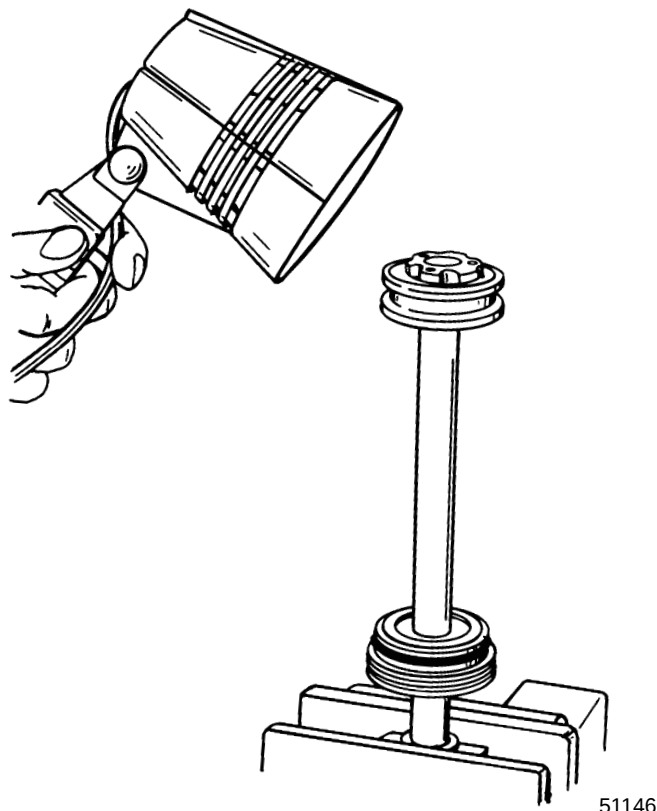
a - Screw (3)  
b - Plate  
c - O-ring  
d - Piston

## CAUTION

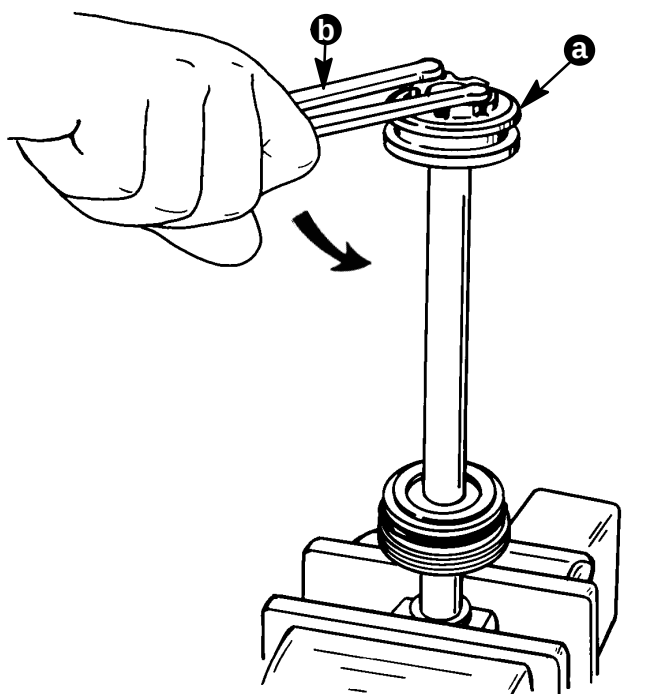
When removing Trim Rod piston, spanner wrench must have 1/4 in. x 5/16 in. long pegs to avoid damage to trim piston.



4. Place trim rod into soft jawed vise and apply heat to loosen piston using torch lamp (P/N 91-63209).
5. Loosen trim rod piston using trim spanner spanner wrench (1/4 in. x 5/16 in. long pegs).
6. Allow trim rod piston to cool, remove from trim rod.



51146



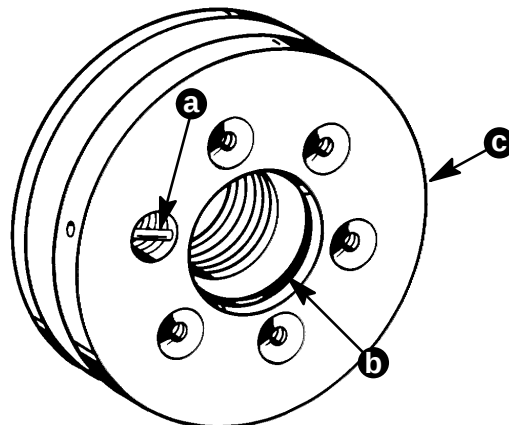
51146

- a - Trim Rod Piston  
b - Spanner Wrench

## ⚠ CAUTION

**Do not remove check ball components from trim rod piston. Removal and re-installation of check valve could result in improper operating pressure and possible power trim system damage. If check valve is defective, replace trim rod piston.**

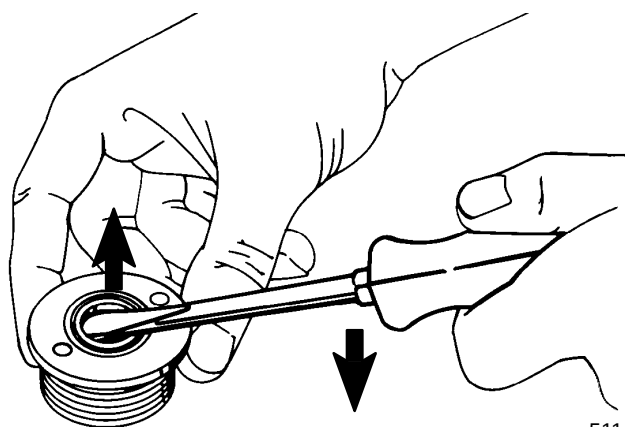
7. Remove inner O-ring from piston.



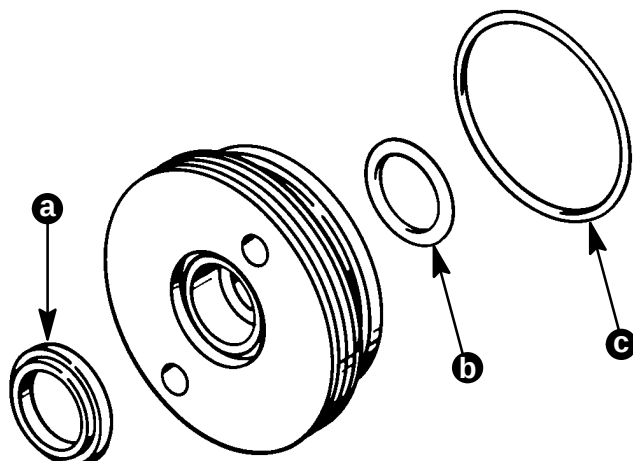
51199

- a - Check Ball Components  
b - O-ring  
c - Piston

8. Remove rod wiper, inner O-ring and outer O-ring.



51147



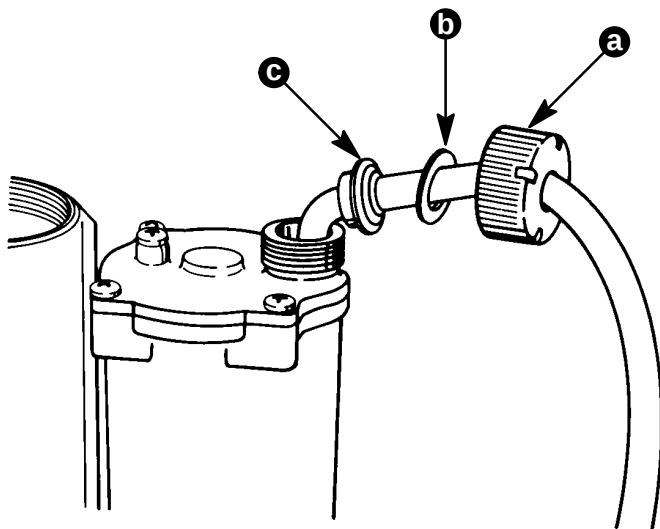
51145

- a - Rod Wiper  
b - Inner O-ring  
c - Outer O-ring



## Trim "Motor" Removal

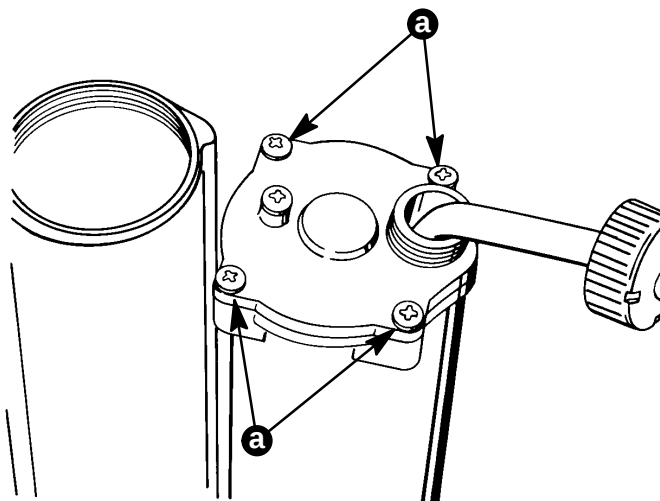
1. Secure power trim assembly in soft jawed vise.
2. Remove cap, washer and grommet from reservoir assembly.



51195

- a - Cap
- b - Washer
- c - Grommet

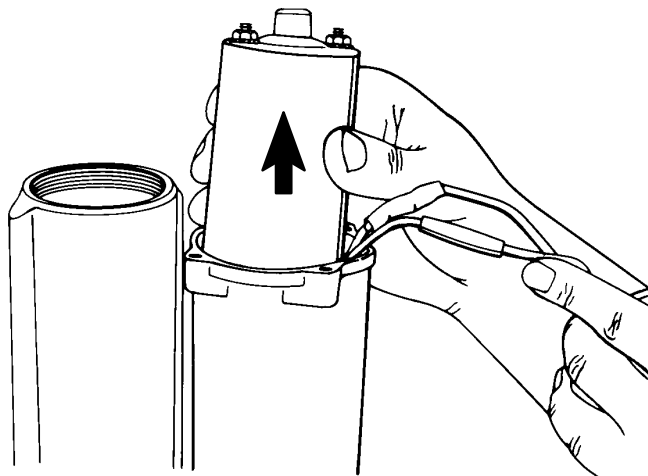
3. Remove screws securing reservoir cap to reservoir.



51193

- a - Screws (4)

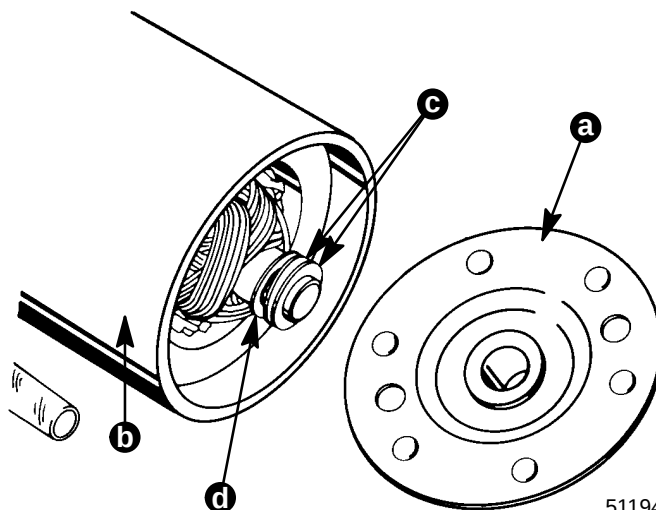
4. Remove motor harness from reservoir.



51196

## Trim Motor Disassembly

1. Remove end cap from motor housing. Note position of washers on armature.

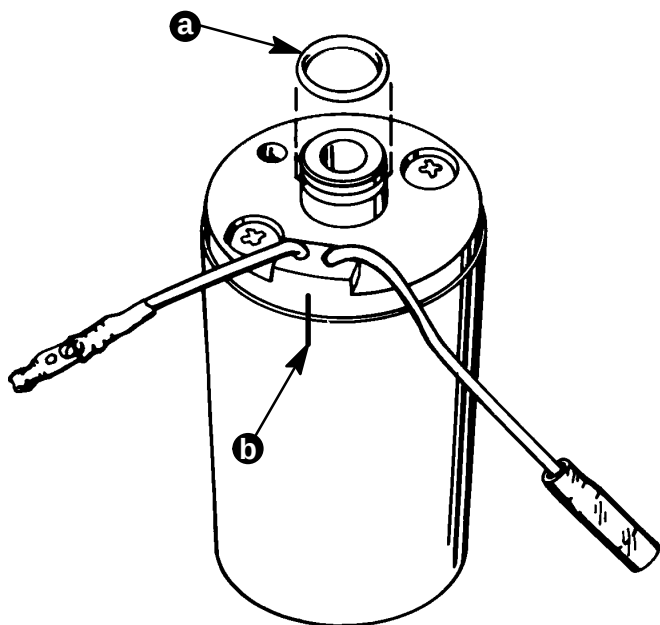


51194

- a - End Cap
- b - Motor Housing
- c - Wave Washer (2)
- d - Washer



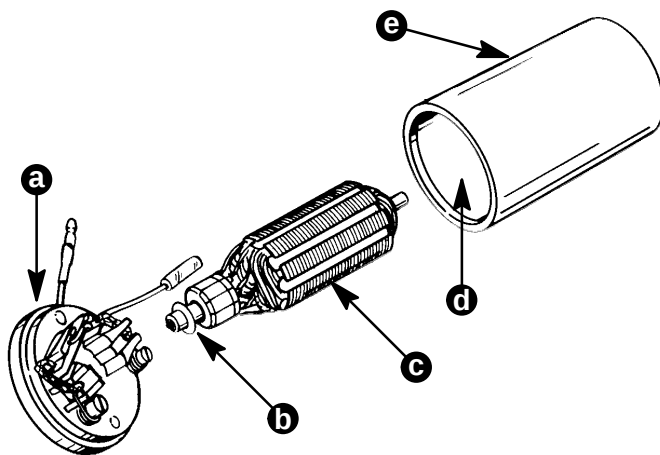
2. Remove O-ring from end frame.
3. Place scribe mark on motor housing and end frame as re-assembly reference, as shown.



51194

- a - O-ring  
b - Scribe Mark

4. Remove end frame and armature from housing.



51194

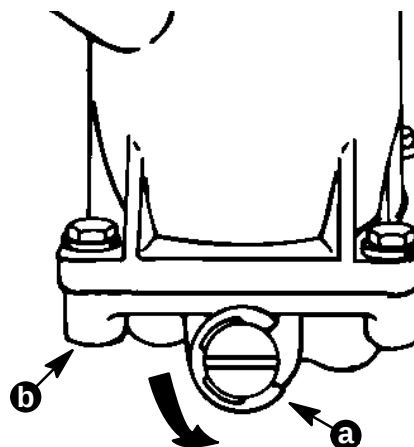
- a - End Frame  
b - Washer  
c - Armature  
d - Fiber Guard (Liner)  
e - Housing

## Reservoir Assembly Removal

### ⚠ CAUTION

**DO NOT ADJUST OR REMOVE REVERSE THRUST VALVE. THIS VALVE IS PRESET AT FACTORY FOR PRECISE REVERSE THRUST PRESSURE AND DOES NOT REQUIRE ADJUSTMENT.**

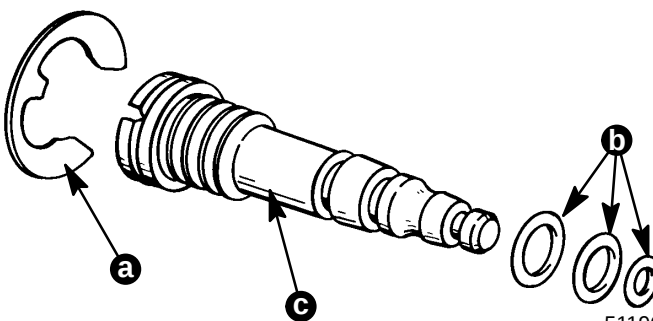
1. Remove manual release valve from manifold.  
**DO NOT** remove or adjust reverse thrust valve.



51194

- a - Manual Release Valve  
b - Manifold

2. Remove "E" clip and O-rings from manual release valve.

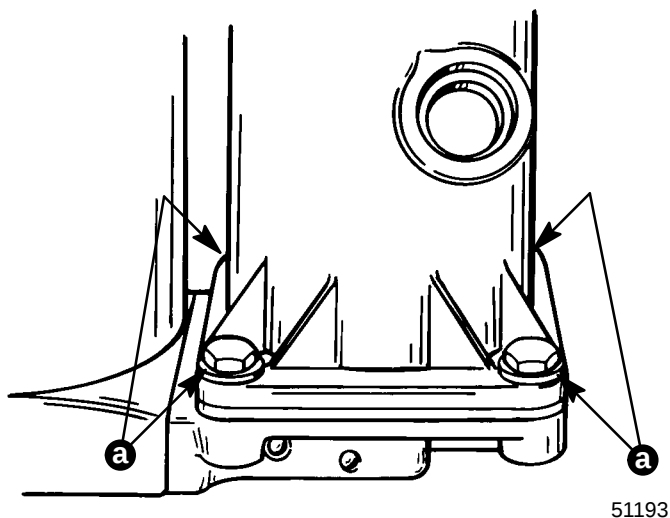


51196

- a - "E" Clip  
b - O-rings  
c - Manual Release Valve

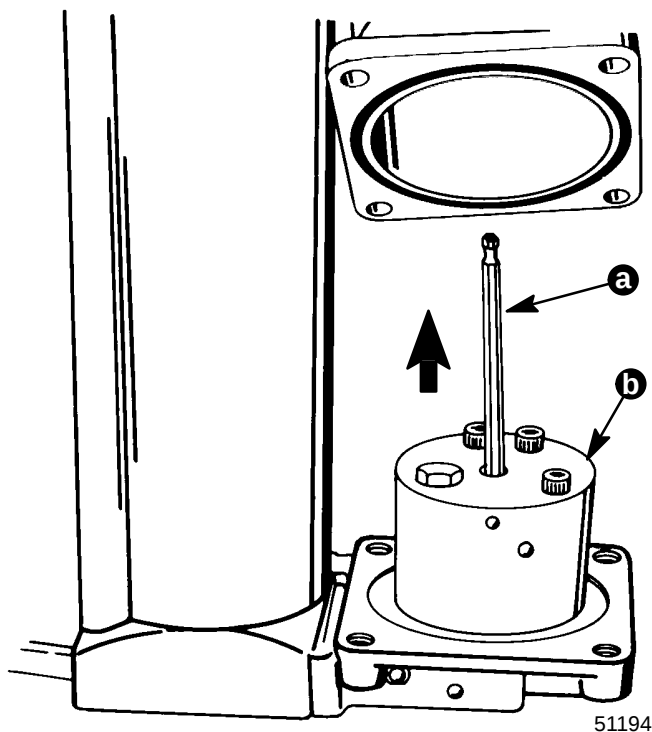


3. Remove four screws securing reservoir to manifold.



a - Screws (4)

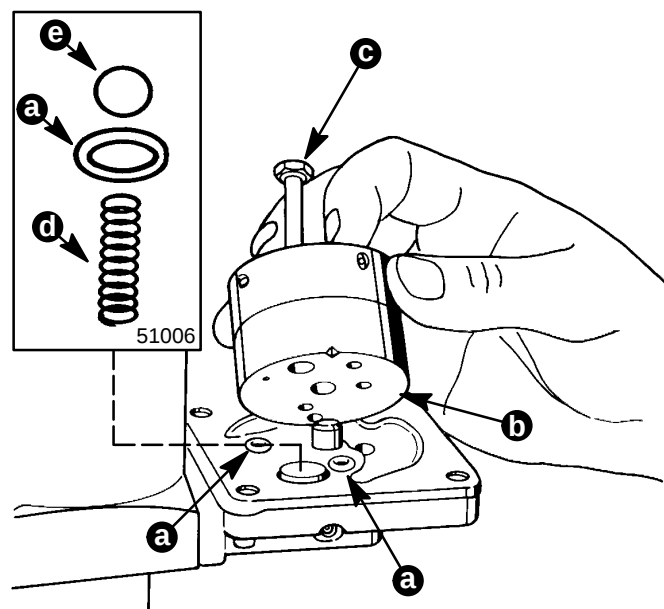
4. Remove reservoir from manifold.
5. Remove drive shaft from oil pump.



a - Drive Shaft  
b - Oil Pump

## Oil Pump/Manifold Removal

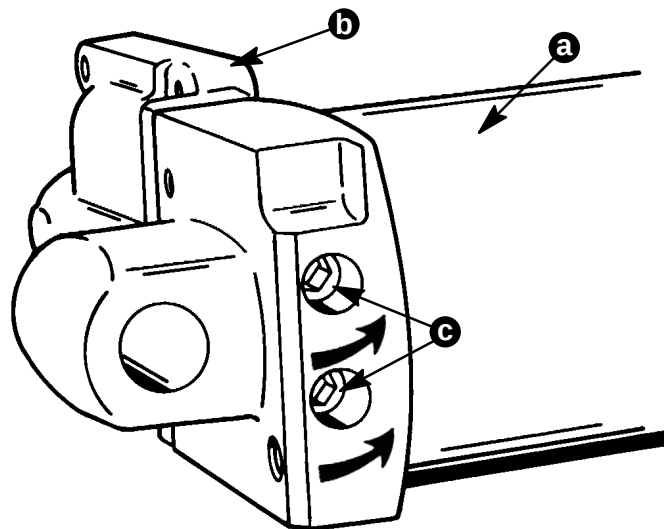
1. Remove screw, oil pump, O-rings and check valve components from manifold.



a - O-rings (3)  
b - Oil Pump  
c - Screw  
d - Spring  
e - Check Ball

51007

2. Remove screws and manifold from cylinder.



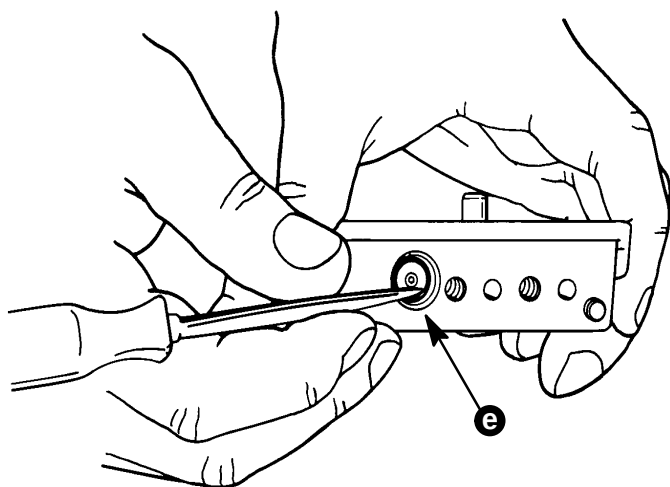
a - Trim Cylinder  
b - Manifold  
c - Screw

51007

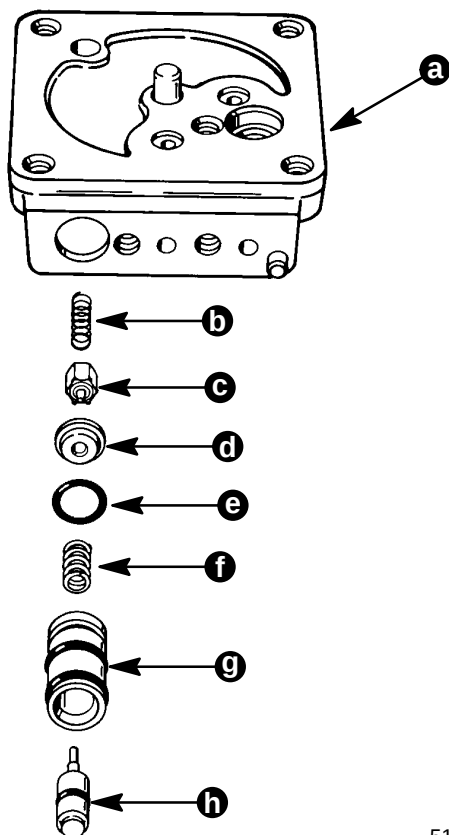


**IMPORTANT: Removal of O-ring (e) from manifold will result in damage to O-ring. O-ring MUST be replaced after removal.**

3. Remove check valve components from manifold.



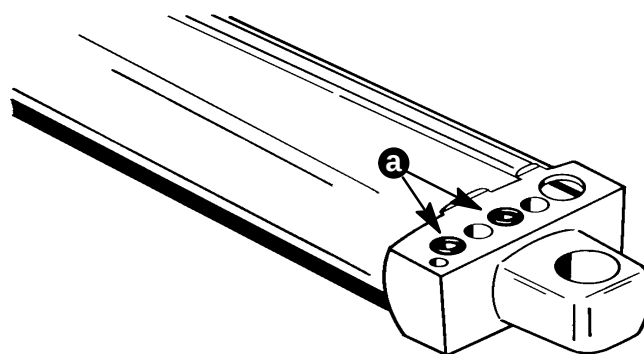
51736



51008

- a - Manifold
- b - Spring
- c - Check Valve
- d - Check Valve Seat
- e - O-ring
- f - Spring
- g - Sleeve
- h - Spool

4. Remove O-rings from cylinder.



51008

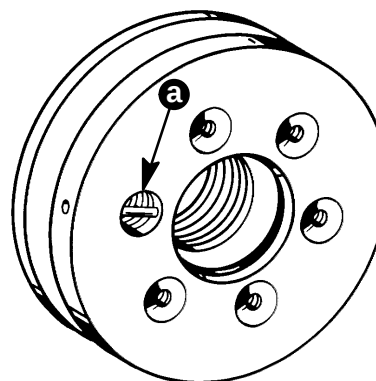
a - O-rings

## Cleaning and Inspection of Trim Rod Components

**IMPORTANT: Components must be dirt and lint free. Slightest amount of debris in Power Trim system could cause system to malfunction.**

### CAUTION

Do not remove check valve components (a) from trim rod piston. Removal and re-installation of check valve could result in improper operating pressure and possible power trim system damage.



51199

Inspect check valve for debris; clean debris from check valve if found. If debris cannot be cleaned from check valve, replace trim rod piston as an assembly.

Clean trim rod and components with parts cleaner and dry with compressed air.

It is recommended that all O-rings in trim system be replaced.

Inspect trim rod. If scraper (located in cap) has failed to keep rod clean, replace scraper.

Lubricate all O-rings using Quicksilver Power Trim and Steering Fluid or; (ATF) Type F, FA or Dexron II.



# Motor and Electrical Tests/Repair

## Trim Pump Motor Test

### **⚠ WARNING**

Do not perform this test near flammables (or explosives), as a spark may occur when making connections.

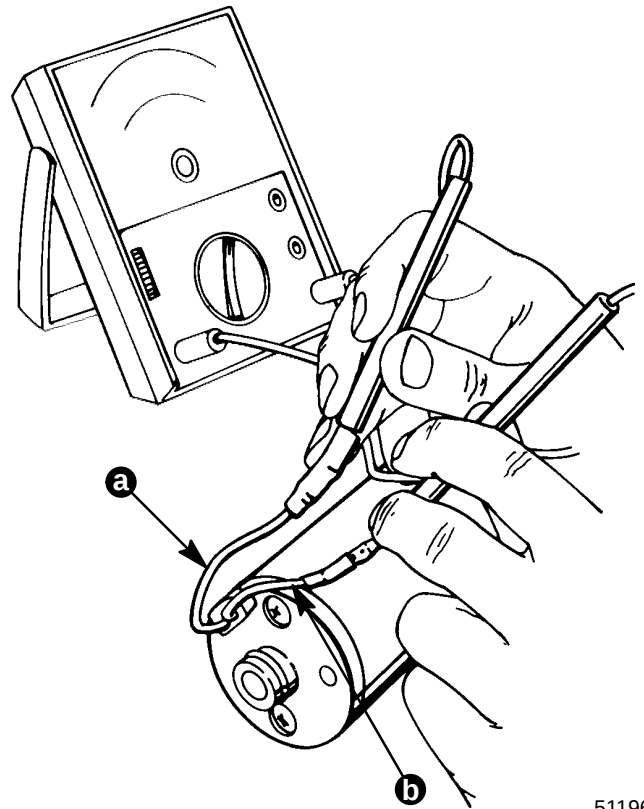
1. Disconnect orange (motor) wire and black (motor) wire from relay switch wiring harness.
2. Connect a 12 volt power supply to motor wires (positive to orange; negative to black results in motor up direction. Positive to black; negative to orange results in motor down direction). Motor should run.
3. If motor does not run, disassemble motor and check components.

## Thermal Overload Switch Test

**IMPORTANT:** If thermal overload switch has been activated, pump motor cannot be tested for a minimum of one minute. After this period switch should close (reset itself) and pump motor may be operated. Perform the following check(s) only if switch does not reset itself.

### **MOTOR ASSEMBLED**

Connect Ohmmeter (R x 1 scale) leads as shown. If switch is good, full continuity (zero ohms) will be indicated. If full continuity is not indicated, disassemble motor and recheck switch per instructions, following.

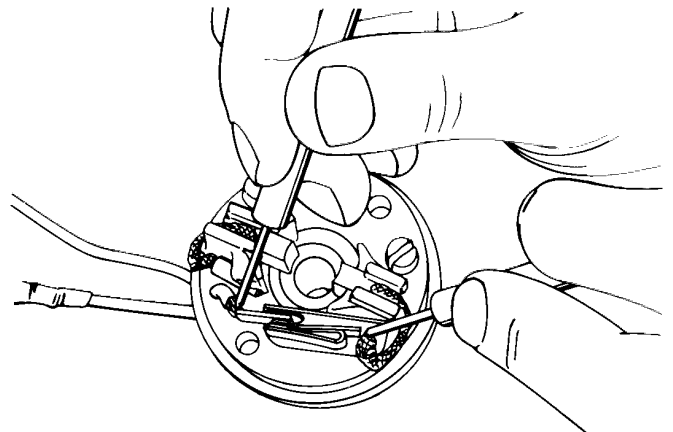


a - Motor Wire (Black)  
b - Motor Wire (Orange)

51196

### **MOTOR DISASSEMBLED**

Connect Ohmmeter (R x 1 scale) leads as shown. If switch is good, full continuity (zero ohms) will be indicated.



51193

If full continuity is not indicated, clean switch contact surfaces, using an ignition point file.

Recheck switch; if full continuity is not indicated, replace end frame.



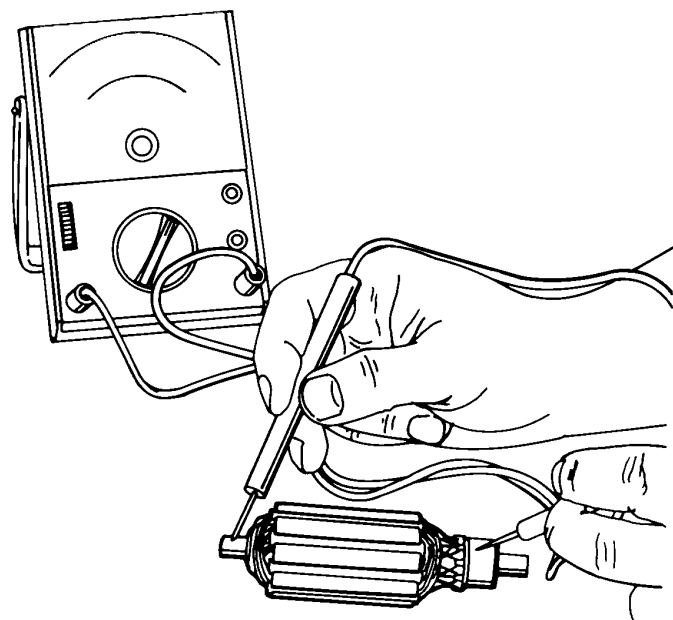
## Armature Tests

### TEST FOR SHORTS

Check armature on a Growler (follow Growler manufacturer's test instructions). Indication of a short requires replacement of armature.

### TEST FOR GROUND

Use an Ohmmeter (R x 1 scale). Place one lead on Ohmmeter on armature shaft and other lead on commutator, as shown. If continuity is indicated, armature is grounded and must be replaced.

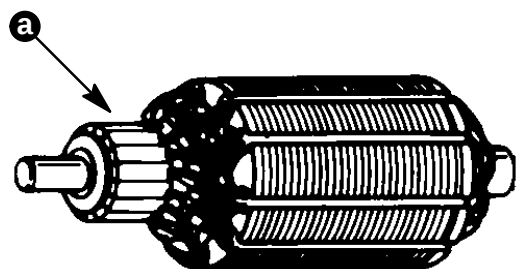


51195

### CHECKING AND CLEANING COMMUTATOR

If commutator (a) is worn it can be turned down on an armature conditioner tool or on a lathe.

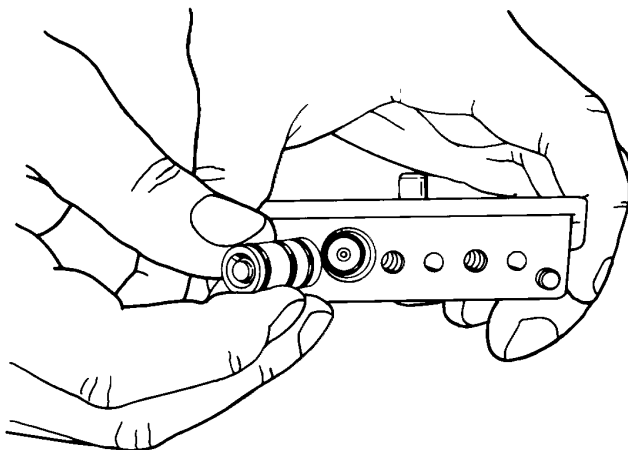
Clean commutator with "00" sandpaper.



## Power Trim System Reassembly

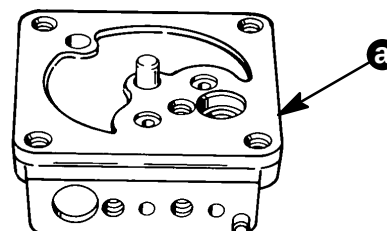
### Manifold/Oil Pump Installation

**IMPORTANT:** Install spring, check valve and O-ring into manifold. Position components in place using sleeve to seat in place.



50999

1. Install check valve components into manifold.



b



c



d



e



f



g



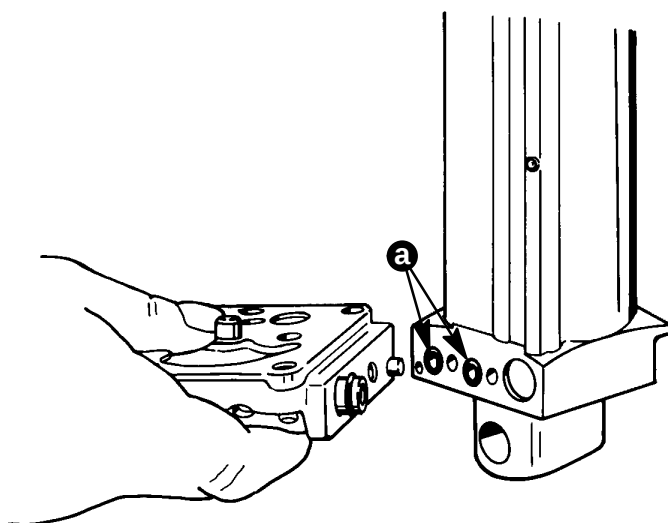
h

51008

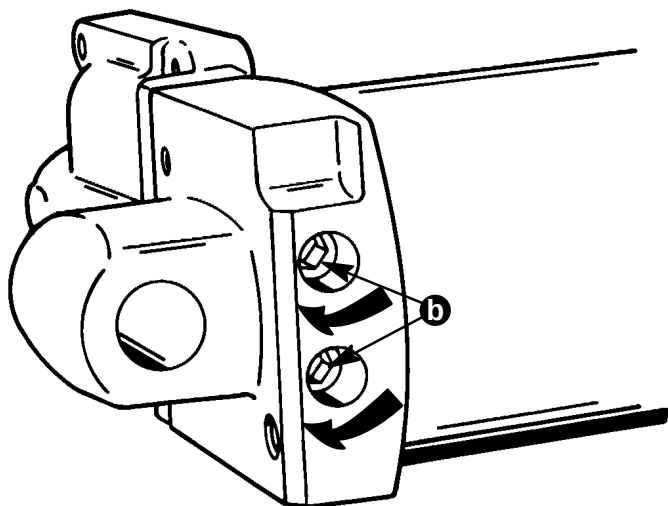
- a - Manifold
- b - Spring
- c - Check Valve
- d - Check Valve Seat
- e - O-ring
- f - Spring
- g - Sleeve
- h - Spool



2. Install O-rings on cylinder and secure manifold assembly to cylinder using screws. Torque screws to 100 lb. in. (11.3 N·m).



51008

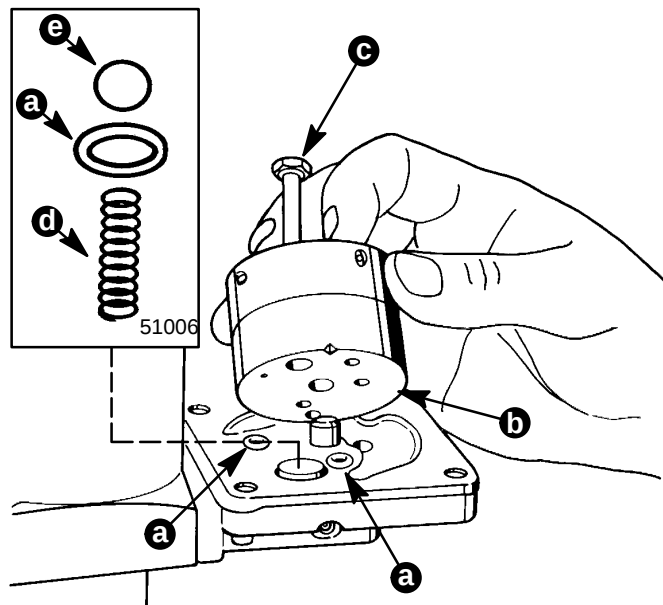


51007

- a - O-ring
- b - Screws [100 lb. in. (11.3 N·m)]

3. Secure power trim unit in soft jawed vise.

4. Install check valve components and O-rings to manifold. Secure oil pump to manifold using bolt. Torque bolt to 90 lb. in. (10.2 N·m).

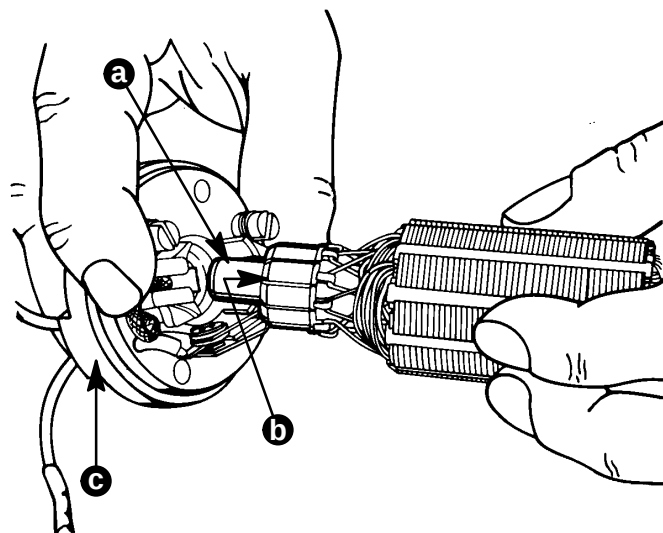


51007

- a - O-rings (3)
- b - Oil Pump
- c - Screw
- d - Spring
- e - Check Ball

## Trim Motor Reassembly

1. Apply Quicksilver Marine Lubricant (2-4-C) to armature shaft and insert into end frame.

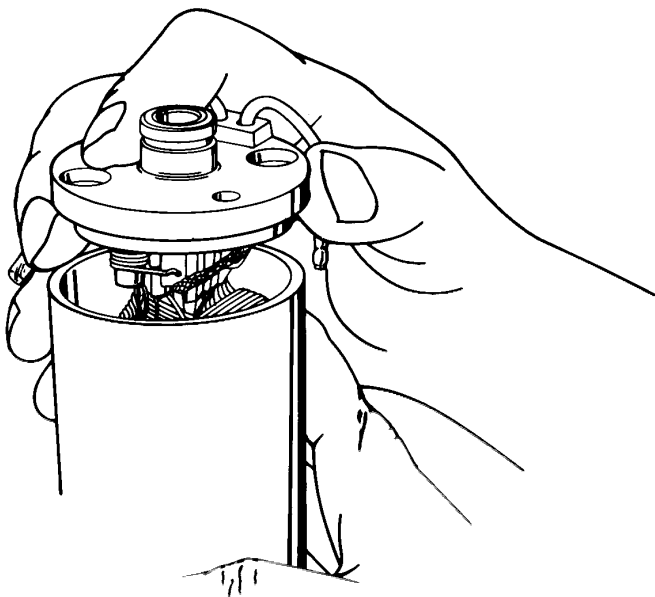


51195

- a - Armature Shaft
- b - Washer
- c - End Frame

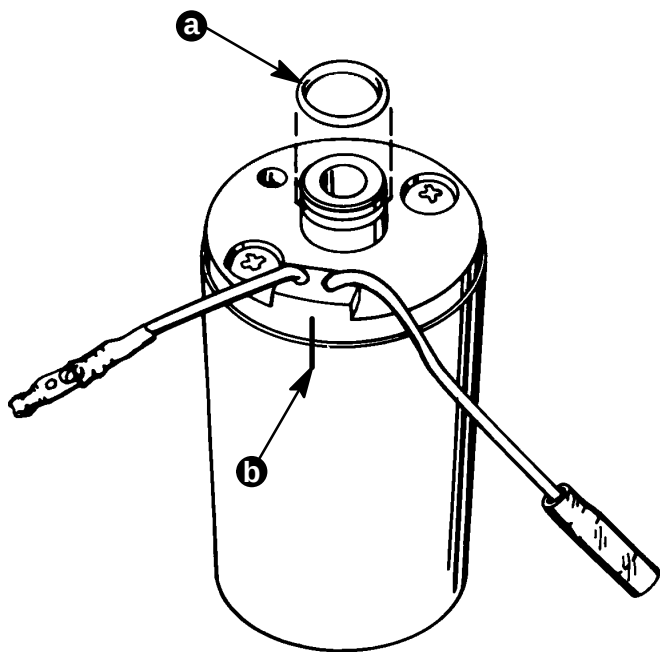


2. Guide armature and end frame into housing as shown.



51196

3. Align scribe mark on housing to mark on end frame.
4. Install lubricated O-ring to end frame.

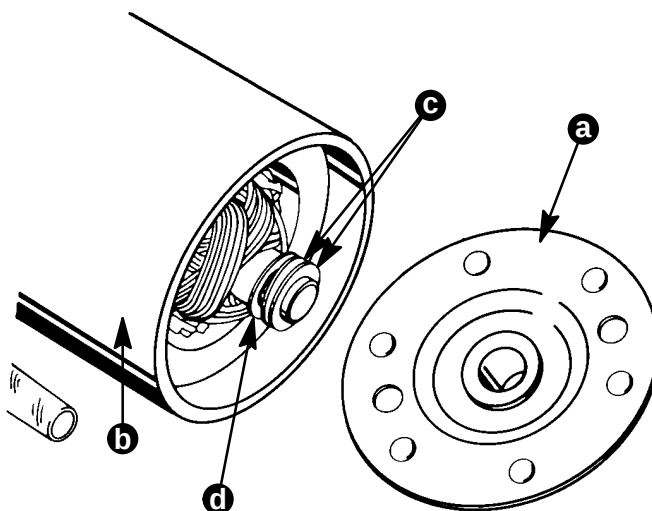


51194

- a - O-ring
- b - Scribe Mark

5. Install washers to armature shaft as shown.

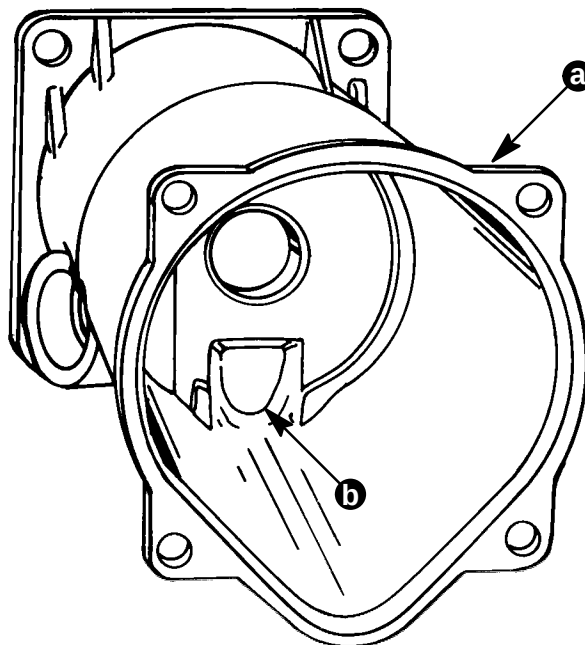
6. Install end cap to housing. Torque nuts to 25 lb. in. (2.8 N·m).



51194

- a - End Cap
- b - Motor Housing
- c - Wave Washer
- d - Washer

**IMPORTANT:** When installing motor, wires (black, orange) must rest in cavity of cylinder allowing motor to seat properly.



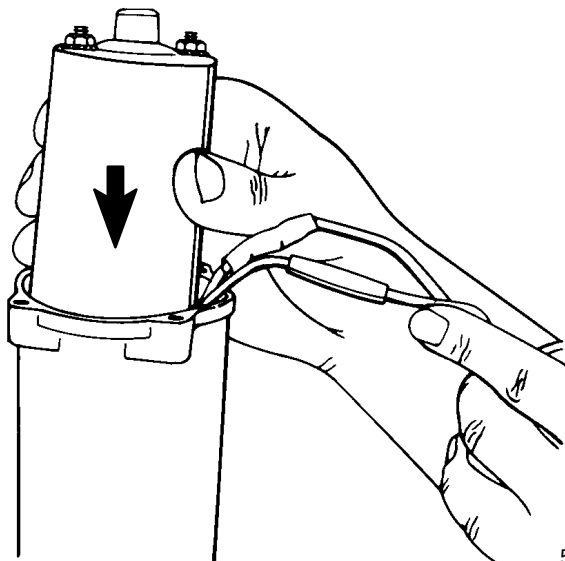
51194

- a - Manifold
- b - Cavity



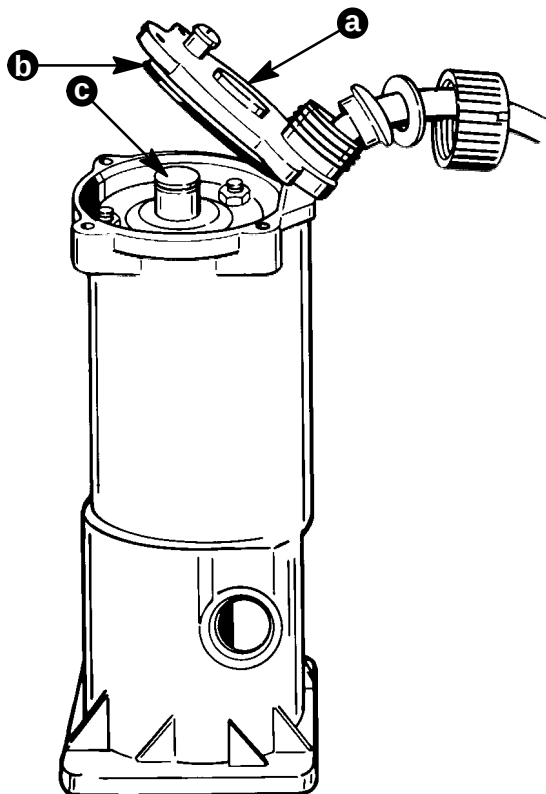
## Reservoir Installation

1. Connect trim motor wires to harness.
2. Insert motor into reservoir. Motor must be seated properly prior to end cap installation.



51196

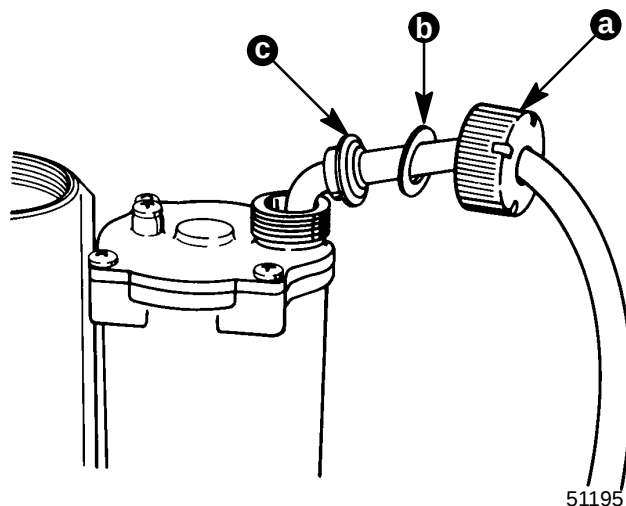
3. Install end cap, O-ring and foam pad to cylinder.
4. Torque screws to 13 lb. in. (1.5 N·m).



51195

- a - End Cap
- b - O-ring
- c - Foam Pad

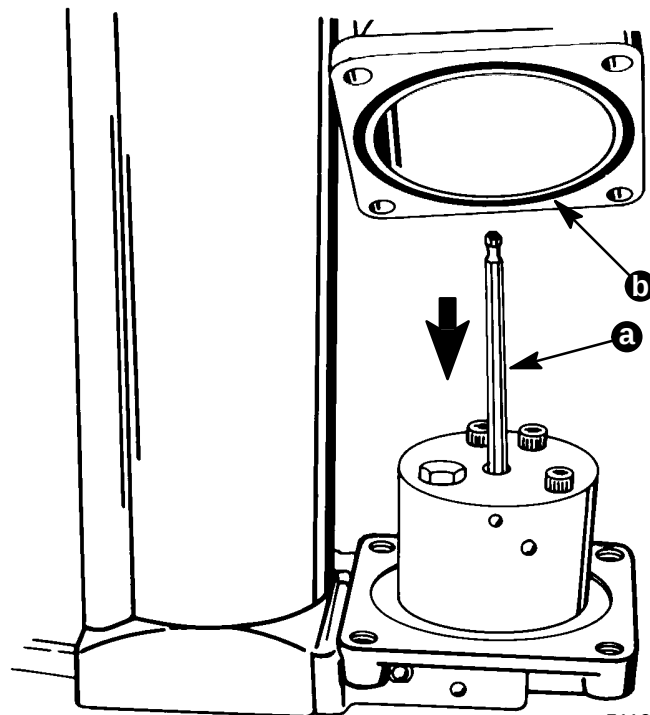
5. Install grommet, washer and screw cap to cylinder end cap. Tighten screw securely.



51195

- a - Screw Cap
- b - Washer
- c - Grommet

6. Place drive shaft into oil pump.
7. Install lubricated O-ring to base of reservoir.
8. Carefully guide (cylinder/motor) down onto drive shaft.

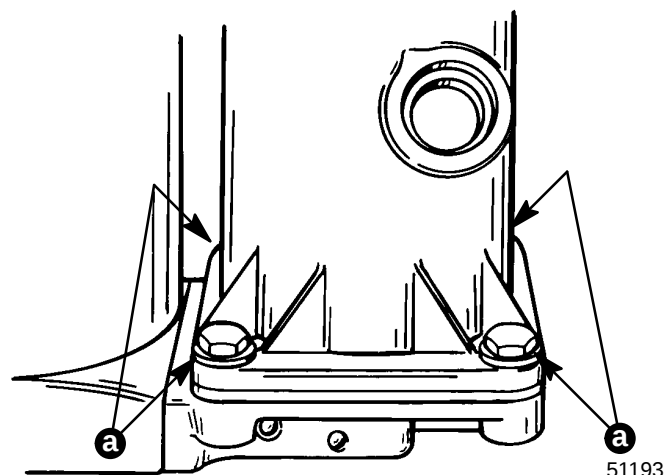


51194

- a - Drive Shaft
- b - O-ring

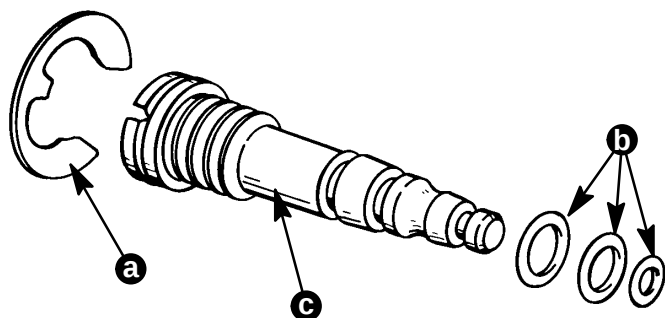


9. Secure reservoir to manifold using four screws. Torque screws to 70 lb. in. (7.7 N·m).



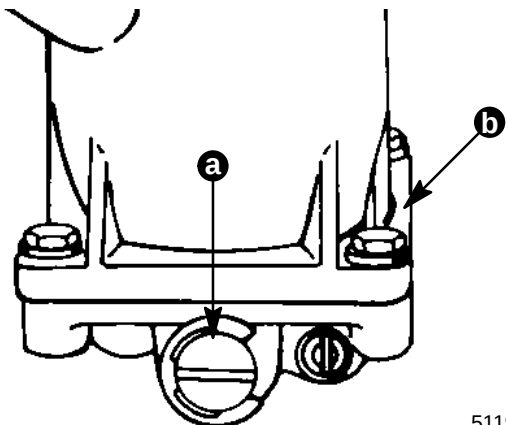
a - Screw

10. Install "E" clip, lubricated O-rings and to manual release valve.



a - "E" Clip  
b - O-ring  
c - Manual Release Valve

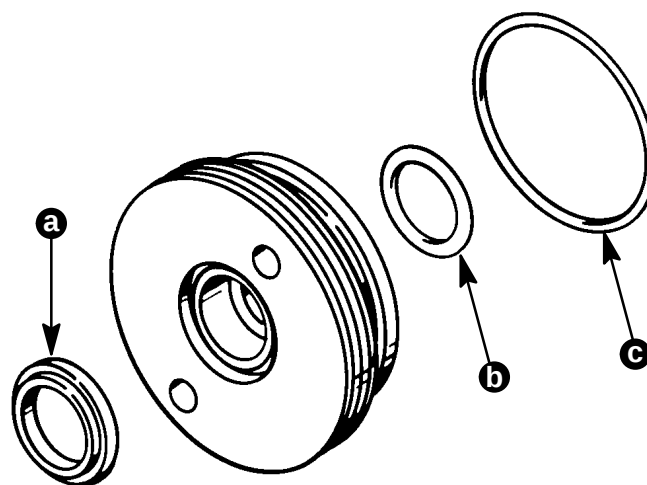
11. Insert manual release valve into manifold and tighten snugly. Back release valve out 3 or 4 turns allowing trim rod installation.



a - Manual Release Valve  
b - Manifold

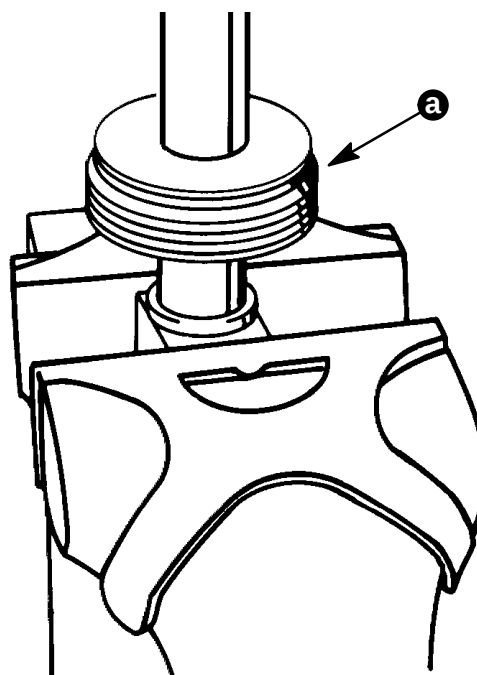
## Trim Rod Reassembly

1. Install lubricated O-rings and rod wiper to end cap.



a - Rod Wiper  
b - Inner O-ring  
c - Outer O-ring

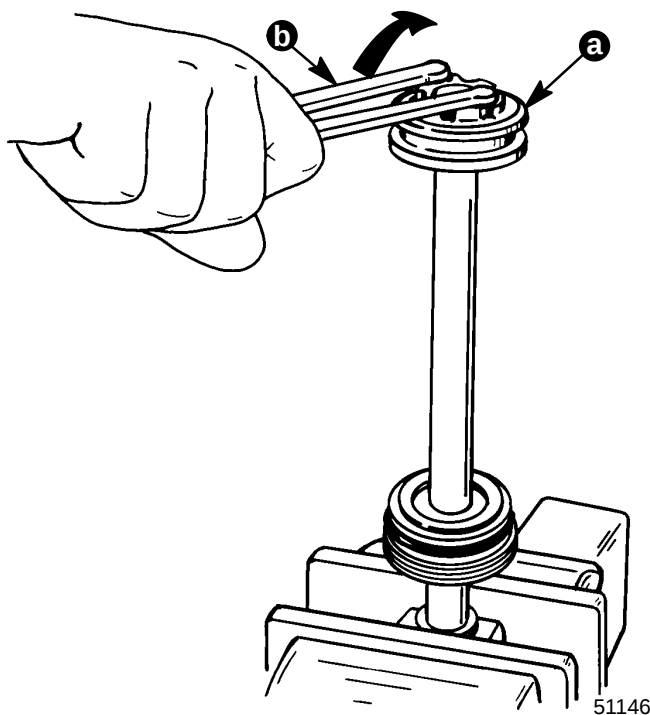
2. Secure trim rod in soft jawed vise as shown.  
3. Slide end cap onto trim rod.



a - End Cap

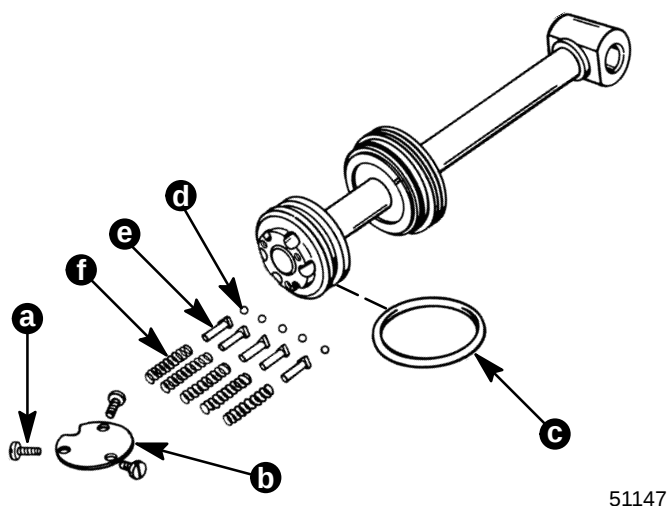


4. Apply Loctite Grade A (271) to threads of trim rod and install rod piston. Tighten piston securely using trim cylinder spanner wrench (1/4 in. x 5/16 in. long peg).



a - Trim Rod Piston  
b - Spanner Wrench

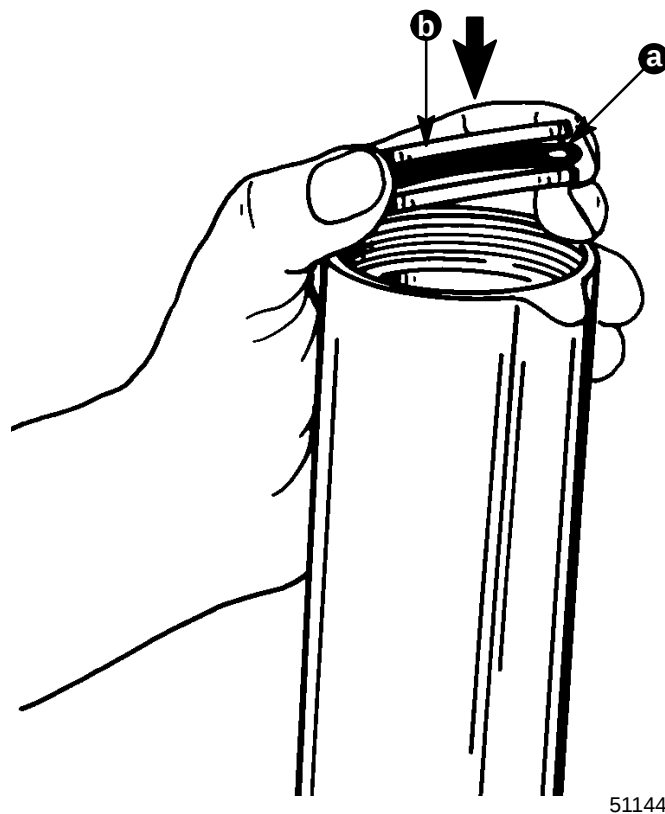
5. Install lubricated O-ring to trim rod piston.
6. Install check valve components into their respective seats.
7. Secure components in place using plate and screws. Torque screws to 35 lb. in. (4.0 N·m).



a - Screw (3)  
b - Plate  
c - O-ring  
d - Ball (5)  
e - Seat, Spring (5)  
f - Spring (5)

## Trim Rod Installation

1. Place trim cylinder in soft jawed vise.
2. Fill trim cylinder three inches (76.2mm) from top of cylinder using Quicksilver Power Trim and Steering Fluid or; (ATF) Type F, FA or Dexron II.
3. Install lubricated O-ring to memory piston and place into cylinder. Push piston down to level of oil.

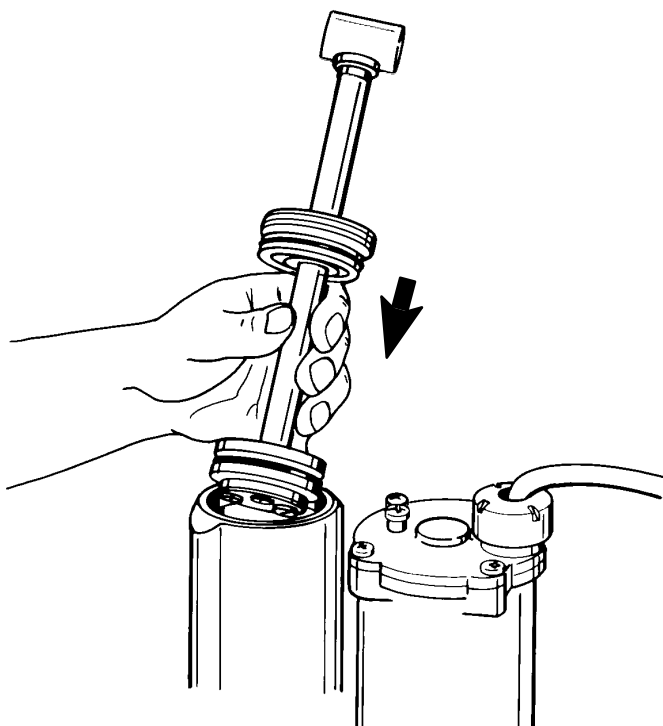


a - O-ring  
b - Memory Piston

**IMPORTANT:** Memory piston must not come in contact with trim rod end cap during end cap/trim rod installation.



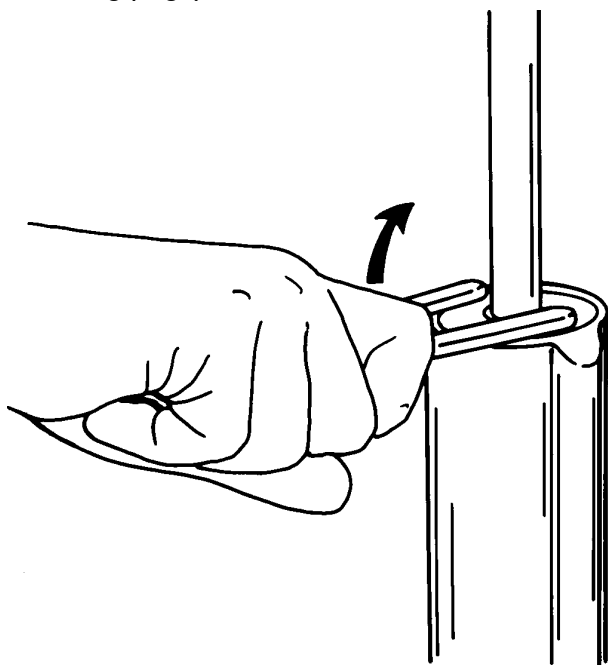
4. Install trim rod into cylinder.



51196

**IMPORTANT:** Memory piston must not come in contact with trim rod end cap during end cap/trim rod installation.

5. Tighten end cap assembly to cylinder securely using trim cylinder spanner wrench (1/4 in. x 5/16 in. long pegs).



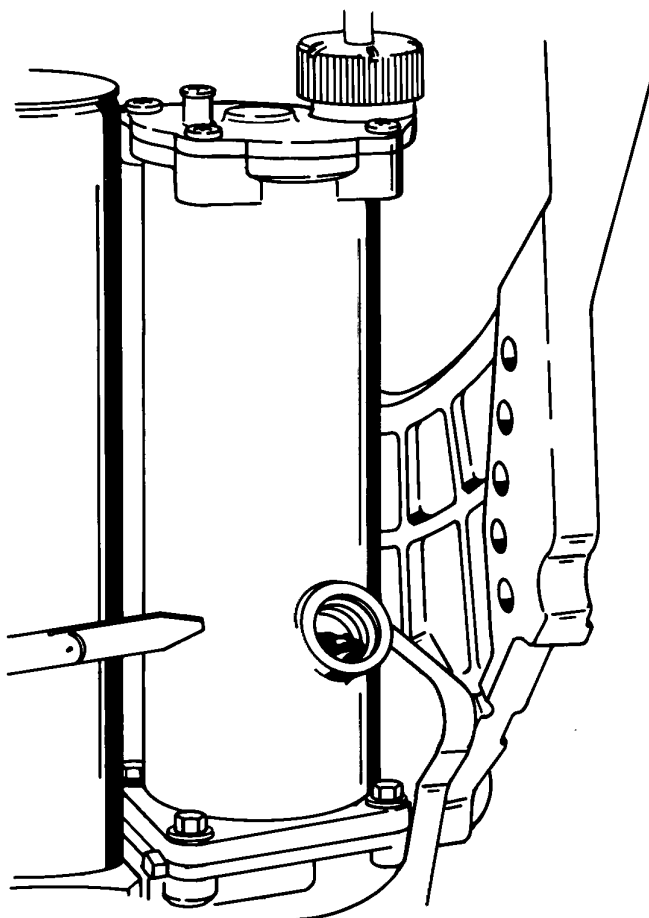
51145

6. Tighten manual release valve snugly following end cap installation.

## Bleeding Power Trim Unit

**IMPORTANT:** Manual release valve must be in the closed position during power trim bleeding and operation.

1. Secure power trim unit in soft jawed vise.
2. Remove fill screw. Add Quicksilver Power Trim and Steering Fluid (92-90100A12) or Automatic Transmission Fluid (ATF) Type F, FA or Dexron II up to threads of reservoir. Install cap.



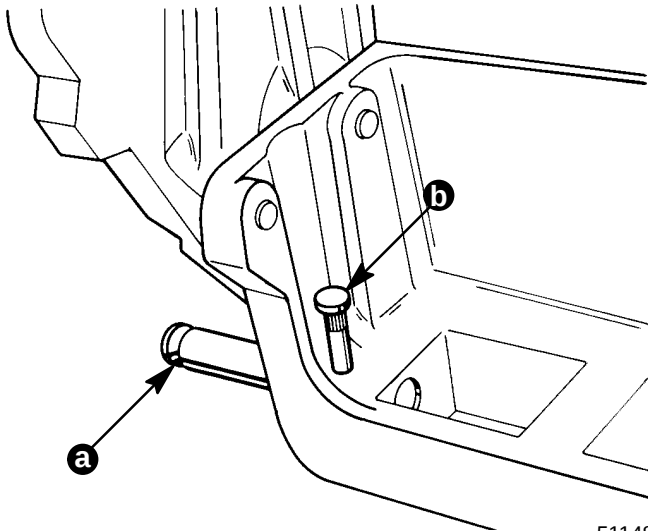
50241

3. Using a 12 volt power supply connect positive lead to green wire, negative lead to blue wire and drive trim rod to the down position. Connect positive lead to blue wire and negative lead to green wire and drive trim rod to the up position. Re-check fluid level, add fluid if required and repeat cycle until fluid level remains at lower portion of threads.



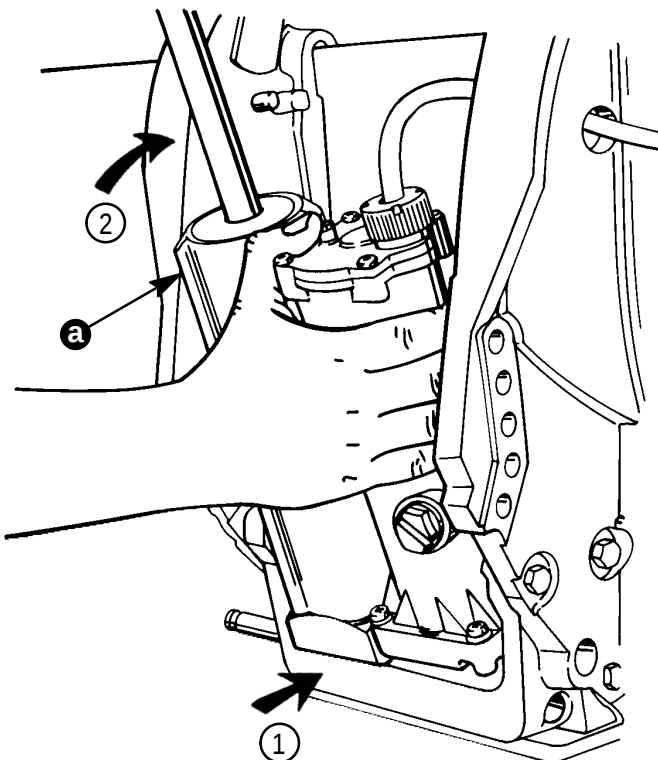
## Power Trim Unit Installation

1. Apply Special Lubricant 101 (92-13872A1) to lower pivot pin hole and pivot pin surface.
2. Start lower pivot pin into pivot pin bore and position lower dowel pin (RETAINED) in its respective hole.



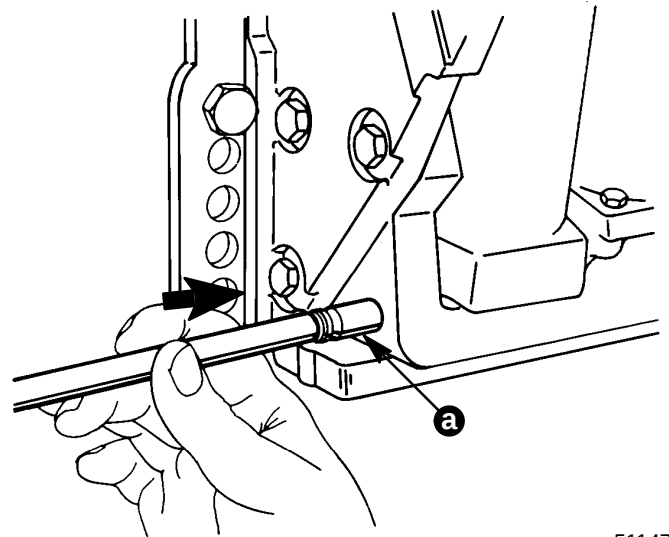
a - Lower Pivot Pin  
b - Lower Dowel Pin

3. Position trim cylinder assembly (BOTTOM FIRST) between clamp brackets and route trim pump electrical harness through access hole in starboard clamp bracket.



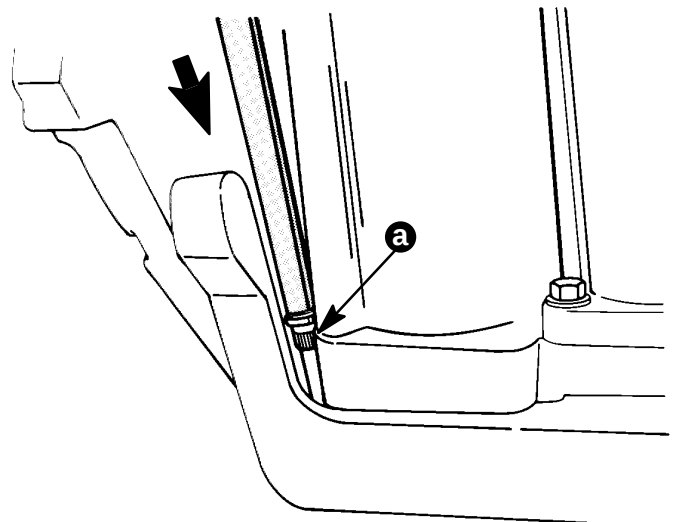
a - Trim Cylinder Assembly

4. Using a suitable punch, drive lower pivot pin into clamp bracket and trim cylinder assembly until pivot pin is flush with outside surface.



a - Lower Pivot Pin

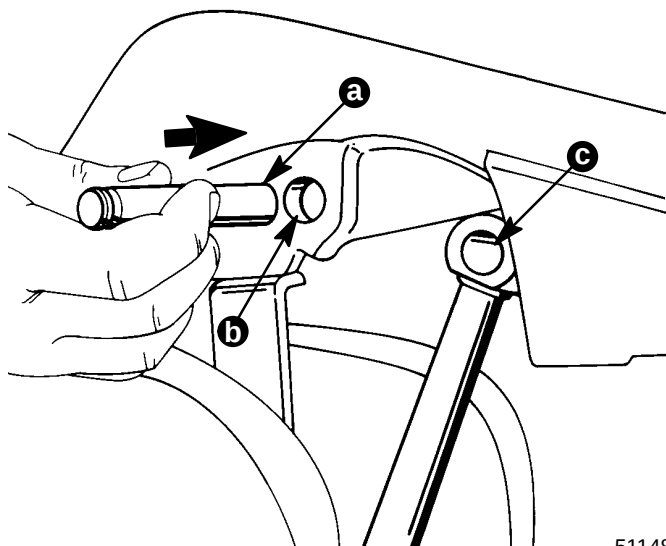
5. Using a suitable punch, drive lower dowel pin into its hole until seated.



a - Lower Dowel Pin



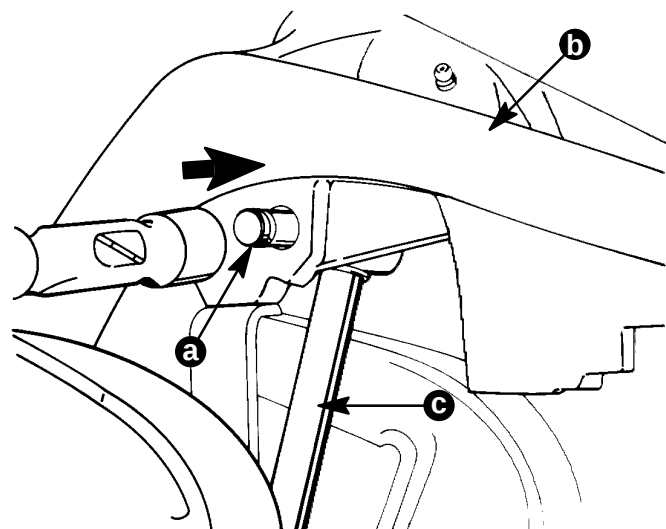
6. Apply Special Lubricant 101 (92-13872A1) to surface of upper pivot pin, pivot pin bore and trim ram bore.



51148

- a - Pivot Pin  
b - Pivot Pin Bore  
c - Trim Ram Bore

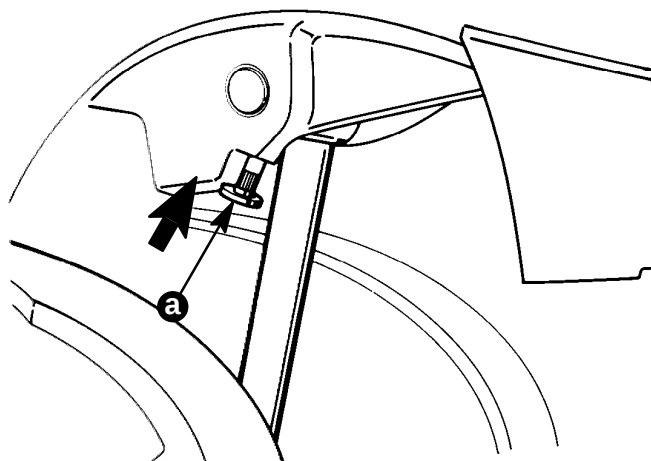
7. Using a suitable mallet, drive upper pivot pin into swivel bracket and through trim ram until pivot pin is flushed with swivel bracket.



51148

- a - Pivot Pin  
b - Swivel Bracket  
c - Trim Ram

8. Drive upper dowel pin (a) into its hole until seated.

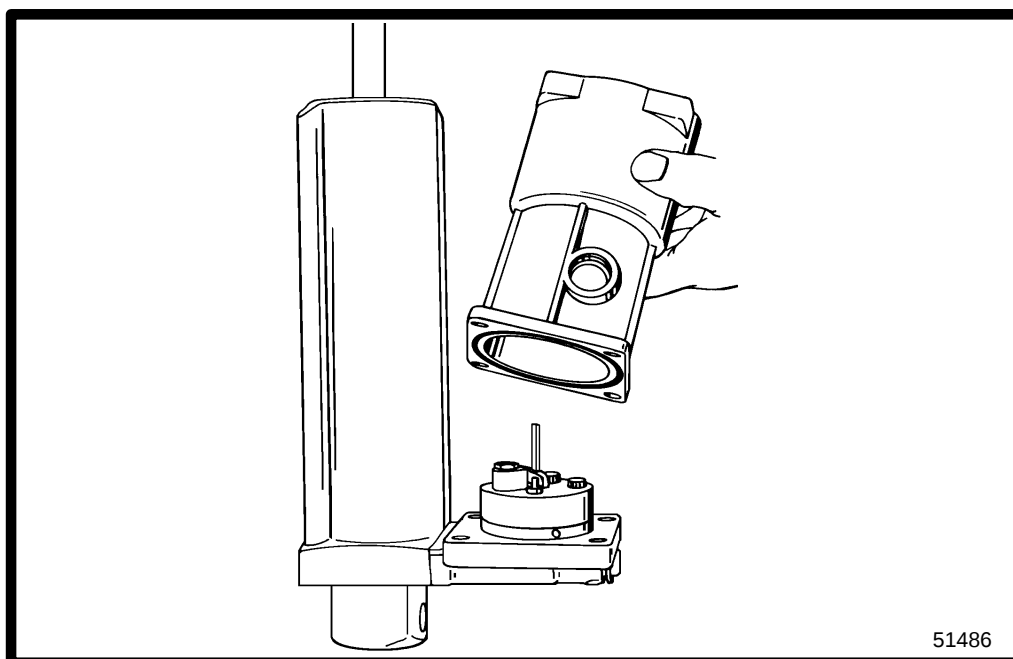


51147

9. Recheck fluid level.  
10. Power trim may now be operated to lower outboard to desired position. Trim system is self bleeding.  
11. Re-connect spark plug leads to spark plugs.  
12. Re-install top cowl.  
13. Connect battery leads to battery terminals.



# MID-SECTION



5

D

## POWER TRIM (DESIGN 3)



# Table of Contents

|                                              | Page  |
|----------------------------------------------|-------|
| Special Tools .....                          | 5D-1  |
| Power Trim - General Information .....       | 5D-1  |
| Description .....                            | 5D-1  |
| Trimming Characteristics .....               | 5D-1  |
| Trimming Outboard "Up" ("Out") .....         | 5D-1  |
| Trimming Outboard "Down" ("In") .....        | 5D-1  |
| Trailing Outboard .....                      | 5D-2  |
| Tilting Outboard Up and Down Manually ..     | 5D-2  |
| Trim "In" Angle Adjustment .....             | 5D-2  |
| Power Trim System Components .....           | 5D-3  |
| Troubleshooting .....                        | 5D-4  |
| Determining if Problem is Electrical or      |       |
| Hydraulic .....                              | 5D-4  |
| Hydraulic System Troubleshooting .....       | 5D-5  |
| Preliminary Checks .....                     | 5D-5  |
| Leak Down Check - Pump and Manifold          |       |
| Assembly .....                               | 5D-5  |
| Leak Down Check - Pilot Valve                |       |
| Assembly .....                               | 5D-6  |
| Leak Down Check - Manual Release             |       |
| Valve .....                                  | 5D-6  |
| Leaks Past Ball and Seat - Piston            |       |
| Assembly .....                               | 5D-6  |
| Troubleshooting Flow Diagram .....           | 5D-7  |
| Troubleshooting Flow Diagram .....           | 5D-8  |
| Electrical System Troubleshooting .....      | 5D-9  |
| Commander 2000 Side Mount Remote             |       |
| Control (Power Trim/Tilt Electric Start with |       |
| Warning Horn) Wiring Diagram .....           | 5D-9  |
| Power Trim System Wiring Diagram .....       | 5D10  |
| Troubleshooting the "Down" Circuit*          |       |
| (When "Up" Circuit is OK) .....              | 5D-11 |
| Troubleshooting the "Up" Circuit*            |       |
| (When "Down" Circuit Is OK) .....            | 5D-12 |
| Troubleshooting the "Down" and "Up" Circuits |       |
| (All Circuits Inoperative)* .....            | 5D-13 |

|                                         | Page  |
|-----------------------------------------|-------|
| Power Trim System Removal .....         | 5D-14 |
| Power Trim System Disassembly .....     | 5D-15 |
| Trim Rod Removal .....                  | 5D-15 |
| Trim Rod Disassembly .....              | 5D-16 |
| Trim "Motor" Removal .....              | 5D-18 |
| Trim "Motor" Disassembly .....          | 5D-18 |
| Reservoir Assembly Removal .....        | 5D-18 |
| Manifold Removal .....                  | 5D-19 |
| Cleaning and Inspection of Trim Rod     |       |
| Components .....                        | 5D-20 |
| Motor and Electrical Tests/Repair ..... | 5D-20 |
| Trim Pump Motor Test .....              | 5D-20 |
| Armature Tests .....                    | 5D-20 |
| Test for Shorts .....                   | 5D-20 |
| Test for Ground .....                   | 5D-20 |
| Checking and Cleaning Commutator ..     | 5D-21 |
| Power Trim System Reassembly .....      | 5D-21 |
| Manifold Installation .....             | 5D-21 |
| Trim Motor Reassembly .....             | 5D-22 |
| Reservoir Installation .....            | 5D-23 |
| Trim Rod Reassembly .....               | 5D-24 |
| Trim Rod Installation .....             | 5D-25 |
| Purging Power Trim Unit .....           | 5D-26 |
| Power Trim Unit Installation .....      | 5D-26 |



## Special Tools

| Description            | Part No. |
|------------------------|----------|
| Torch Lamp             | 91-63209 |
| Spanner Wrench         | 91-74951 |
| Multi-Meter DVA Tester | 91-99750 |

## Quicksilver Lubricants and Service Aids

| Description                   | Part No.   |
|-------------------------------|------------|
| Power Trim and Steering Fluid | 91-9010012 |
| Loctite 271                   | 91-32609-1 |
| Liquid Neoprene               | 91-25711-1 |
| Anti-Corrosion Grease         | 91-78376A6 |

## Power Trim - General Information

### Description

The Power Trim system consists of an electric motor, pressurized fluid reservoir, pump and trim cylinder.

The remote control (or trim panel) is equipped with a switch that is used for trimming the outboard “up” and “down”, and for tilting the outboard for shallow water operation (at slow speed) or for “trailing”. The outboard can be trimmed “up” or “down” while engine is under power or when engine is not running.

### Trimming Characteristics

When trimming outboard from a mid-trim position (trim tab in neutral, straight fore-and-aft position), you can expect the following results:

#### TRIMMING OUTBOARD “UP” (“OUT”)

##### WARNING

**Excessive trim “out” may reduce the stability of some high speed hulls. To correct instability at high speed, reduce the power gradually and trim the motor “In” slightly before resuming high speed operation. (Rapid reduction in power will cause a sudden change of steering torque and may cause additional momentary boat instability.)**

Will lift bow of boat, usually increasing top speed.

Transfers steering torque harder to port (left) on installations below 23 in. transom height.

Increases clearance over submerged objects.

In excess, can cause “porpoising” and/or ventilation.

In excess, can cause insufficient water supply to water pump resulting in serious water pump and/or powerhead overheating damage.

##### WARNING

**Excessive engine trim angle will result in insufficient water supply to water pump causing water pump and/or powerhead overheating damage. Make sure that water level is above gear housing water intake holes whenever engine is running.**

Operating “Up” circuit will actuate the “up” relay (located under engine cowl) and close the electric motor circuit. The electric motor drives the pump, forcing fluid thru internal passageways into the “up” side of the trim cylinder.

The trim cylinder/trim ram will position the engine at the desired trim angle within the 20° maximum trim range. The Power Trim system is designed so the engine cannot be trimmed beyond the 20° maximum trim angle as long as engine RPM is above approximately 2000 RPM.

The engine can be raised beyond the 20° maximum trim angle for shallow water operation, etc., by keeping the engine RPM below 2000 RPM. If engine RPM increases above 2000 RPM, the thrust created by the propeller (if deep enough in the water) will cause the trim system to automatically lower the engine back to the 20° maximum trim angle.

#### TRIMMING OUTBOARD “DOWN” (“IN”)

##### WARNING

**Excessive speed at minimum trim “In” may cause undesirable and/or unsafe steering conditions. Each boat should be tested for handling characteristics after any adjustment is made to the tilt angle (tilt bolt relocation).**

Will help planing off, particularly with a heavy load.

Usually improves ride in choppy water.

In excess, can cause boat to veer to the left or right (bow steer).

Transfers steering torque harder to right (or less to the left).

Improves planing speed acceleration (by moving tilt bolt one hole closer to transom).



Operating “Down” circuit will actuate the “down” relay (located under engine cowl) and close the electric motor circuit (motor will run in opposite direction of the “Up” circuit). The electric motor will drive the pump, forcing fluid thru internal passageways into the “down” side of the tilt ram. The tilt ram will move the engine down to the desired angle.

## Trailing Outboard

### ⚠ WARNING

Excessive engine trim angle will result in insufficient water supply to water pump causing water pump and/or powerhead overheating damage. Make sure that water level is above gear housing water intake holes whenever engine is running.

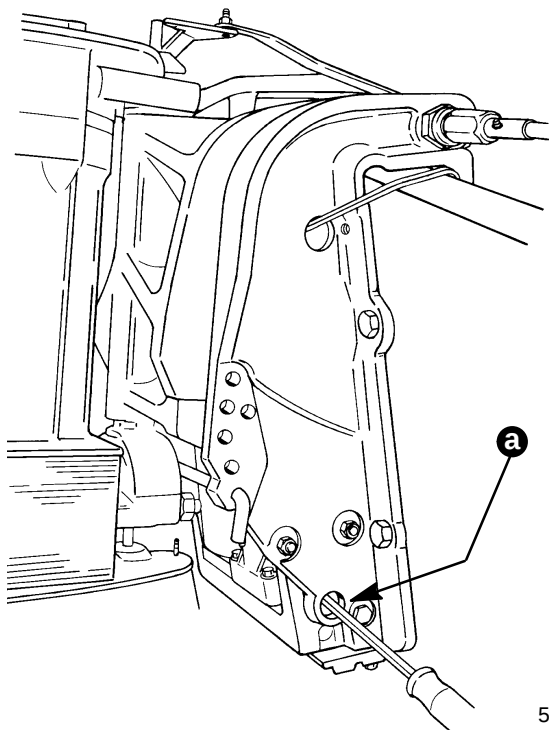
While operating “up” circuit, the ram will continue to tilt outboard to full up position for trailering.

## Tilting Outboard Up and Down Manually

### ⚠ WARNING

Before opening the manual release valve, make sure all persons are clear of engine as engine will drop to full “down” position when valve is opened.

With power trim installed, the outboard can be raised or lowered manually by opening the manual release valve 3 turns **maximum** (counterclockwise).



52028

a - Manual Release Valve

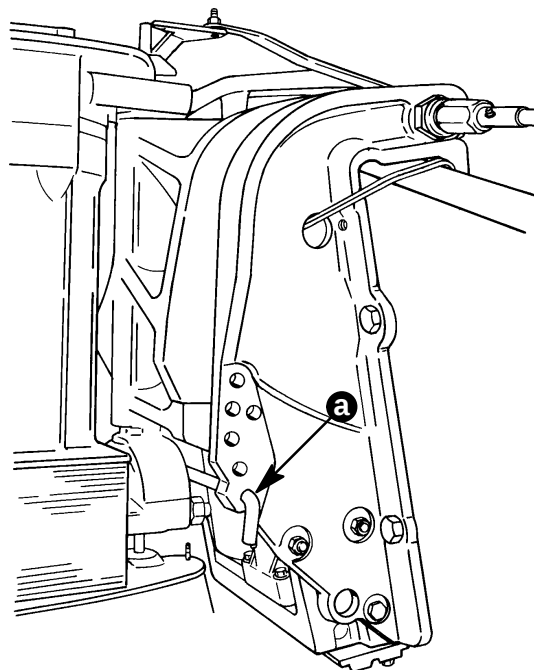
## Trim “In” Angle Adjustment

### ⚠ WARNING

Operating some boats with engine trimmed to the full “in” trim angle [not using trim adjustment bolt (a)] at planing speed will cause undesirable and/or unsafe steering conditions. Each boat must be water tested for handling characteristics after engine installation and after any trim adjustments.

**IMPORTANT:** Some boat/motor combinations, that do not use the trim adjustment bolt (a) and are trimmed to the full “in” trim angle, will not experience any undesirable and/or unsafe steering conditions during planing speed. Thus, not using trim adjustment bolt may be desired. However, some boats with engine trimmed to the full “in” trim angle at planing speed will cause undesirable and/or unsafe steering conditions. If these steering conditions are experienced, under no circumstances should the engine be operated without the trim adjustment bolt and without the bolt adjusted in the proper holes to prevent unsafe handling characteristics.

Water test the boat not using the trim adjustment bolt. If undesirable and/or unsafe steering conditions are experienced (boat runs with nose down), install trim adjustment bolt in proper hole to prevent unsafe handling characteristics.



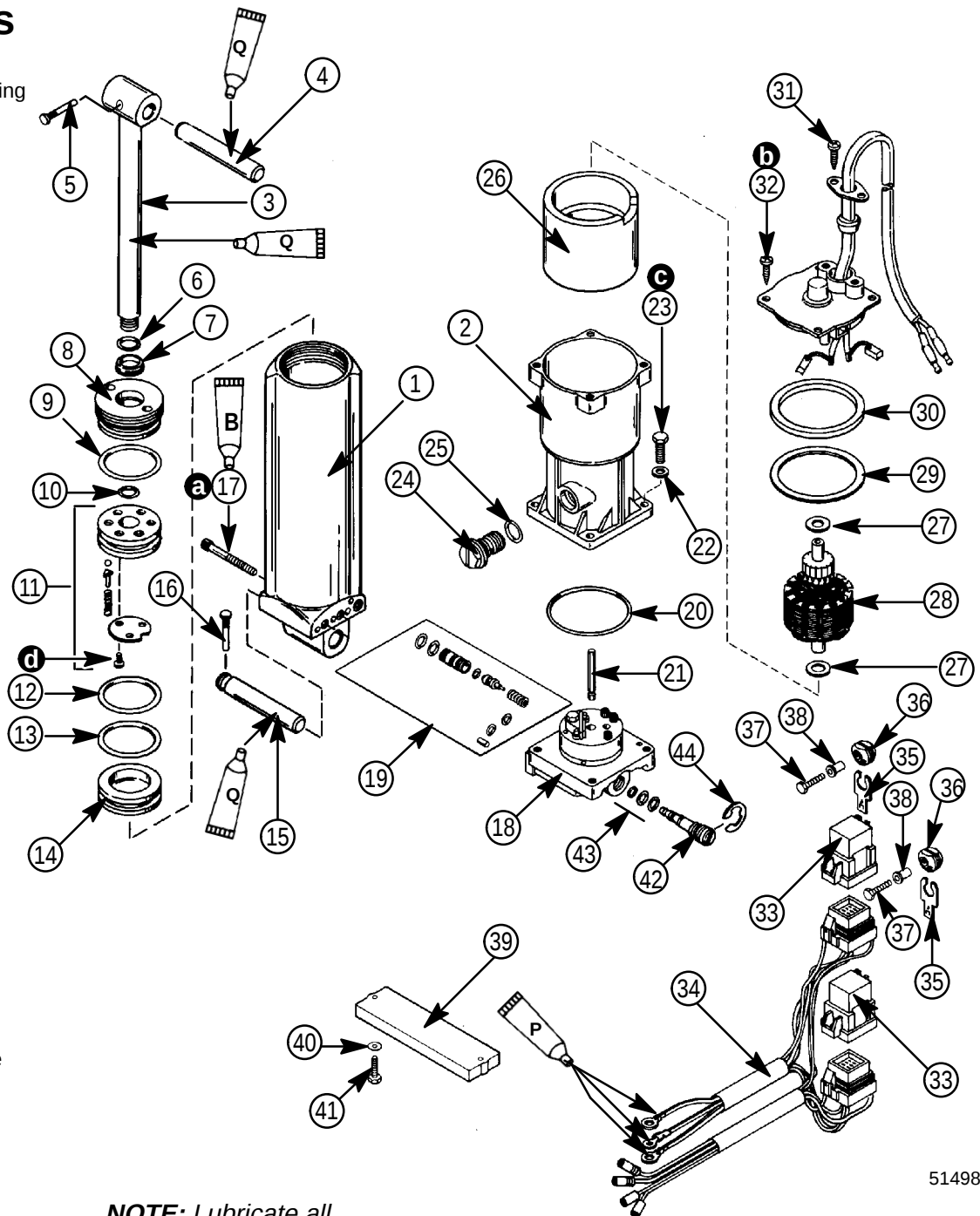
52029

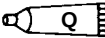
a - Trim Adjustment Bolt



# Power Trim System Components

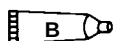
- 1 - Tilt/Trim Cylinder
- 2 - Reservoir/Motor Housing
- 3 - Piston Rod
- 4 - Upper Pivot Shaft
- 5 - Cross Pin
- 6 - O-ring
- 7 - End Cap Seal
- 8 - End Cap
- 9 - O-ring
- 10- O-ring
- 11- Piston Assembly
- 12- O-ring
- 13- O-ring
- 14- Memory Piston
- 15- Lower Pivot Shaft
- 16- Cross Pin
- 17- Screw (2)
- 18- Pump Assembly
- 19- Pilot Valve Assembly
- 20- O-ring
- 21- Driveshaft
- 22- Washer (4)
- 23- Screw (4)
- 24- Fill Screw
- 25- O-ring
- 26- Motor Frame
- 27- Thrust Washer (2)
- 28- Armature
- 29- Ring
- 30- Seal
- 31- Screw (2)
- 32- Screw (4)
- 33- Relay
- 34- Wiring Harness
- 35- Relay Mount (2)
- 36- Rubber Mount (2)
- 37- Screw (2)
- 38- Spacer (2)
- 39- Anode
- 40- Washer (2)
- 41- Screw (2)
- 42- Manual Release Valve
- 43- O-ring
- 44- E-clip



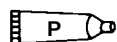
**NOTE:** Lubricate all O-rings and seals with 

51498

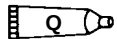
## Quicksilver Lubricants and Service Aids



Loctite "271" (92-32609-1)



Liquid Neoprene (92-25711-1)



Power Trim and Steering Fluid (92-90100A12)

## Torque Specifications

- a** - 100 lb. in. (11.1 N·m)
- b** - 13 lb. in. (1.5 N·m)
- c** - 70 lb. in. (7.7 N·m)
- d** - 35 lb. in. (4.0 N·m)

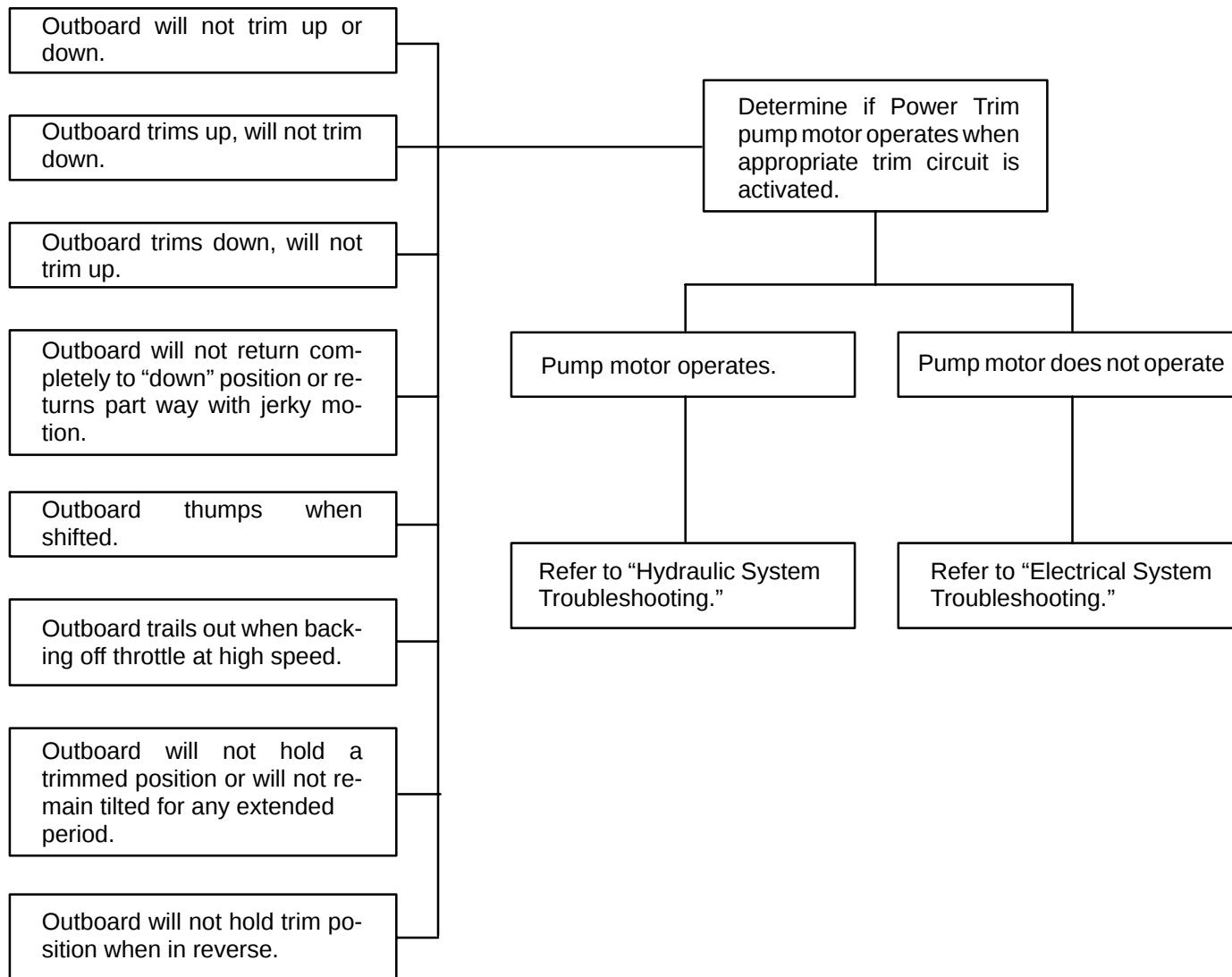


# Troubleshooting

## Determining if Problem is Electrical or Hydraulic

When a problem is encountered with the Power Trim system, the first step is to determine whether the malfunction is in the “electrical system” or the “hydraulic system.” Refer to the following chart to determine which system is at fault.

**Problem Chart**





## Hydraulic System Troubleshooting

Support outboard with tilt lock lever when servicing power trim system.

**After debris or failed components have been found (during troubleshooting procedures) disassemble unit completely and replace all O-rings. Check ball valve components and castings must be cleaned using engine cleaner and compressed air or replaced prior to reassembly.**

**Power trim system is pressurized. Outboard must be in the full "UP" position (cylinder fully extended) prior to fill screw or manual release valve removal.**

Refer to instructions following if disassembly is required.

Follow preliminary checks before proceeding to troubleshooting flow diagrams (following).

### Preliminary Checks

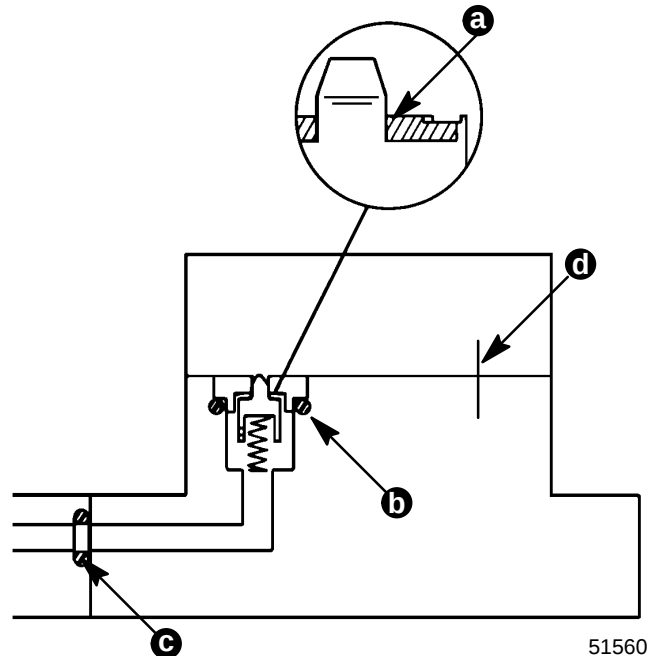
**Operate Power Trim System after each check to see if problem is corrected. If not, proceed with the next check.**

1. Check that manual release valve is tightened to full right (clockwise) position.
2. Check trim pump fluid level with outboard in full "UP" position and fill if necessary. Refer to "Fill and Purge the Power Trim System."
3. Check for external leaks in Power Trim system. Replace defective part(s) if leak is found.
4. Outboard not holding tilted position (falls to trim in position) indicates debris or defective components in trim valve assembly. Clean or replace components as required.
5. Check manual release valve for broken stem and one O-ring remaining in the release valve passage. (Separate the manifold assembly from the cylinder to dislodge broken stem.) Install new release valve and test system.
6. Check for nicked, deteriorated, or misplaced O-rings throughout trim system.

## Leak Down Check - Pump and Manifold Assembly

**NOTE:** Scribe (d) pump housing and manifold before disassembly.

1. Debris or chips between valve and seat (a), usually imbedded in rubber valve seat.
2. Nicked or deteriorated O-ring (b).
3. Nicked, deteriorated, or misplaced O-ring (c).



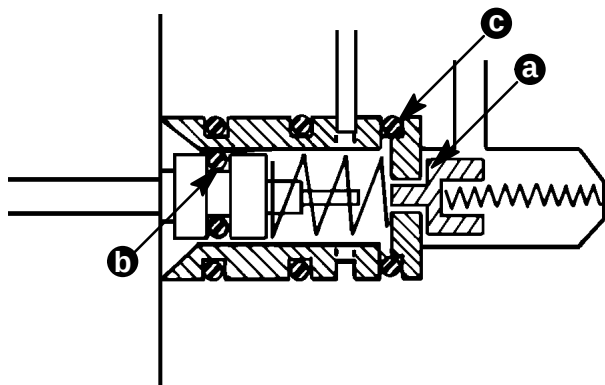
4. After reassembly, insert driveshaft and check pump rotor resistance to turning - housing halves can shift/turn during reassembly. Align scribe marks (d) carefully.



## Leak Down Check - Pilot Valve Assembly

1. Debris or chips between valve and seat, usually imbedded in rubber valve seat.
2. Pilot valve installed from non-chamfered end of spool, results in nicked or damaged O-ring.
3. Nicked or deteriorated O-ring.

A leak path is created between the UP side of the cylinder and the reservoir. The trim system will leak down until the trim port in cylinder is covered.

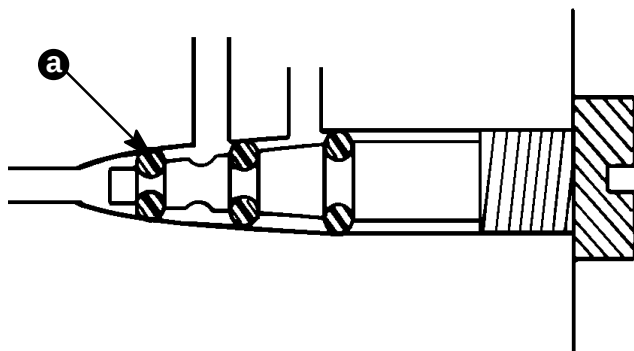


51560

- a - Valve and Seat
- b - Pilot Valve O-ring
- c - O-ring

## Leak Down Check - Manual Release Valve

1. Debris or chips under O-ring (a).
2. Flash from valve molding causing O-ring (a) to not seal.
3. Nicked O-ring (a).



51560

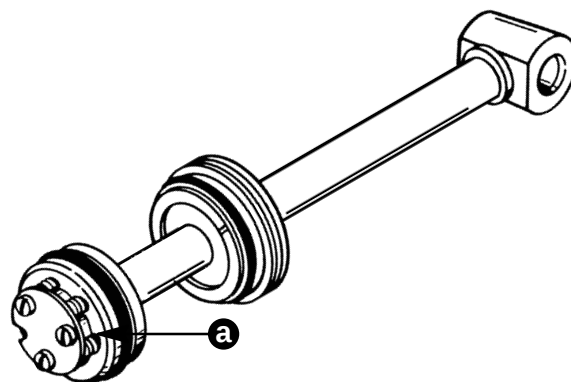
- a - O-ring

## Leaks Past Ball and Seat - Piston Assembly

Unit will trim to full or near full down position and then will begin to trim up while trim switch is held in "DOWN" mode.

If trim switch is released, outboard can be pushed (by hand) down to the point where trim UP started.

1. Inspect balls and seats in piston assembly for debris or damage. Repair or replace balls/seats.

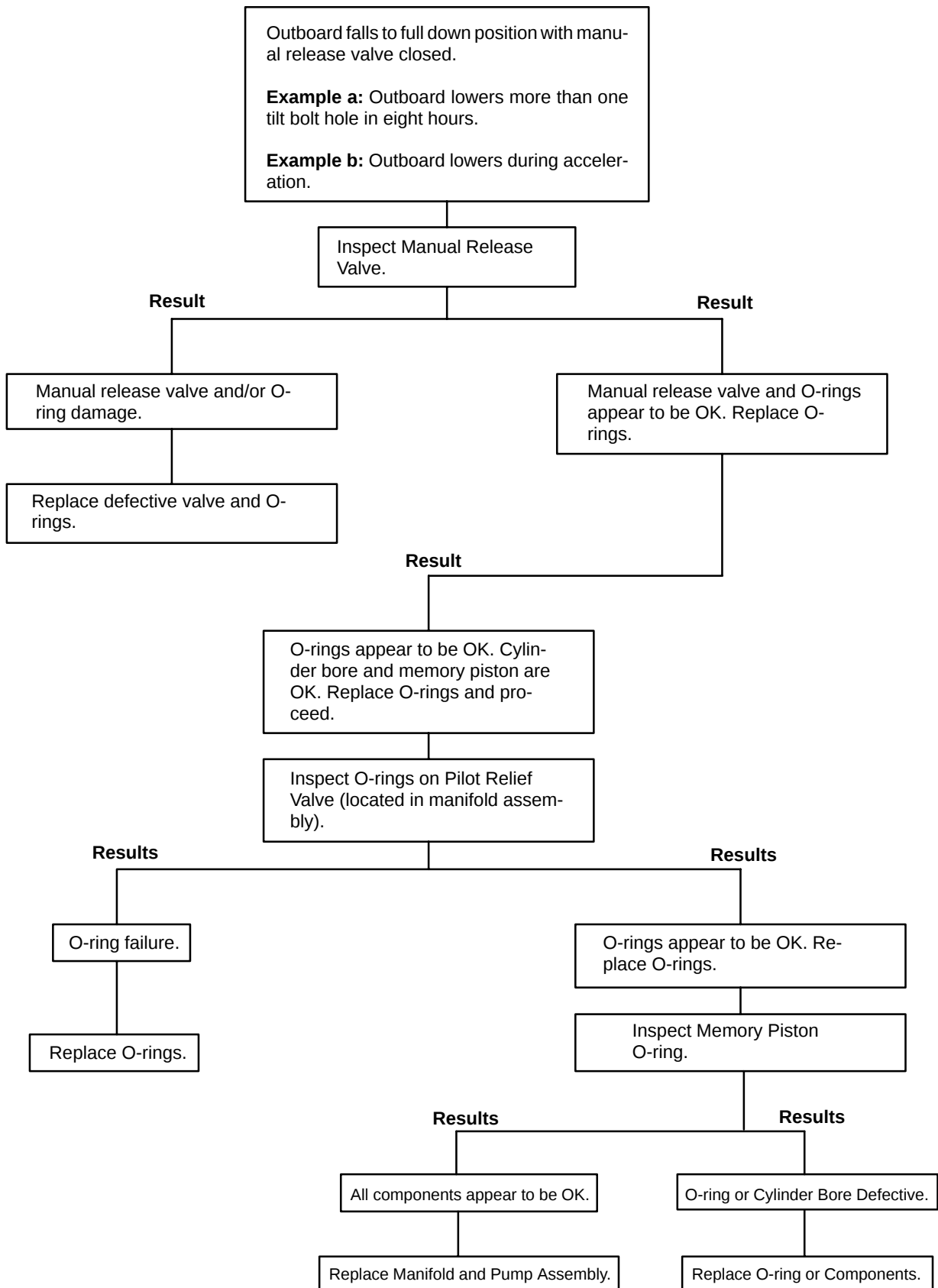


51143

- a - Ball and Seat. Check All For Debris or Damage.

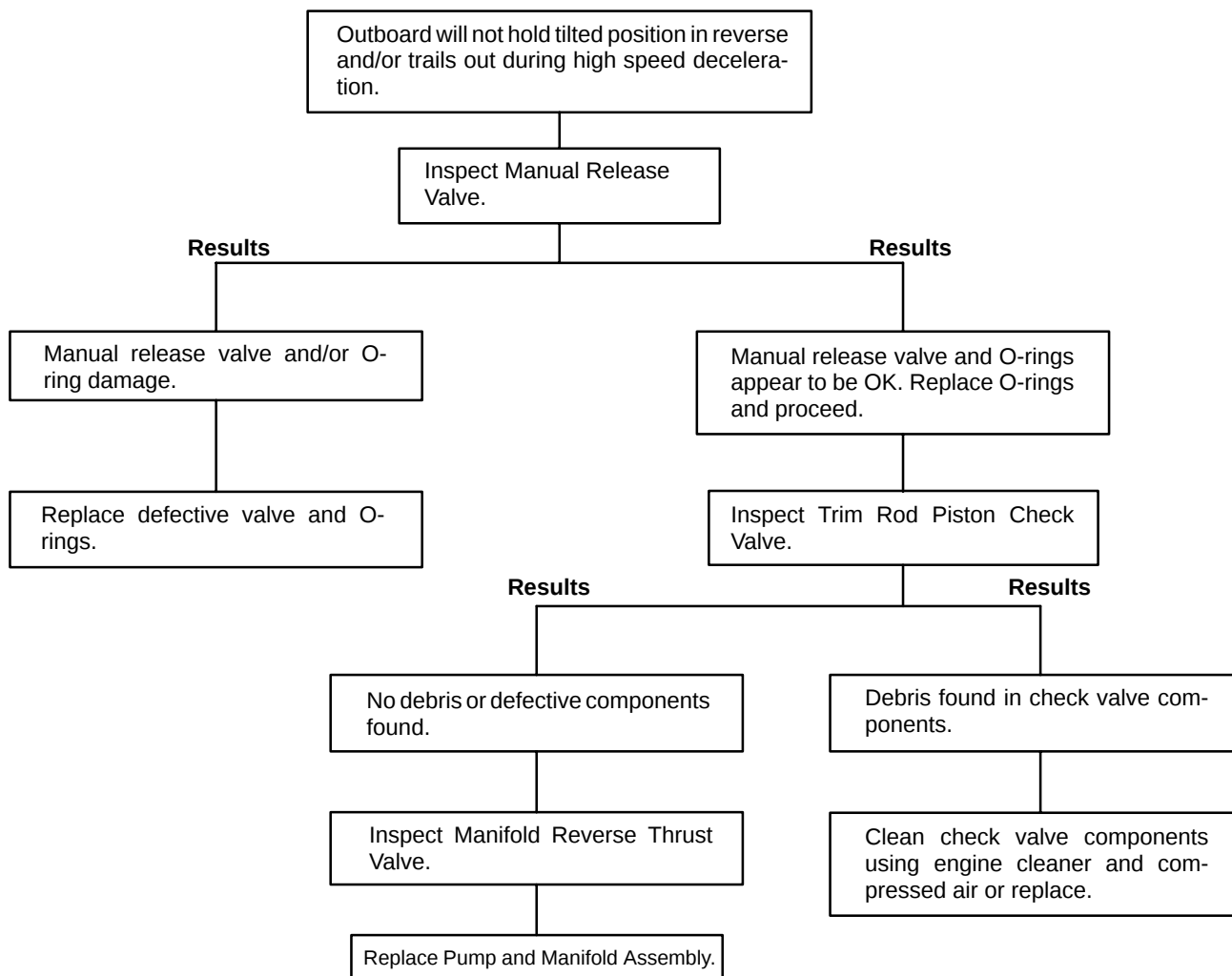


## Troubleshooting Flow Diagram





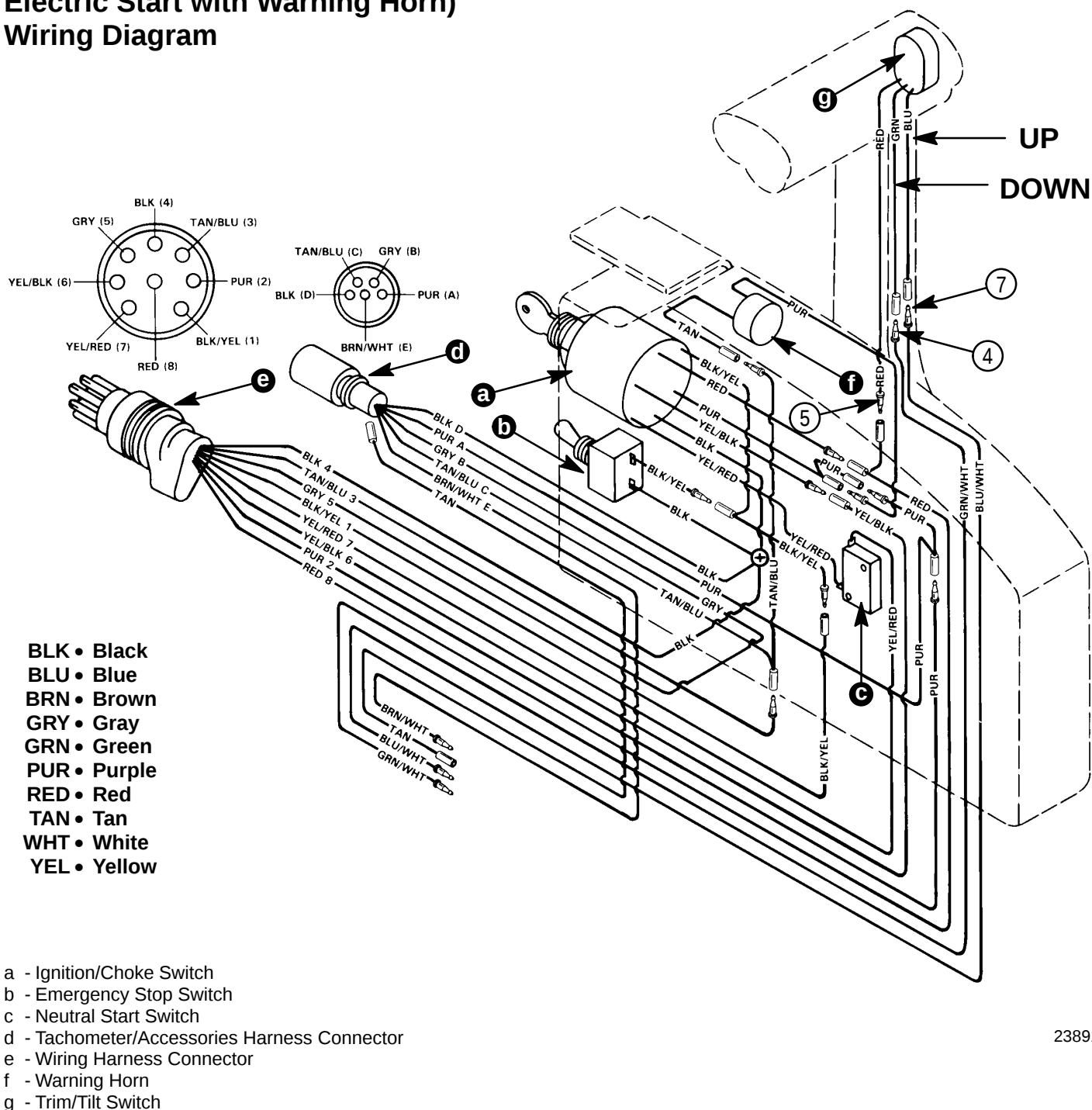
## Troubleshooting Flow Diagram





## Electrical System Troubleshooting

### COMMANDER 2000 Side Mount Remote Control (Power Trim/Tilt Electric Start with Warning Horn) Wiring Diagram

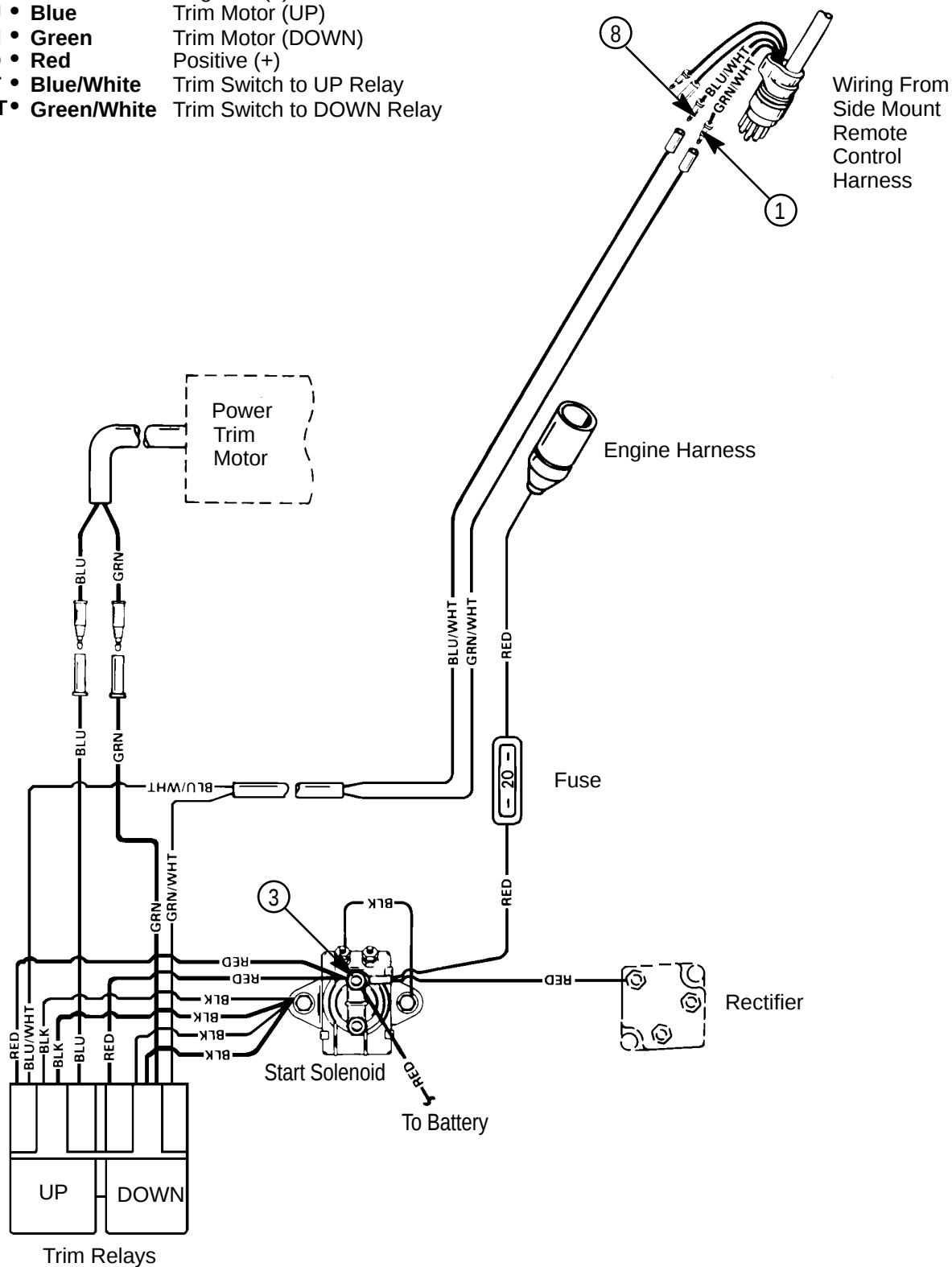


23891



## Power Trim System Wiring Diagram

|                       |                           |
|-----------------------|---------------------------|
| BLK • Black           | Negative (-)              |
| BLU • Blue            | Trim Motor (UP)           |
| GRN • Green           | Trim Motor (DOWN)         |
| RED • Red             | Positive (+)              |
| BLU/WHT • Blue/White  | Trim Switch to UP Relay   |
| GRN/WHT • Green/White | Trim Switch to DOWN Relay |

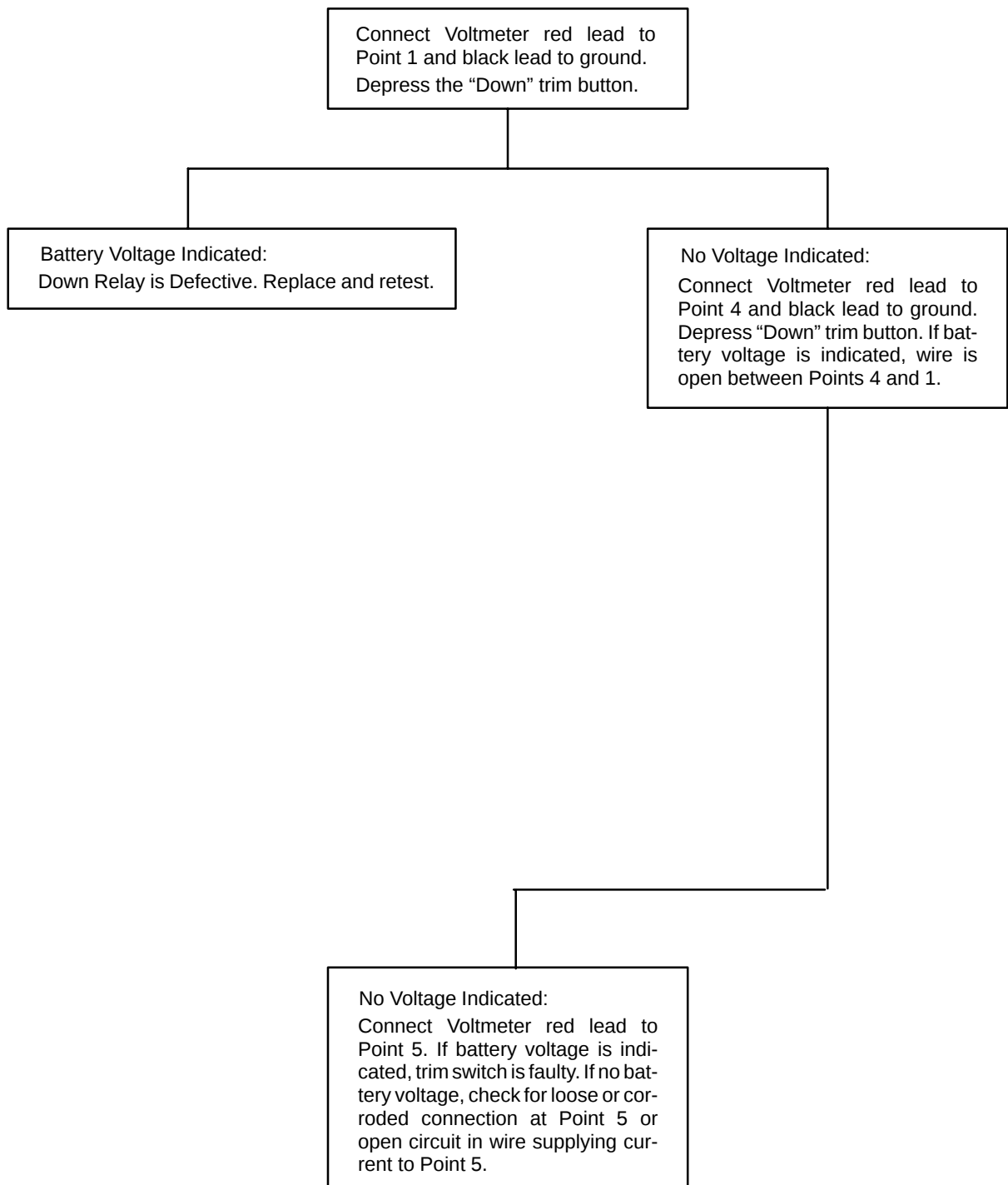


51507



## Troubleshooting the “Down” Circuit\* (When “Up” Circuit is OK)

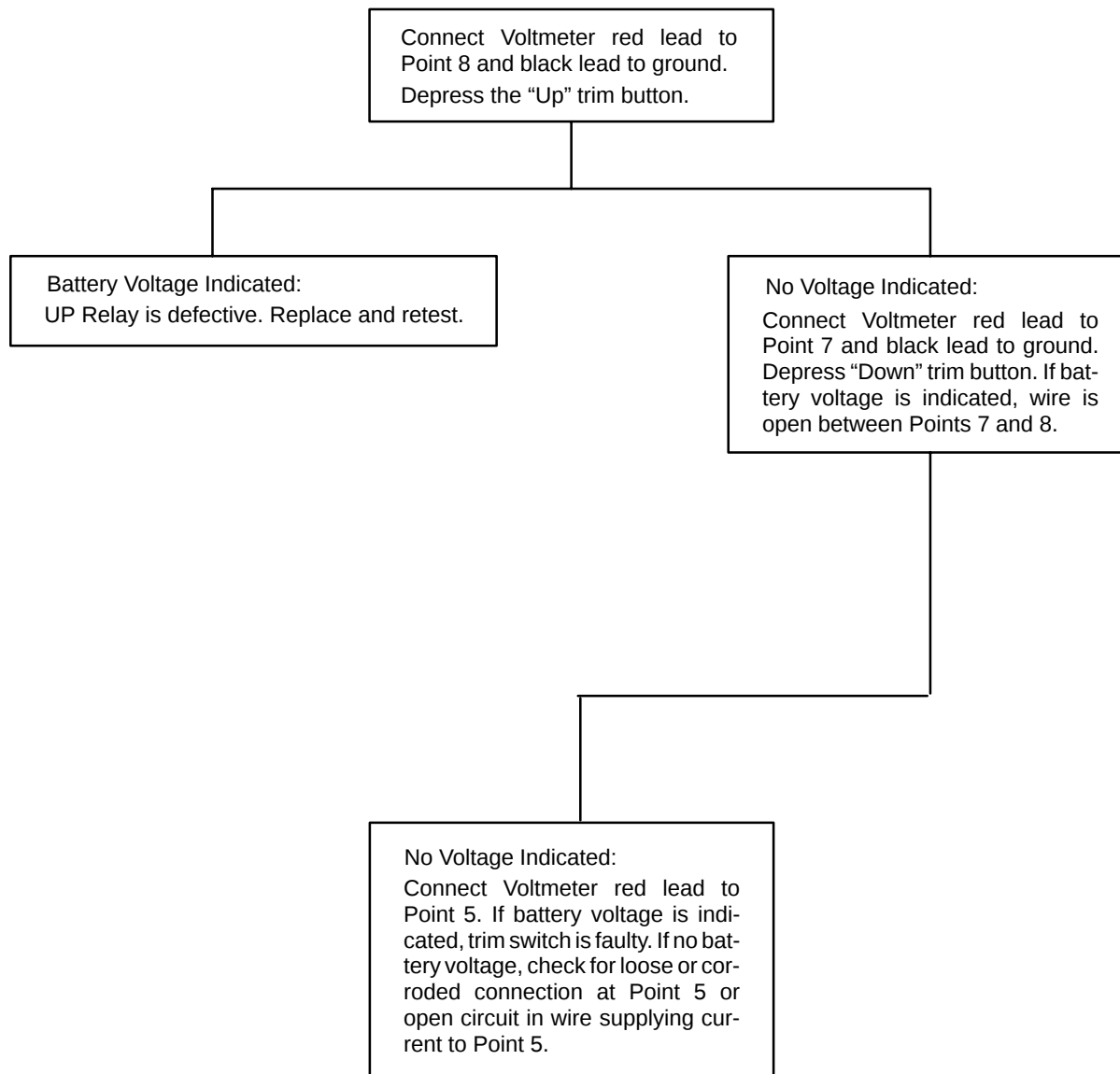
\*Remote Control Not Equipped with Trailer  
Button





## Troubleshooting the “Up” Circuit\* (When “Down” Circuit Is OK)

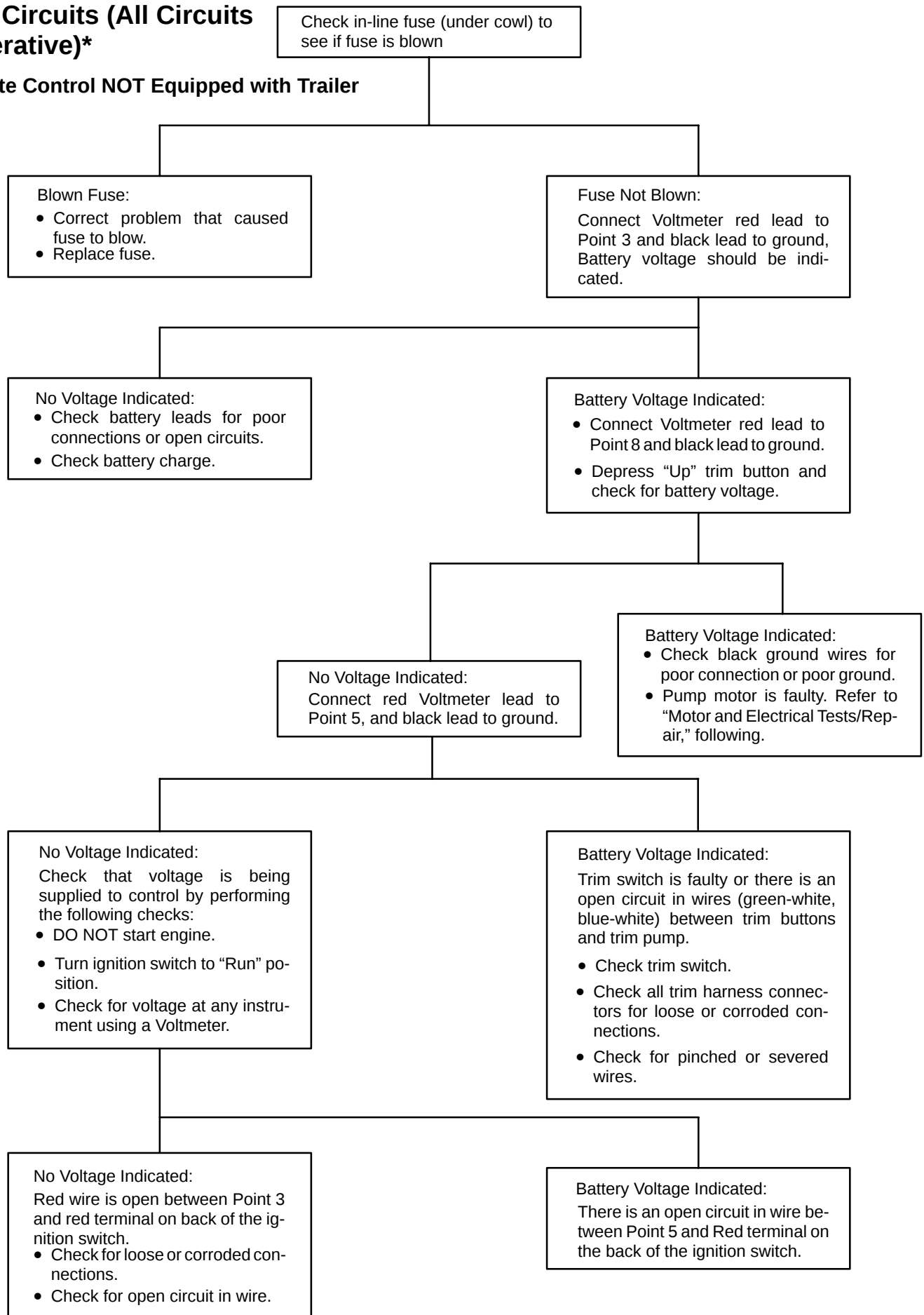
\*Remote Control NOT Equipped with Trailer  
Button





## Troubleshooting the “Down” and “Up” Circuits (All Circuits Inoperative)\*

**\*Remote Control NOT Equipped with Trailer Button**

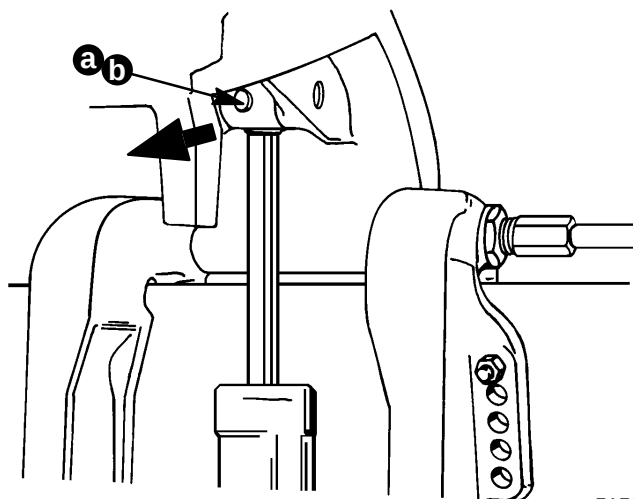




## Power Trim System Removal

Support outboard with tilt lock lever when servicing power trim system.

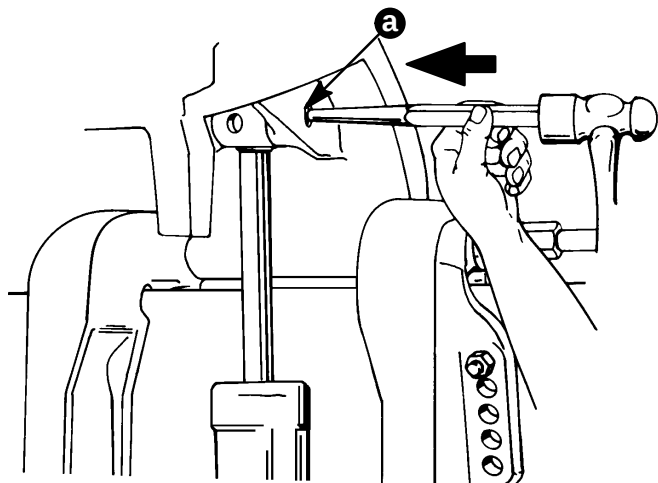
1. Disconnect power trim harness from outboard wiring harness.
2. Remove screw and clip securing wiring harness to clamp bracket.
3. Remove trim gauge sender (if equipped).
4. Use suitable tool to remove upper headed cross pin. Retain pin. Straight pin is hard to remove (see item 5).



51505

- a - Cross Pin (Design 1 - Straight)  
b - Cross Pin (Design 2 - Headed)

5. Drive out upper pivot pin. This will shear cross pin.

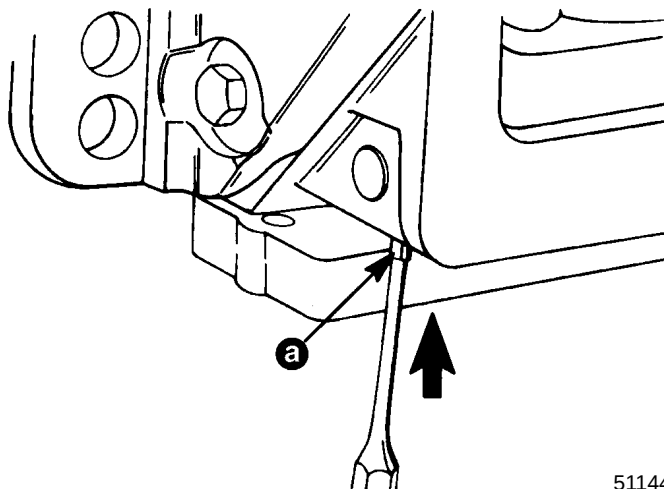


50515

- a - Upper Pivot Pin

Inspect cross pin hole and pivot pin hole for damage.

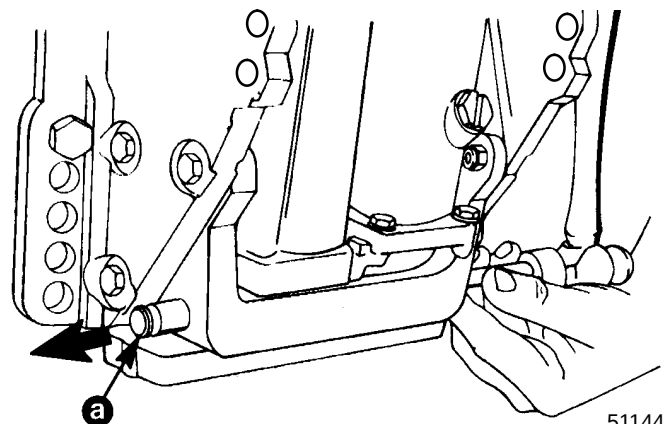
6. Use suitable punch to remove (DRIVE UP) lower dowel pin. Retain dowel pin.



51144

- a - Cross Pin

7. Use suitable punch to drive out lower pivot pin.

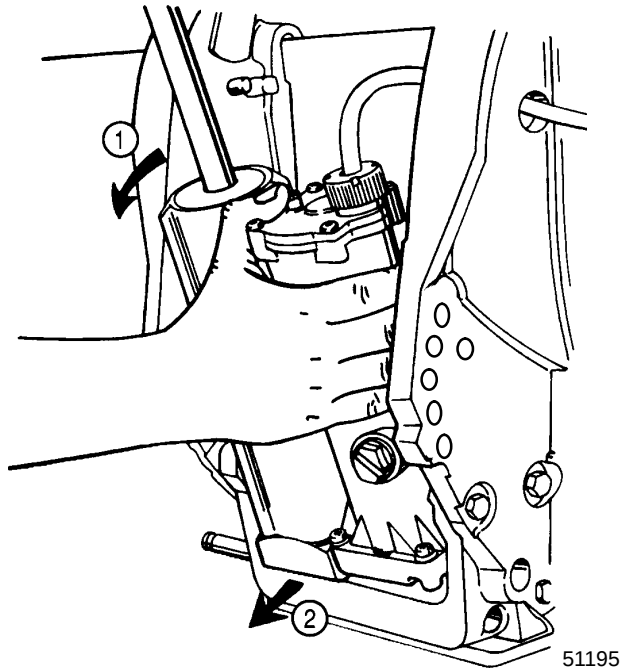


51144

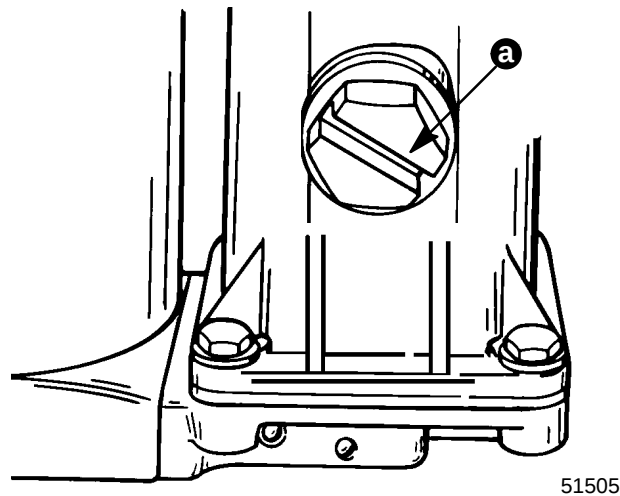
- a - Pivot Pin



8. Tilt power trim assembly (top first) out from clamp bracket and remove assembly.

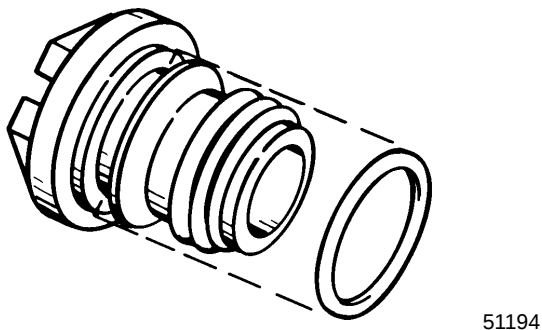


9. Remove fill screw and drain unit.



a - Fill Screw

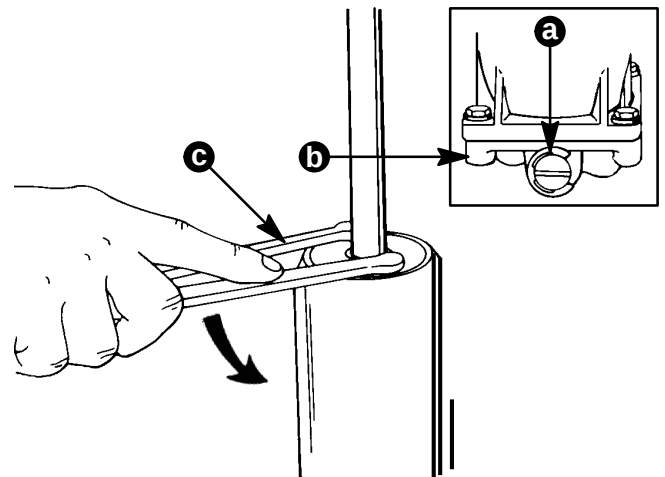
10. Remove O-ring from fill cap.



## Power Trim System Disassembly

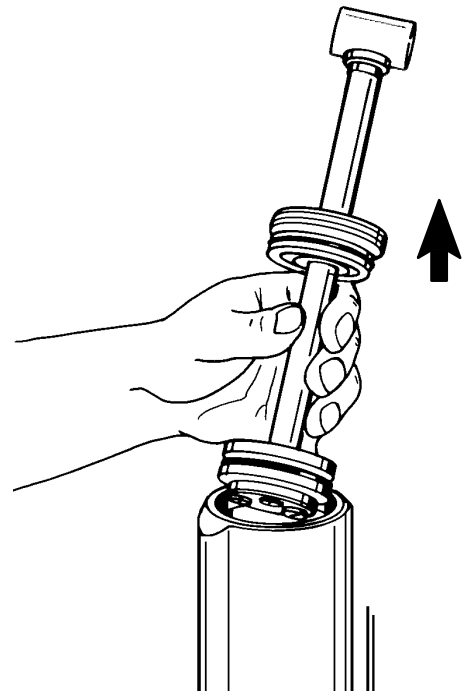
### Trim Rod Removal

1. Secure power trim assembly in soft jawed vise.
2. Open manual release valve three turns **maximum** (counterclockwise) and position trim rod to full up position.
3. Remove cylinder end cap assembly from cylinder using spanner wrench (1/4 in. x 5/16 in. long pegs).



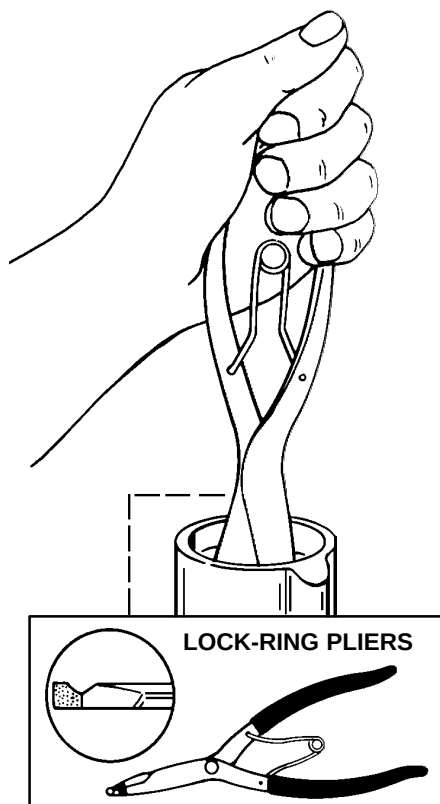
a - Manual Release Valve  
b - Manifold  
c - Spanner Wrench (P/N 91-74951)

4. Remove trim rod assembly from cylinder.

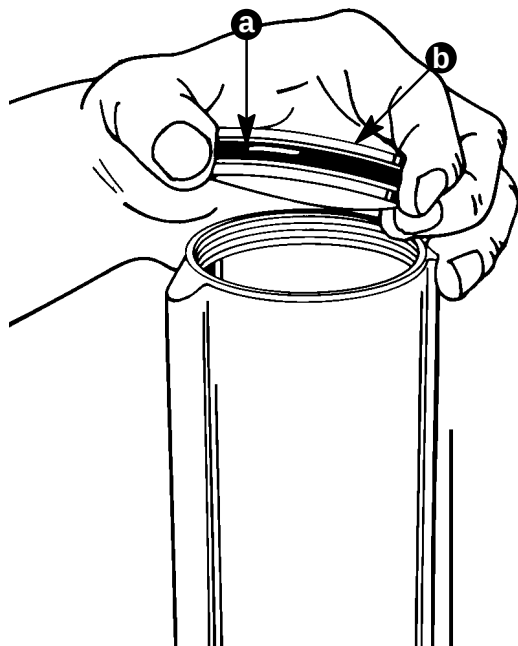




5. Remove memory piston from cylinder using lock-ring pliers (Craftsman P/N 4735) or suitable tool.



6. Remove O-ring from memory piston.

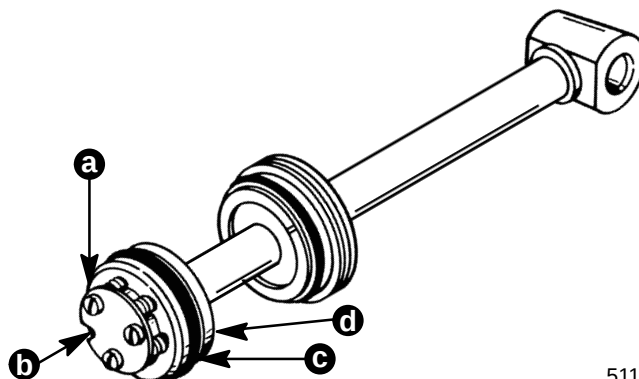


- a - O-ring  
b - Memory Piston

7. Remove trim system from vise and empty fluid into appropriate container.

## Trim Rod Disassembly

1. Place trim rod assembly on clean work surface.
2. Remove screws securing plate to trim rod piston and O-ring.
3. Remove check ball components from trim rod piston.



51143

- a - Screw (3)  
b - Plate  
c - O-ring  
d - Piston

### ⚠ CAUTION

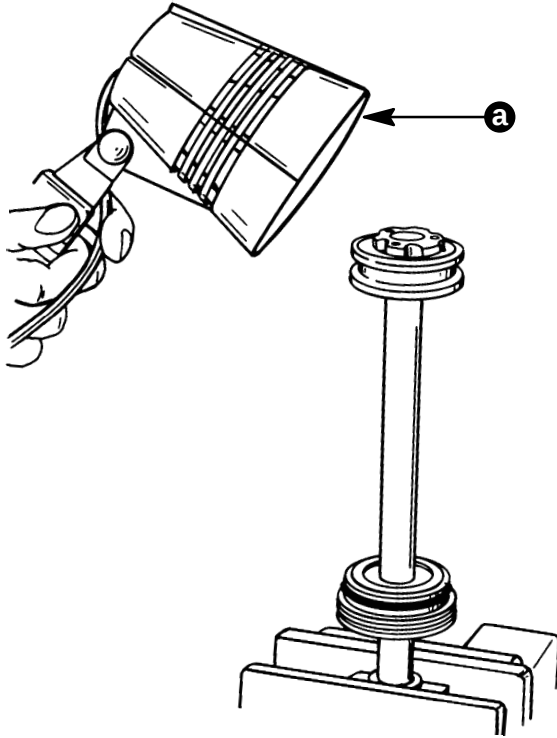
When removing Trim Rod piston, spanner wrench must have 1/4 in. x 5/16 in. long pegs to avoid damage to trim piston.

51193

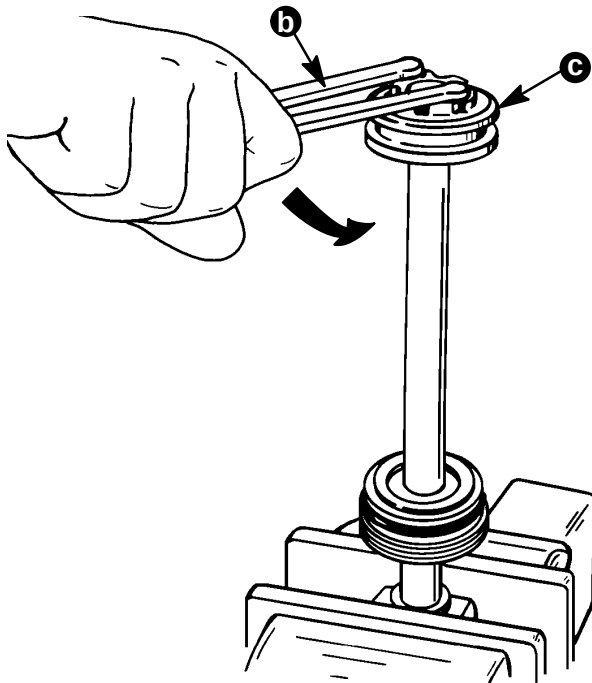
51196



4. Place trim rod into soft jawed vise and apply heat to shock piston using torch lamp (a) (P/N 91-63209).
5. Loosen trim rod piston using spanner wrench (1/4 in. x 5/16 in. long pegs).
6. Allow trim rod piston to cool. Remove from trim rod.



a - Torch Lamp



b - Spanner Wrench  
c - Trim Rod Piston

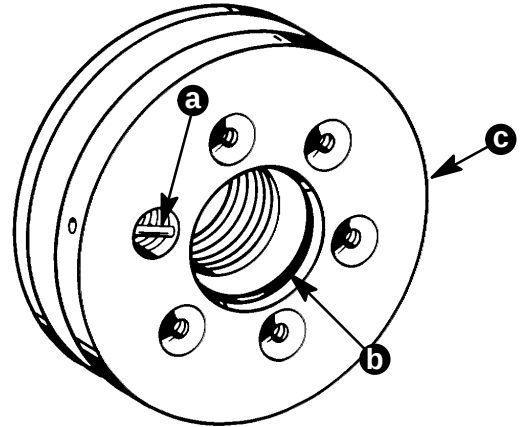
51146

51146

## ⚠ CAUTION

Do not remove check ball components (a) from trim rod piston. Removal and re-installation of check valve could result in improper operating pressure and possible power trim system damage. If check valve is defective, replace trim rod piston.

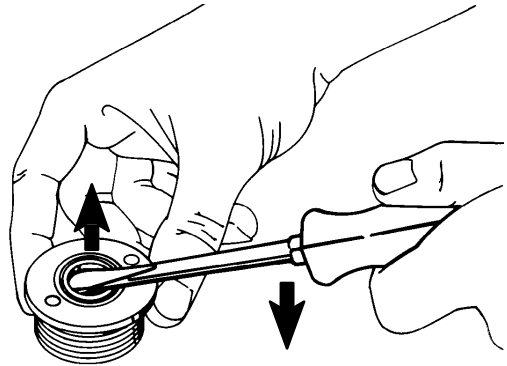
7. Remove inner O-ring from piston.



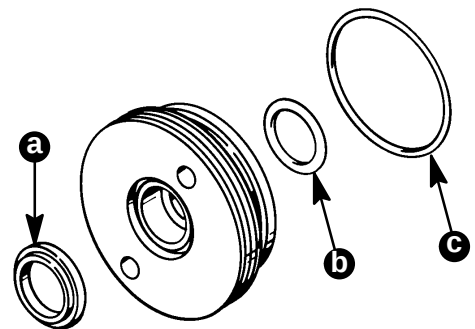
51199

a - Check Ball Components  
b - O-ring  
c - Piston

8. Remove rod wiper, inner O-ring and outer O-ring.



51147



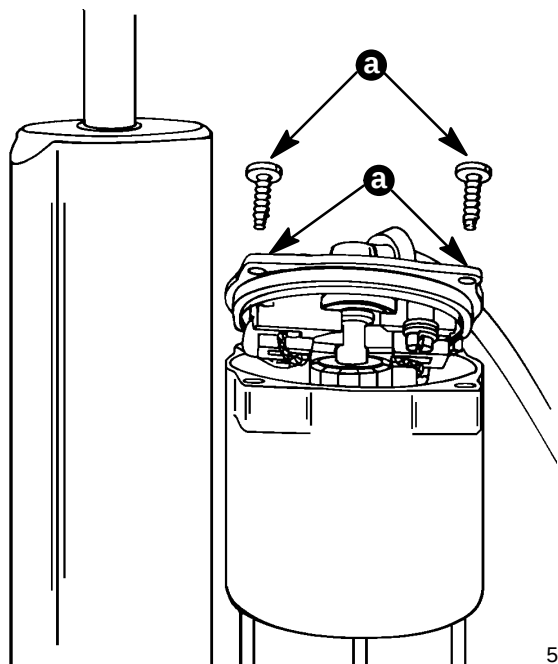
51145

a - Rod Wiper  
b - Inner O-Ring  
c - Outer O-Ring



## Trim "Motor" Removal

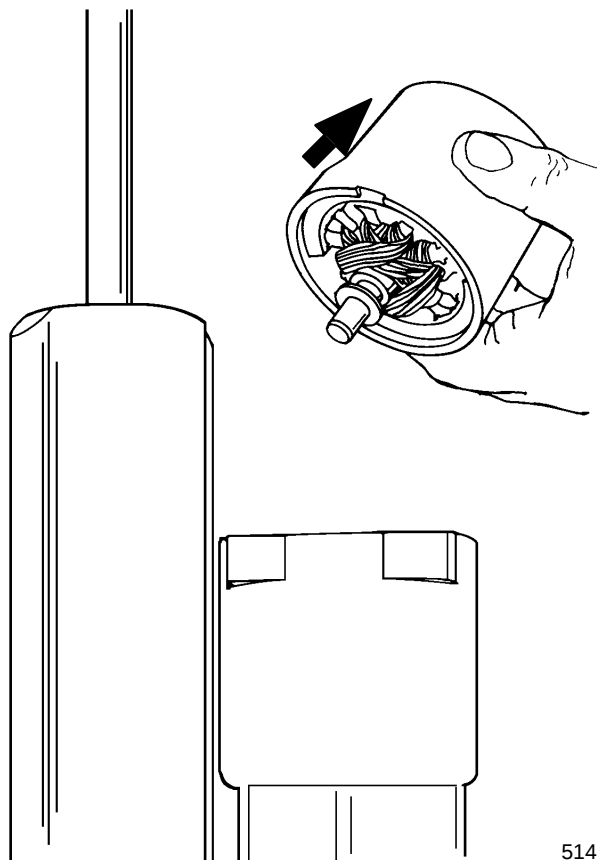
1. Secure power trim assembly in soft jawed vise.
2. Remove screws securing end cap to reservoir and remove end cap.



51486

a - Screws (4)

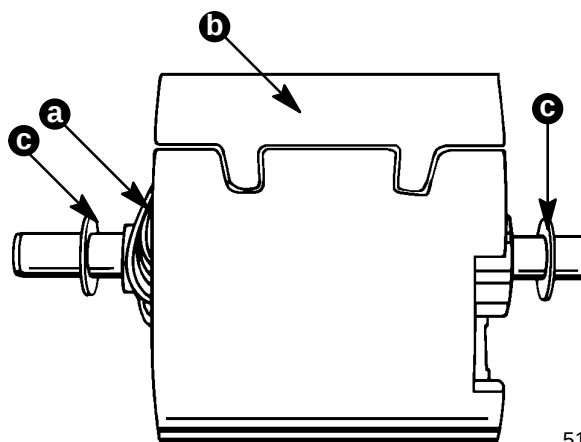
3. Remove motor from reservoir.



51484

## Trim "Motor" Disassembly

1. Remove armature from motor frame. Note position of washers on armature.

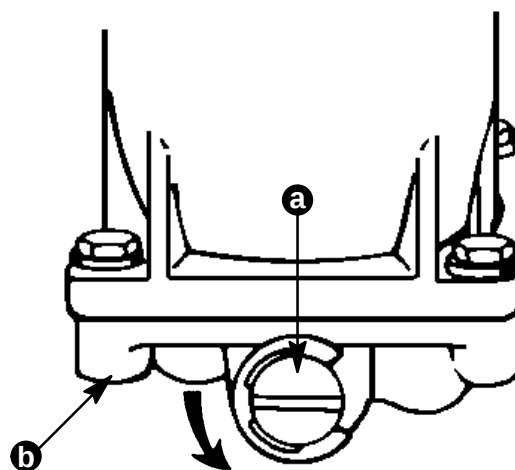


51486

a - Armature  
b - Motor Frame  
c - Washer (1 each end of armature)

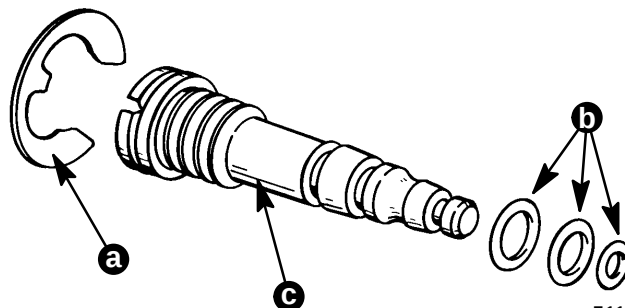
## Reservoir Assembly Removal

1. Remove manual release valve from manifold.



a - Manual Release Valve  
b - Manifold

2. Remove "E" clip and O-rings from manual release valve.

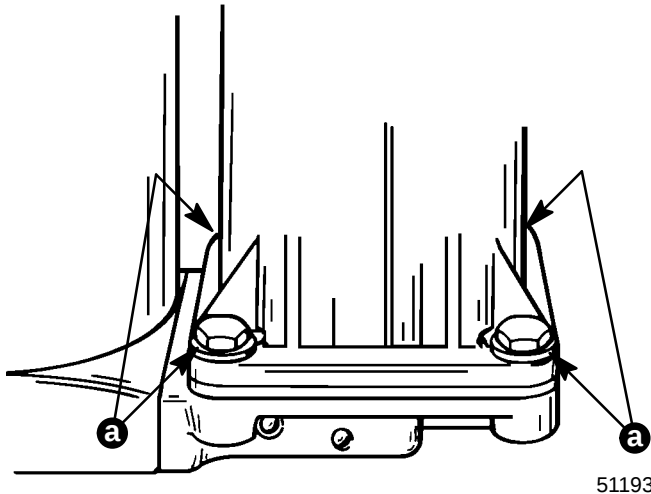


51196

a - "E" Clip  
b - O-rings  
c - Manual Release Valve

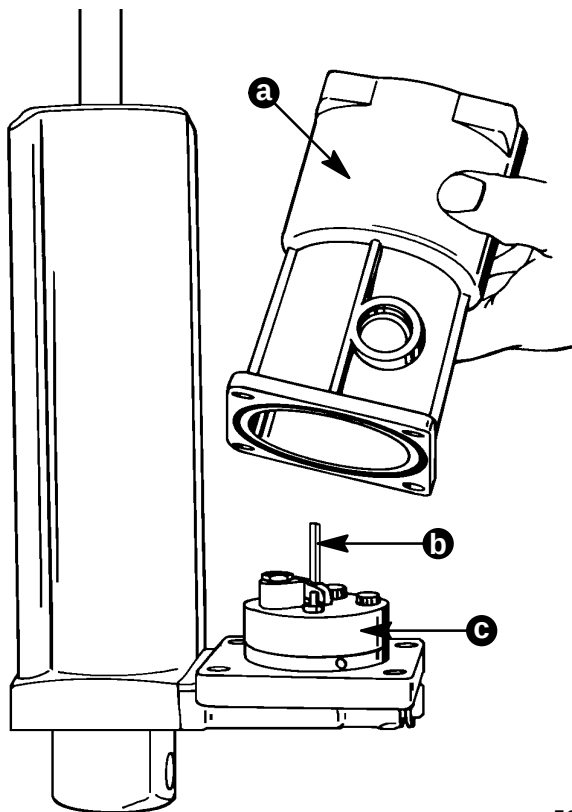


3. Remove four screws securing reservoir to manifold.



a - Screws (4)

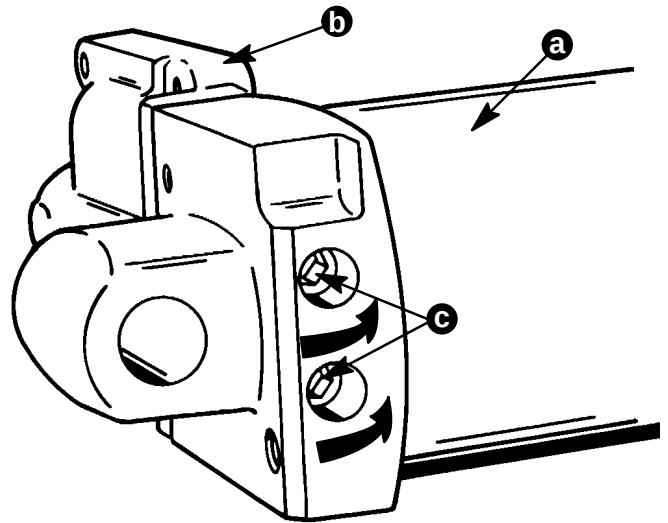
4. Remove reservoir from manifold.
5. Remove drive shaft from oil pump.



a - Reservoir  
b - Drive Shaft  
c - Oil Pump

## Manifold Removal

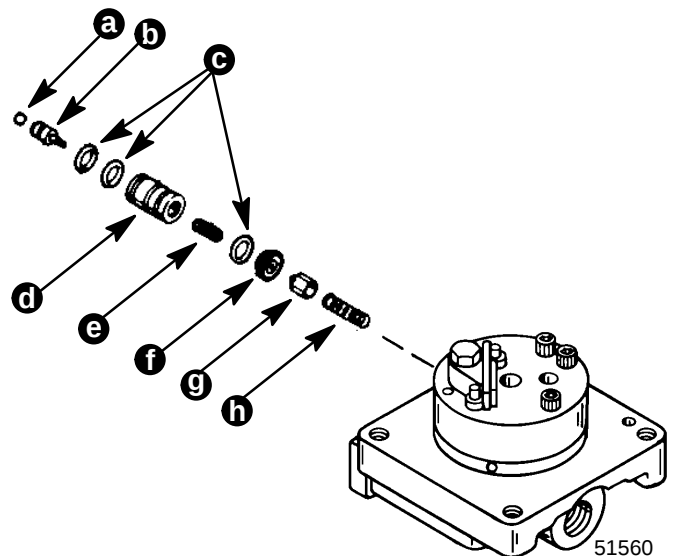
1. Remove screws and manifold from cylinder.



a - Trim Cylinder  
b - Manifold  
c - Screw (2)

2. Remove check valve components from manifold.

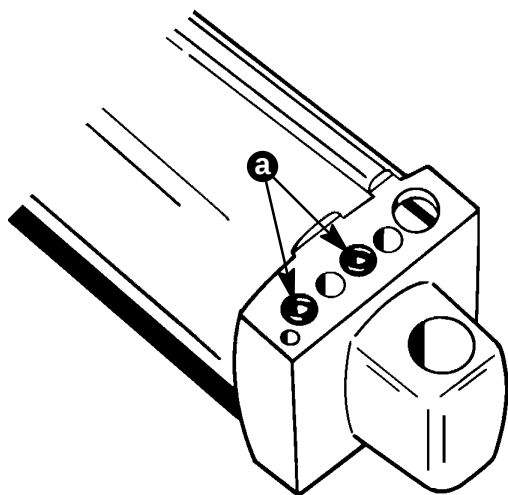
**IMPORTANT:** Sleeve (d) is chamfered on I.D. on end opposite drilled cross hole. Install spool (b) (with O-ring installed) from chamfered end of sleeve to avoid possibility of damaging O-ring on spool.



a - O-ring (0.114 I.D.)  
b - Spool  
c - O-ring (0.301 I.D.) (3 each)  
d - Sleeve  
e - Spring  
f - Valve Seat  
g - Valve  
h - Spring



3. Remove O-rings from cylinder.



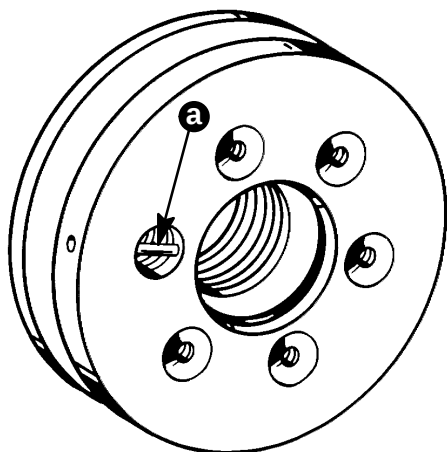
51008

a - O-rings (2)

## Cleaning and Inspection of Trim Rod Components

### ⚠ CAUTION

Do not remove check ball components (a) from trim rod piston. Removal and re-installation of check valve could result in improper operating pressure and possible power trim system damage.



51199

Inspect check valve for debris; clean debris from check valve if found. If debris cannot be cleaned from check valve, replace trim rod piston as an assembly.

Clean trim rod and components with parts cleaner and dry with compressed air.

It is recommended that all O-rings in trim system be replaced.

Inspect trim rod. If scraper (located in cap) has failed to keep rod clean, replace scraper.

Lubricate all O-rings using Quicksilver Power Trim and Steering Fluid or; (ATF) Type F, FA or Dexron II.

## Motor and Electrical Tests/Repair

### Trim Pump Motor Test

#### ⚠ WARNING

Do not perform this test near flammables (or explosives), as a spark may occur when making connections.

1. Disconnect green (motor) wire and blue (motor) wire from trim system wiring harness.
2. Connect a 12 volt power supply to motor wires (positive to blue; negative to green results in motor up direction. Positive to green; negative to blue results in motor down direction). Motor should run.
3. If motor does not run, disassemble motor and check components.

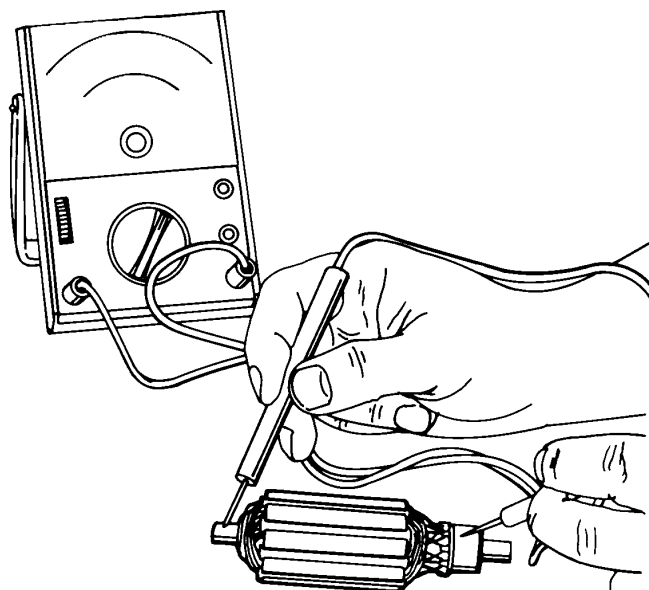
### Armature Tests

#### TEST FOR SHORTS

Check armature on a Growler (follow Growler manufacturer's test instructions). Indication of a short requires replacement of armature.

#### TEST FOR GROUND

Use an Ohmmeter (R x 1 scale). Place one lead on Ohmmeter on armature shaft and other lead on commutator, as shown. If continuity is indicated, armature is grounded and must be replaced.



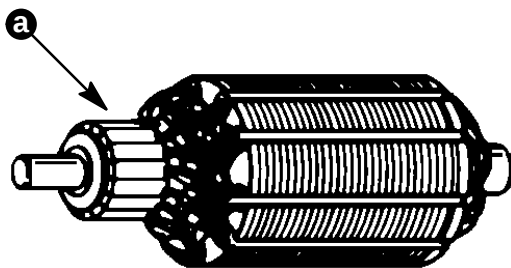
51195



## CHECKING AND CLEANING COMMUTATOR

If commutator (a) is worn it can be turned down on an armature conditioner tool or on a lathe.

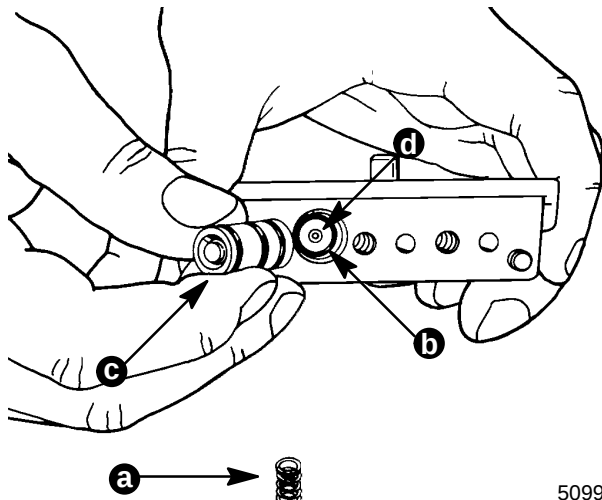
Clean commutator with "00" sandpaper.



## Power Trim System Reassembly

### Manifold Installation

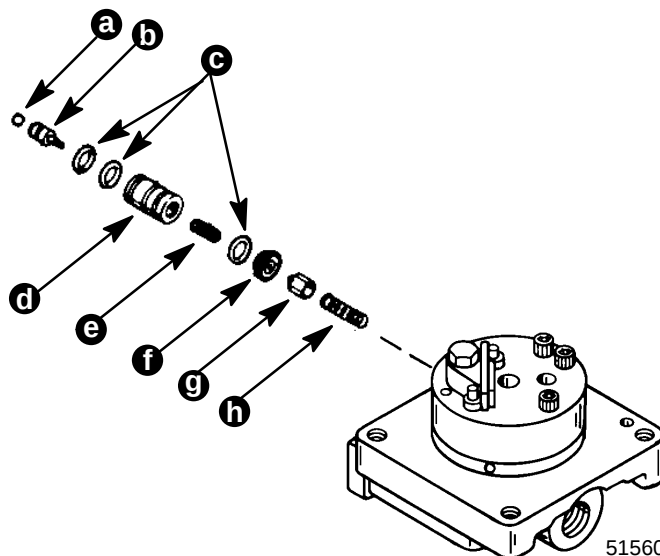
**IMPORTANT:** Install spring, check valve and O-ring into manifold. Position components in place using sleeve to seat in place. It is recommended that O-ring and valve seat be replaced when installing Screw and Seal Kit 811226A1 in manifold.



- a - Spring
- b - O-ring
- c - Sleeve
- d - Valve Seat

50999

1. Install check valve components into manifold.

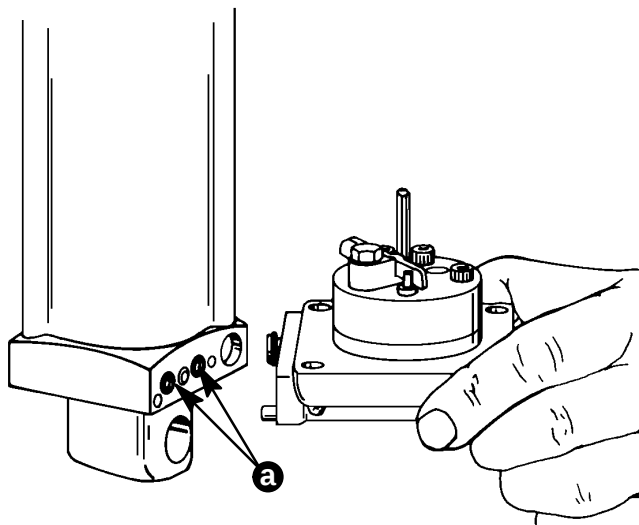


- a - O-ring (0.114 I.D.)
- b - Spool
- c - O-ring (0.301 I.D.) (3 each)
- d - Sleeve
- e - Spring
- f - Valve Seat
- g - Valve
- h - Spring

51560

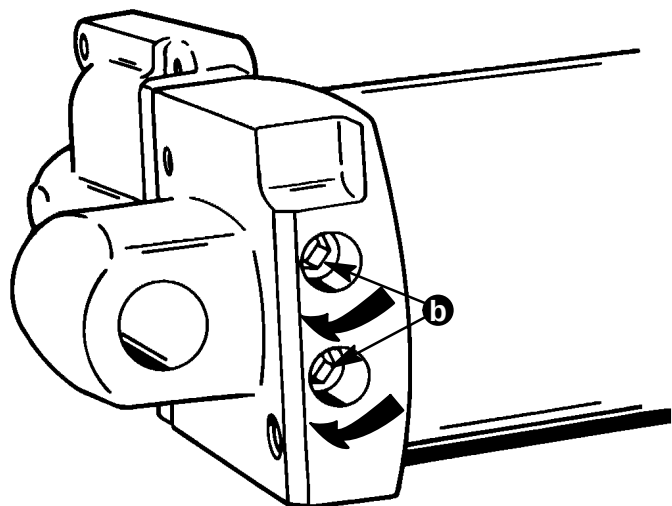
**IMPORTANT:** Sleeve (d) is chamfered on I.D. on end opposite drilled cross hole. Install spool (e) (with O-ring installed) from chamfered end of sleeve to avoid possibility of damaging O-ring on spool.

2. Install O-rings on cylinder and secure manifold assembly to cylinder using screws. Torque screws to 100 lb. in. (11.0 N-m).



- a - O-rings (2)

51486



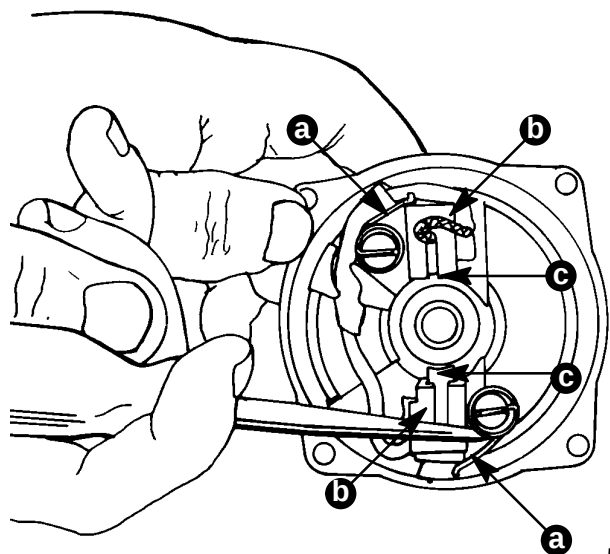
51007

b - Screws [100 lb. in. (11 N·m)] (2)

3. Secure power trim unit in soft jawed vise.

## Trim Motor Reassembly

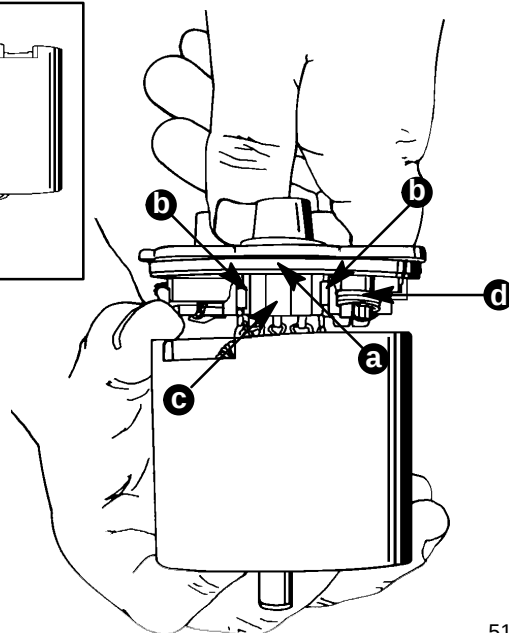
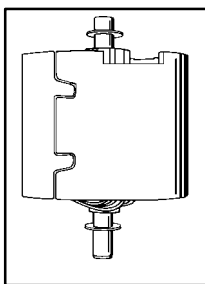
1. Place brush tension springs on outer ends of brush housings to release tension on brushes.



51485

a - Brush Tension Spring (2)  
b - Brush Housing (2)  
c - Brush (2)

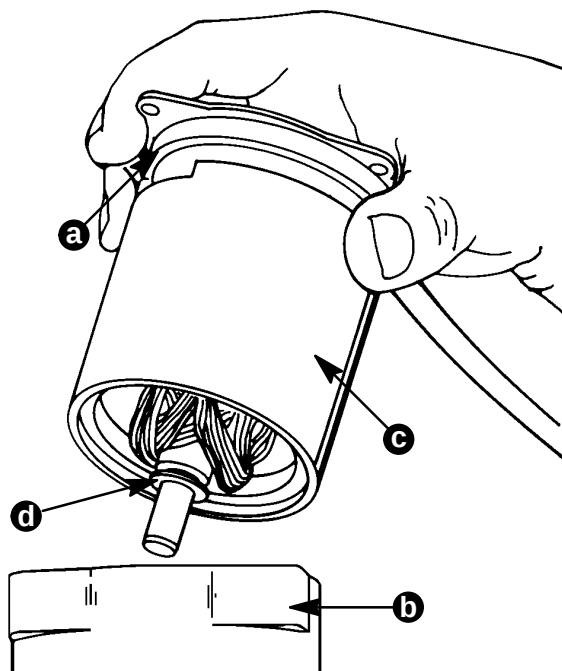
2. Lubricate end cap bushing with Quicksilver 2-4-C Lubricant and install armature and motor frame into end cap. As brushes contact commutator, release brush tension spring from ends of brush housings (returning springs to apply brush pressure to commutator). Install washer on each end of armature before installing armature into end cap (see inset).



51484

a - End Cap Bushing. Lubricate with Quicksilver 2-4-C Lubricant  
b - Brush (2)  
c - Commutator  
d - Brush Tension Spring (2)

3. Guide armature and motor frame into reservoir housing as shown.



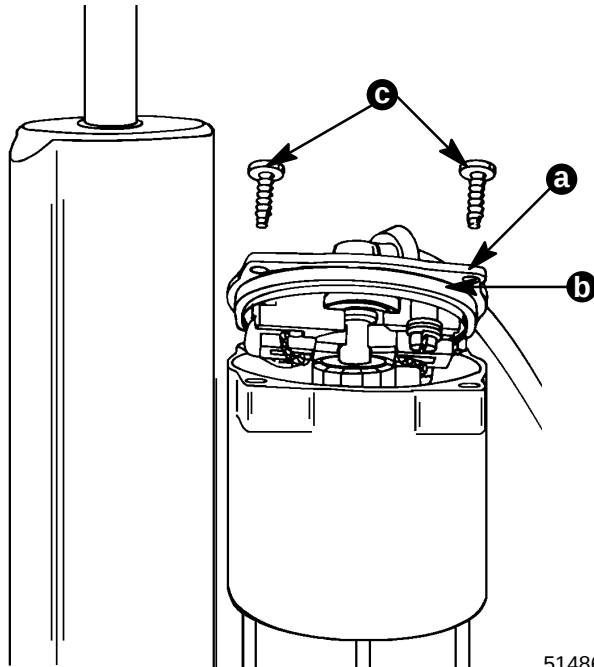
51485

a - End Cap  
b - Motor Housing  
c - Armature and Motor Frame  
d - Washer (One Each End of Armature)



## Reservoir Installation

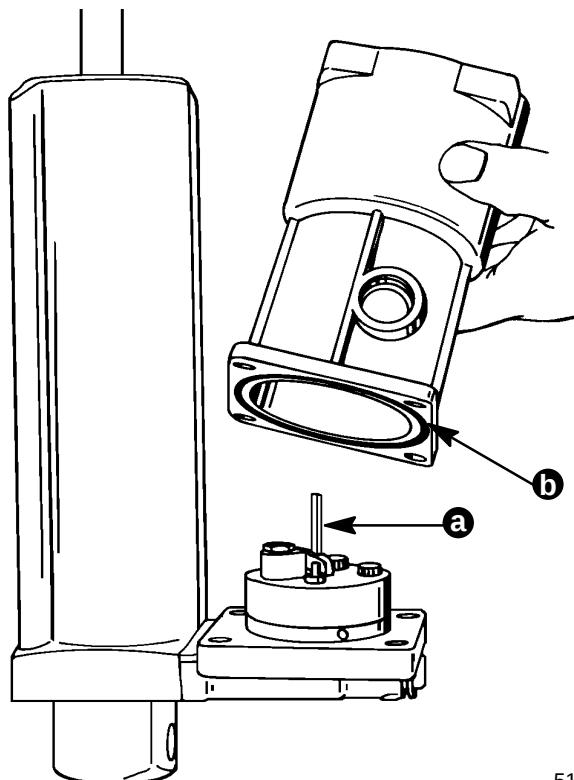
1. Torque end cap screws to 13 lb. ft. (1.5 N·m).



51486

- a - End Cap
- b - O-ring
- c - Screws (4)

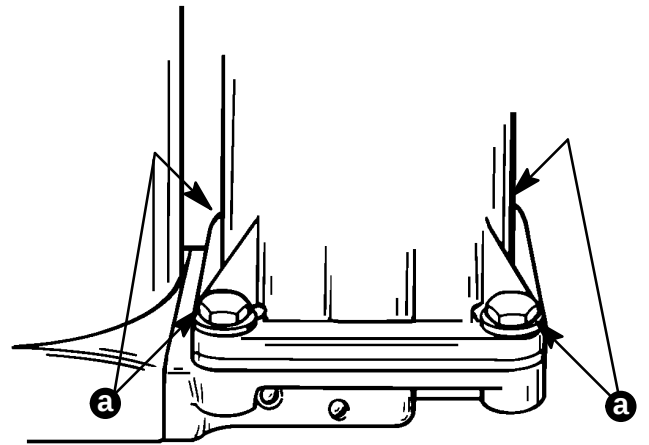
2. Place drive shaft into oil pump.
3. Install lubricated O-ring to base of reservoir.
4. Carefully guide (with motor) down onto drive shaft.



51486

- a - Drive Shaft
- b - O-ring

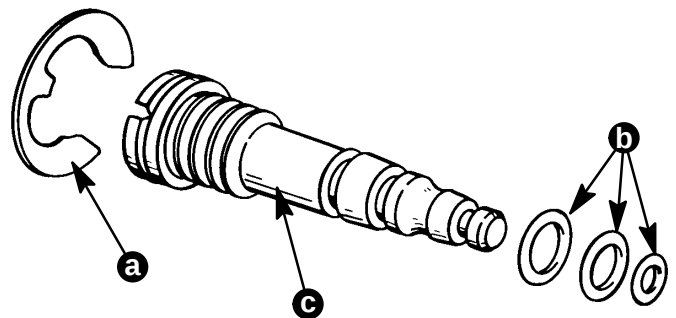
5. Secure reservoir to manifold using four screws. Torque screws to 70 lb. in. (7.7 N·m).



51193

- a - Screws (4)

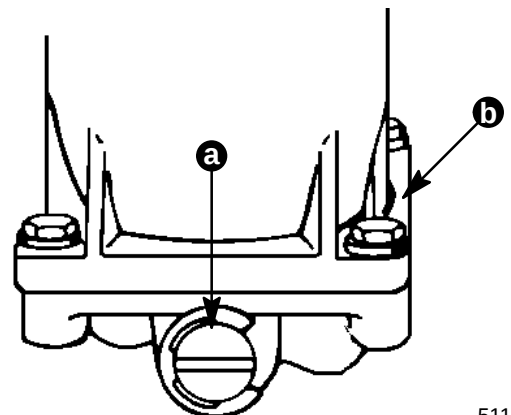
6. Install lubricated O-rings and "E" clip to manual release valve.



51196

- a - "E" Clip
- b - O-ring
- c - Manual Release Valve

7. Insert manual release valve into manifold and tighten snugly. Back release valve out 3 turns **maximum** allowing trim rod installation.



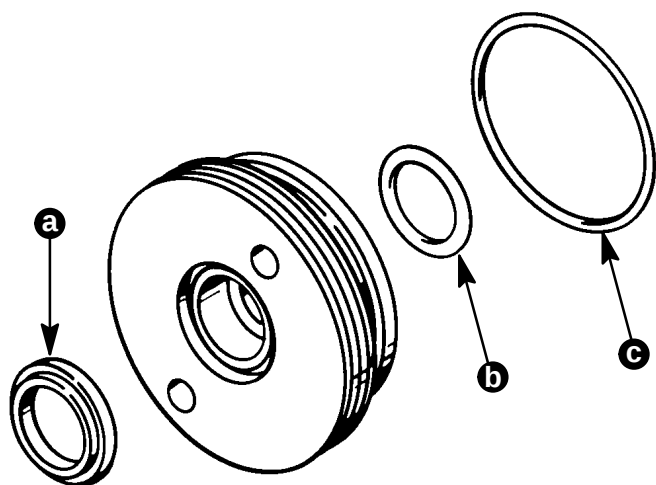
51194

- a - Manual Release Valve
- b - Manifold



## Trim Rod Reassembly

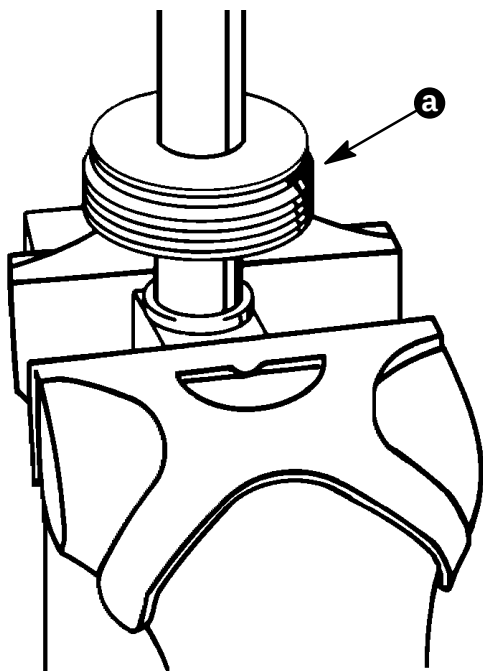
1. Install lubricated O-rings and rod wiper to end cap.



51145

- a - Rod Wiper
- b - Inner O-ring
- c - Outer O-ring

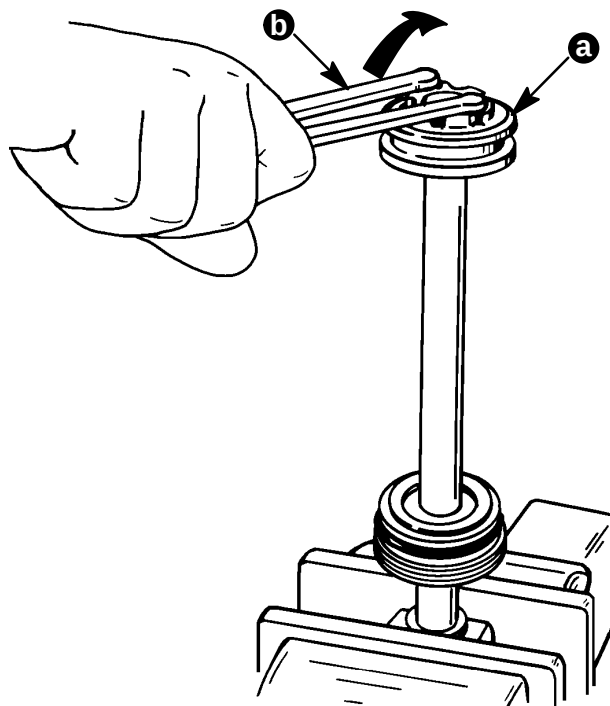
2. Secure trim rod in soft jawed vise as shown.
3. Slide end cap onto trim rod.



51146

- a - End Cap

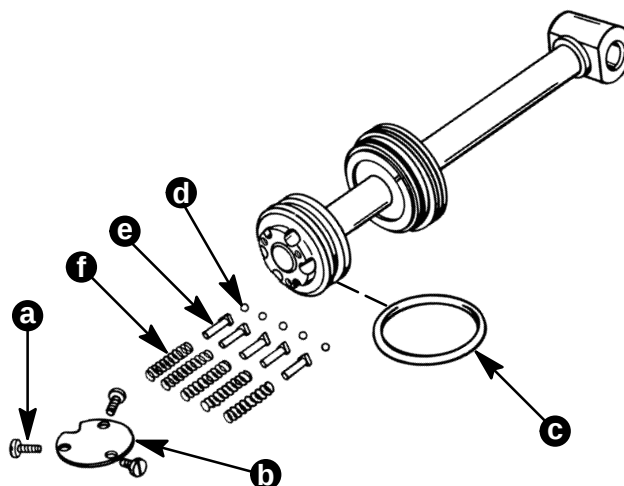
4. Apply Loctite Grade A (271) to threads of trim rod and install rod piston. Tighten piston securely using spanner wrench (1/4 in. x 5/16 in. long peg).



51146

- a - Trim Rod Piston
- b - Spanner Wrench

5. Install lubricated O-ring to trim rod piston.
6. Install check ball components into its respective bore.
7. Secure components in place using plate and screws. Torque screws to 35 lb. in. (4.0 N·m).



51147

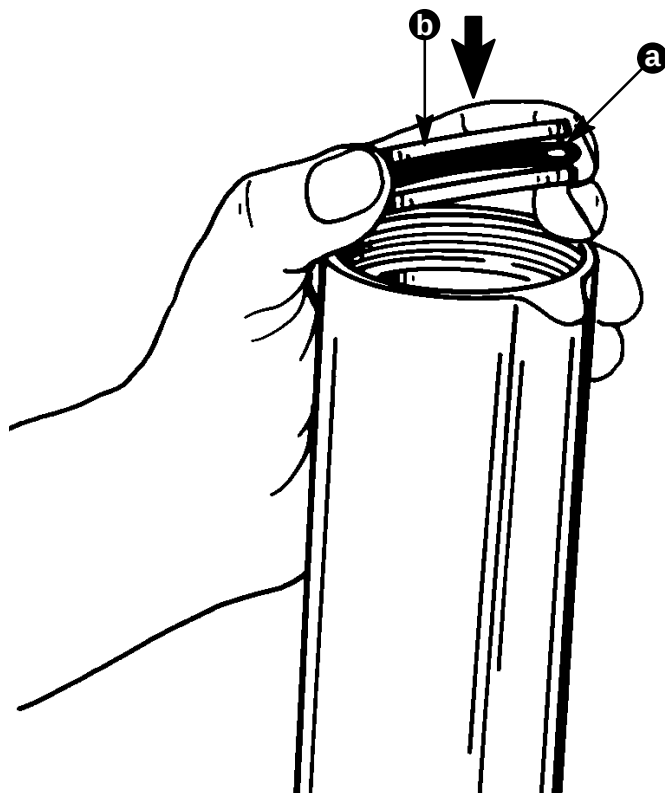
- a - Screw (3)
- b - Plate
- c - O-ring
- d - Ball (5)
- e - Seat, Spring (5)
- f - Spring (5)



## Trim Rod Installation

1. Place trim cylinder in soft jawed vise.
2. Fill trim cylinder three inches (76.2mm) from top of cylinder using Quicksilver Power Trim and Steering Fluid or; (ATF) Type F, FA or Dexron II.
3. Install lubricated O-ring to memory piston and place into cylinder. Push piston down to level of oil.

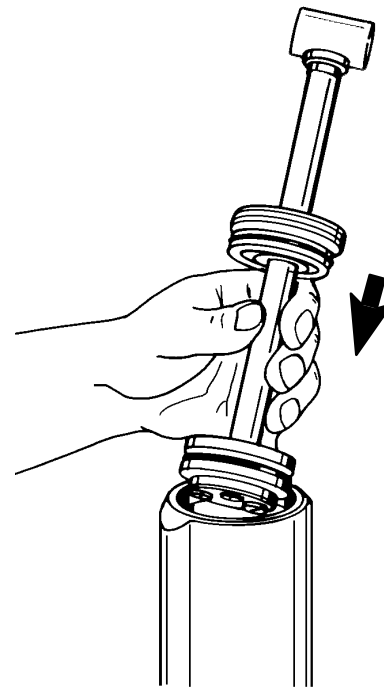
**Memory piston must not contact end cap during trim rod/end cap installation.**



51144

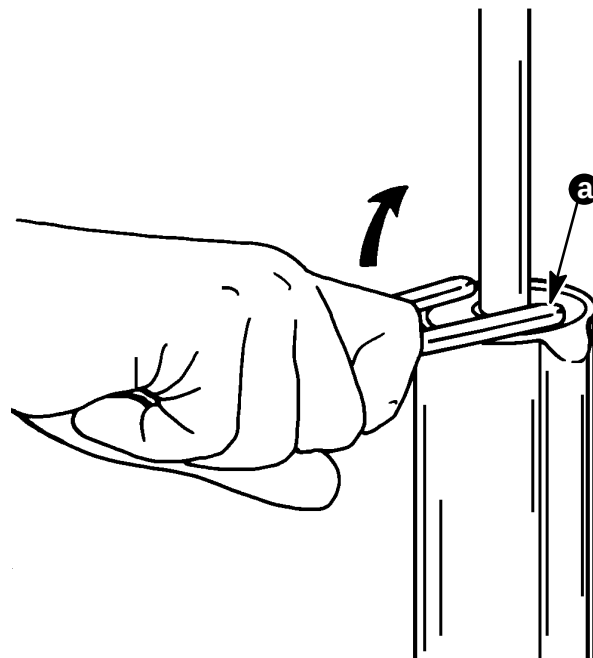
- a - O-ring  
b - Memory Piston

4. Install trim rod into cylinder.



51196

5. Tighten end cap assembly to cylinder securely using spanner wrench (1/4 in. x 5/16 in. long pegs).



51145

- a - Spanner Wrench (P/N 91-74951)

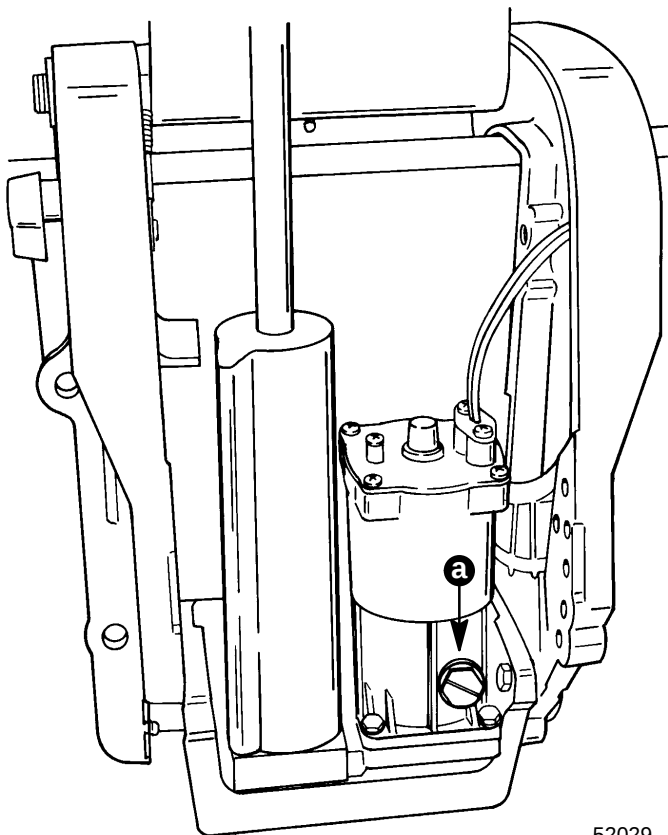
6. Tighten manual release valve snugly following end cap installation.



## Purging Power Trim Unit

**Manual release valve must be in full closed position during power trim purging and operation.**

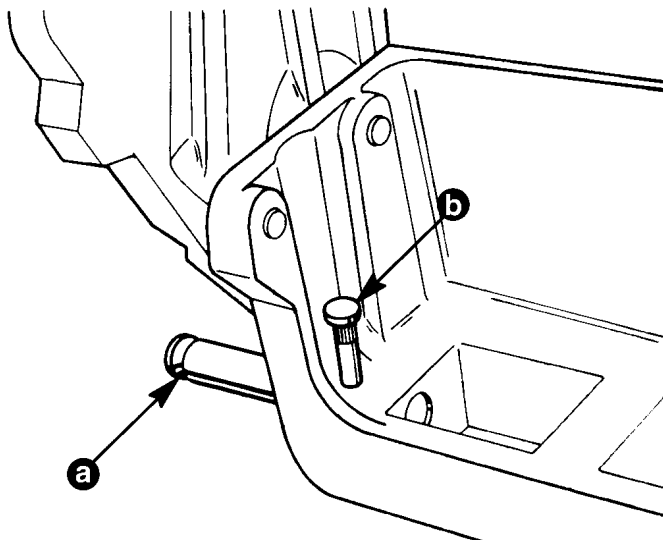
1. Secure power trim unit in soft jawed vise.
2. Remove fill cap (a). Add Quicksilver Power Trim and Steering Fluid (92-90100A12) or Automatic Transmission Fluid (ATF) Type F, FA or Dexron II up to threads of reservoir. Install cap (a).



3. Using a 12 volt power supply connect positive lead to green wire, negative lead to blue wire and drive trim rod to the down position. Connect positive lead to blue wire and negative lead to green wire and drive trim rod to the up position. Re-check fluid level, add fluid as required and repeat cycle until fluid level remains at lower portion of threads.

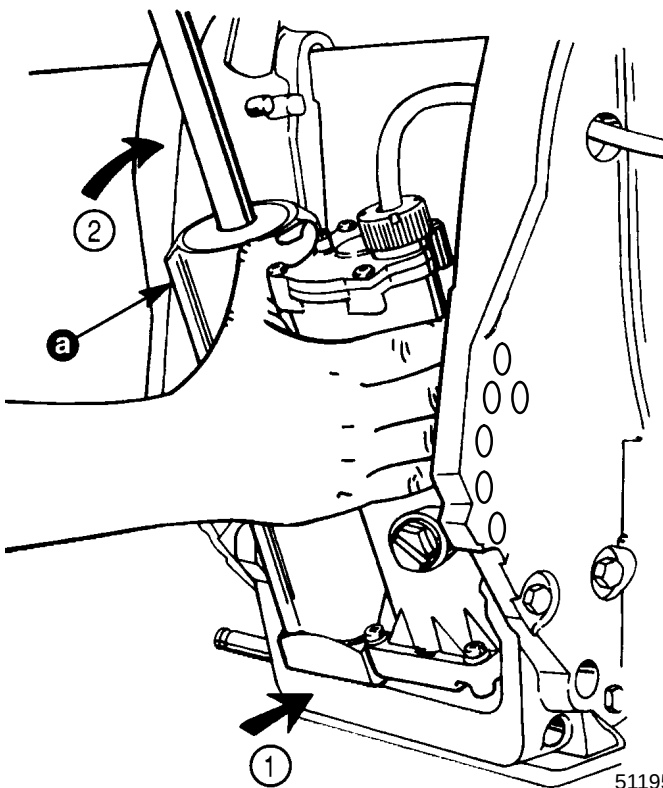
## Power Trim Unit Installation

1. Apply Special Lubricant 101 (92-13872A1) to lower pivot pin bore and pivot pin surface.
2. Start lower pivot pin into pivot pin bore and position lower cross pin (RETAINED) in its respective hole.



a - Lower Pivot Pin  
b - Lower Dowel Pin

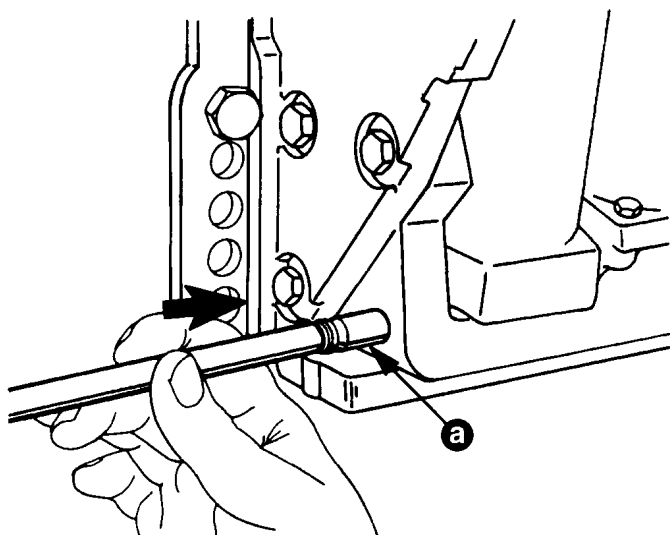
3. Position trim cylinder assembly (BOTTOM FIRST) between clamp brackets and route trim pump electrical harness through access hole in starboard clamp bracket.



a - Trim Cylinder Assembly



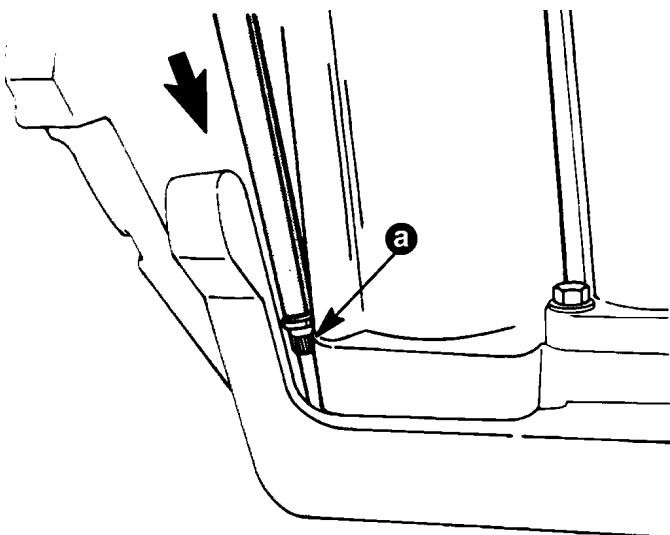
4. Using a suitable punch, drive lower pivot pin into clamp bracket and trim cylinder assembly until pivot pin is flush with outside surface.



51147

a - Lower Cross Pin

5. Using a suitable punch, drive lower pivot pin into clamp bracket and trim cylinder assembly until pivot pin is flush with outside surface.

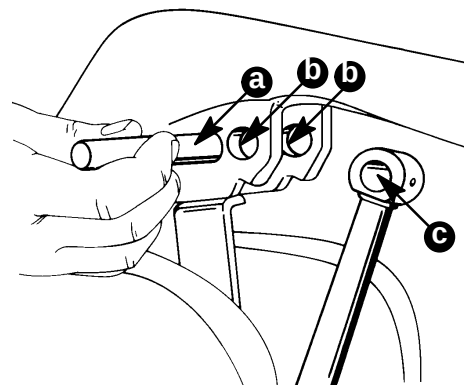


51148

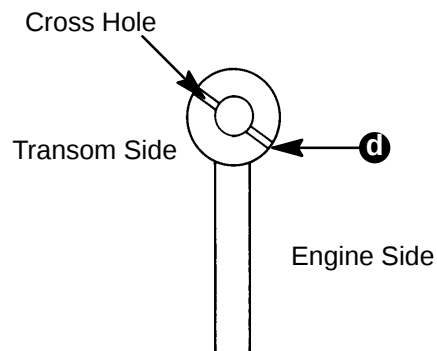
a - Lower Dowel Pin

6. Apply Special Lubricant (92-13872A1) to surface of upper pivot pin, pivot pin bore and trim ram bore.

**NOTE:** Install trim ram with cross hole located as shown. If trim ram is installed reversed, the trim sender (if installed) will not operate.



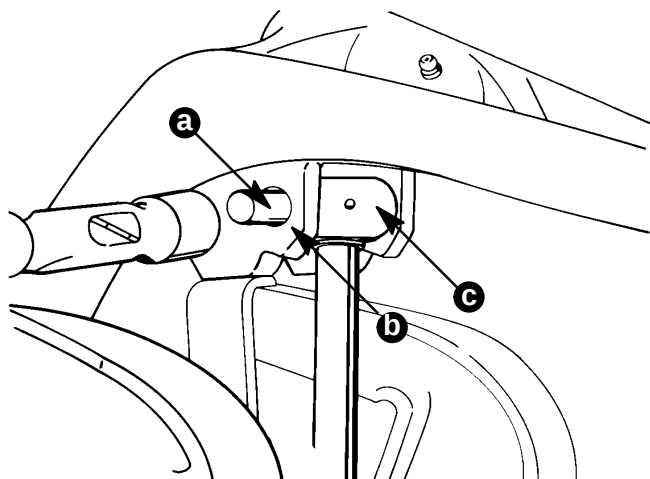
51515



- a - Pivot Pin  
b - Pivot Pin Bore  
c - Trim Ram Bore  
d - Install Trim Ram As Shown



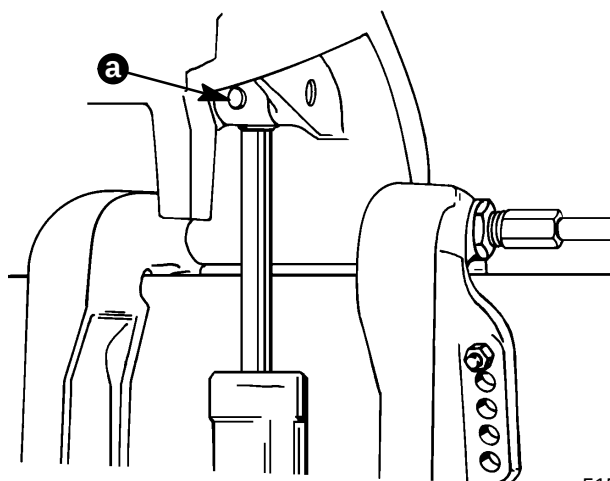
7. Using a suitable mallet, drive upper pivot pin into swivel bracket and through trim ram until pivot pin is flush with swivel bracket.



51515

- a - Pivot Pin  
b - Swivel Bracket  
c - Trim Ram

8. Drive upper retaining pin (a) in until seated.

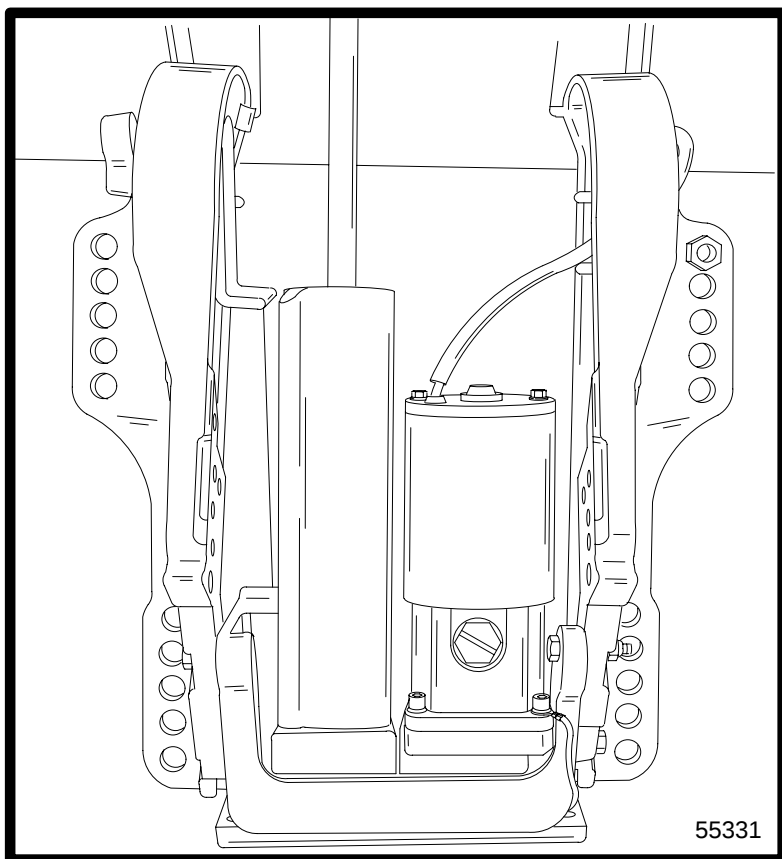


51505

9. Recheck fluid level.
10. Power trim may now be operated to lower outboard to desired position. Trim system is self purging.
11. Reconnect power trim leads to relays under ignition cover.
12. Reinstall spark plug leads to spark plugs.
13. Reinstall cowls.
14. Connect battery leads to battery terminals.



# MID-SECTION



5

E

## POWER TRIM (DESIGN 4)



# Table of Contents

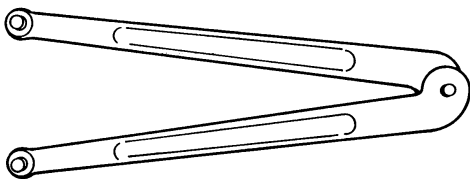
|                                          | Page  |
|------------------------------------------|-------|
| Special Tools .....                      | 5E-1  |
| Theory Of Operation .....                | 5E-4  |
| Adjustments .....                        | 5E-4  |
| Trimming Characteristics .....           | 5E-4  |
| Trimming Outboard "Up" ("Out") .....     | 5E-4  |
| Trimming Outboard "Down" ("In") .....    | 5E-4  |
| Trailing Outboard .....                  | 5E-5  |
| Tilting Outboard Up and Down             |       |
| Manually .....                           | 5E-5  |
| Trim Up .....                            | 5E-7  |
| Tilt Up .....                            | 5E-9  |
| Maximum Tilt .....                       | 5E-11 |
| Down Mode .....                          | 5E-13 |
| Shock Function Up .....                  | 5E-15 |
| Shock Function Return .....              | 5E-17 |
| Manual Tilt .....                        | 5E-19 |
| Troubleshooting .....                    | 5E-20 |
| Preliminary Checks .....                 | 5E-20 |
| Hydraulic System Troubleshooting         |       |
| Flow Chart .....                         | 5E-21 |
| Hydraulic System Troubleshooting         |       |
| Flow Chart .....                         | 5E-22 |
| Hydraulic System Troubleshooting         |       |
| Flow Chart .....                         | 5E-23 |
| Hydraulic System Troubleshooting         |       |
| Flow Chart .....                         | 5E-24 |
| Troubleshooting the Power Trim           |       |
| Electrical System (Wiring Diagram) ..... | 5E-25 |
| Troubleshooting the Power Trim           |       |
| Electrical System .....                  | 5E-26 |

|                                               | Page  |
|-----------------------------------------------|-------|
| Power Trim System Removal .....               | 5E-27 |
| Power Trim Disassembly .....                  | 5E-28 |
| Trim Motor Removal .....                      | 5E-29 |
| Pump and Components Removal .....             | 5E-29 |
| Manifold Removal .....                        | 5E-30 |
| Shock Rod Removal .....                       | 5E-30 |
| Shock Rod Disassembly .....                   | 5E-31 |
| Memory Piston Removal .....                   | 5E-33 |
| Cleaning/Inspection/Repair .....              | 5E-34 |
| Trim Motor Electrical Tests .....             | 5E-34 |
| Reassembly .....                              | 5E-35 |
| O-Ring and Seal Placement .....               | 5E-35 |
| O-ring Sizes .....                            | 5E-36 |
| O-ring Description and Sizes .....            | 5E-37 |
| Power Trim Reassembly .....                   | 5E-38 |
| Shock Rod Reassembly .....                    | 5E-38 |
| Shock Rod Installation .....                  | 5E-39 |
| Trim Limit Assembly Installation .....        | 5E-40 |
| Manual Release Valve Installation .....       | 5E-40 |
| Manifold Installation .....                   | 5E-40 |
| Oil Pump Installation .....                   | 5E-41 |
| Pressure Operated Assembly Installation ..... | 5E-42 |
| Reservoir/Motor Installation .....            | 5E-42 |
| Bleeding Power Trim Unit .....                | 5E-43 |
| Installation of Power Trim System .....       | 5E-43 |

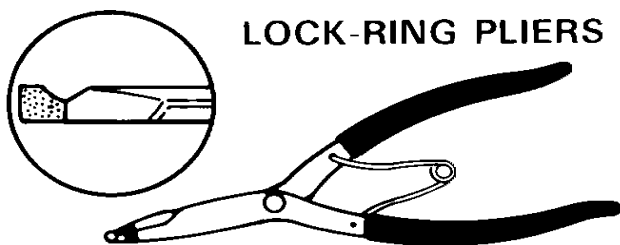


## Special Tools

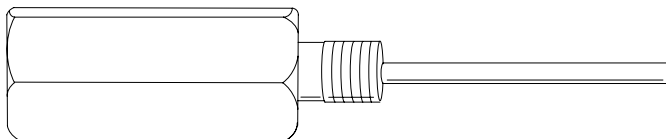
1. Spanner Wrench P/N 91-74951



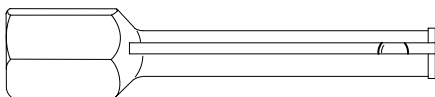
2. Lock-Ring Pliers P/N 91-822778A3



3. Expanding Rod P/N CG 41-11



4. Collet P/N CG 41-14







## POWER TRIM COMPONENTS

| REF. NO. | QTY. | DESCRIPTION                | TORQUE      |         |      |
|----------|------|----------------------------|-------------|---------|------|
|          |      |                            | lb. in.     | lb. ft. | N·m  |
| –        | 1    | POWER TRIM PUMP            |             |         |      |
| 1        | 1    | SHOCK ROD KIT              |             | 45      | 61   |
| 2        | 1    | MEMORY PISTON ASSEMBLY     |             |         |      |
| 3        | 1    | O RING REBUILD KIT         |             |         |      |
| 4        | 2    | O RING                     |             |         |      |
| 5        | 1    | CYLINDER ASSEMBLY          |             |         |      |
| 6        | 1    | TRIM LIMIT VALVE KIT       |             |         |      |
| 7        | 1    | PUMP ASSEMBLY              |             |         |      |
| 8        | 1    | MOTOR KIT                  |             |         |      |
| 9        | 1    | RESERVOIR PLUG             | Drive Tight |         |      |
| 10       | 1    | MANUAL RELEASE ASSEMBLY    | Drive Tight |         |      |
| 11       | 1    | MANIFOLD KIT               |             |         |      |
| 12       | 1    | SCREW KIT (MOTOR)          | 80          |         | 9.0  |
| 13       | 1    | DRIVE SHAFT                |             |         |      |
| 14       | 1    | FILTER KIT                 |             |         |      |
| 15       | 1    | P.O. CHECK ASSEMBLY KIT    | 120         |         | 13.5 |
| 16       | 1    | CABLE                      |             |         |      |
| –        | 1    | O RING KIT (COMPLETE TRIM) |             |         |      |
| 17       | 2    | GROOVE PIN                 |             |         |      |
| 18       | 1    | ANCHOR PIN                 |             |         |      |
| 19       | 1    | PIN                        |             |         |      |
| 20       | 1    | BRACKET                    |             |         |      |
| 21       | 1    | HARNESS-Trim               |             |         |      |
| 22       | 2    | SCREW (M6 x 25)            |             |         |      |
| 23       | 2    | RELAY                      |             |         |      |
| 24       | 2    | BRACKET                    |             |         |      |
| 25       | 2    | GROMMET                    |             |         |      |
| 26       | 2    | BUSHING                    |             |         |      |

**A** – Torque cylinder cap to 45 lb. ft. (61 N·m)

**B** – Torque screws to 80 lb. in. (9.0 N·m)

**C** – Torque screws to 70 lb. in. (7.9 N·m)

**D** – Torque plugs to 120 lb. in. (13.5 N·m)

**E** – Torque screws to 100 lb. in. (11 N·m)

**F** – Torque shock piston to 90 lb. ft. (122 N·m)



## Theory Of Operation

The Power Trim system consists of an electric motor, pressurized fluid reservoir, pump and trim cylinder.

The remote control (or trim panel) is equipped with a switch that is used for trimming the outboard “up” and “down”, and for tilting the outboard for shallow water operation (at slow speed), or for “trailing”. The outboard can be trimmed “up” or “down” while engine is under power or when engine is not running.

## Adjustments

### Trimming Characteristics

**NOTE:** Because varying hull designs react differently in various degrees of rough water, it is recommended to experiment with trim positions to determine whether trimming “up” or “down” will improve the ride in rough water.

When trimming your outboard from a mid-trim position (trim tab in neutral, straight fore-and-aft position), you can expect the following results:

#### TRIMMING OUTBOARD “UP” (“OUT”)

##### WARNING

Excessive trim “out” may reduce the stability of some high speed hulls. To correct instability at high speed, reduce the power gradually and trim the motor “In” slightly before resuming high speed operation. (Rapid reduction in power will cause a sudden change of steering torque and may cause additional momentary boat instability.)

- Will lift bow of boat, generally increasing top speed.
- Transfers steering torque harder to left on installations below 23 in. transom height.
- Increases clearance over submerged objects.
- In excess, can cause porpoising and/or ventilation.
- In excess, can cause insufficient water supply to water pump resulting in serious water pump and/or powerhead overheating damage.

##### WARNING

**Excessive engine trim angle will result in insufficient water supply to water pump causing water pump and/or powerhead overheating damage. Make sure that water level is above gear housing water intake holes whenever engine is running.**

Operating “Up” circuit will actuate the “up” relay (located under engine cowl) and close the electric motor circuit. The electric motor will drive the pump, thus forcing automatic transmission fluid through internal passageways into the “up” side of the trim cylinder.

The trim cylinder/trim rod will position the engine at the desired trim angle within the 20° maximum trim range. The power trim system is designed so the engine cannot be trimmed beyond the 20° maximum trim angle as long as engine RPM is above approximately 2000 RPM.

The engine can be raised beyond the 20° maximum trim angle for shallow water operation, etc., by keeping the engine RPM below 2000 RPM. If engine RPM increases above 2000 RPM, the thrust created by the propeller (if deep enough in the water) will cause the trim system to automatically lower the engine back to the 20° maximum trim angle.

#### TRIMMING OUTBOARD “DOWN” (“IN”)

##### WARNING

**Excessive speed at minimum trim “In” may cause undesirable and/or unsafe steering conditions. Each boat should be tested for handling characteristics after any adjustment is made to the tilt angle (tilt pin relocation).**

- Will help planing off, particularly with a heavy load.
- Usually improves ride in choppy water.
- In excess, can cause boat to veer to the left or right (bow steer).
- Transfers steering torque harder to right (or less to the left).
- Improves planing speed acceleration (by moving tilt pin one hole closer to transom).

Operating “Down” circuit will actuate the “down” relay (located under engine cowl) and close the electric motor circuit (motor will run in opposite direction of the “Up” circuit). The electric motor will drive the pump, thus forcing automatic transmission fluid through internal passageways into the “down” side of the trim cylinder. The trim rod will move the engine downward to the desired angle.



## Trailing Outboard

### **⚠ WARNING**

Excessive engine trim angle will result in insufficient water supply to water pump causing water pump and/or powerhead overheating damage. Make sure that water level is above gear housing water intake holes whenever engine is running.

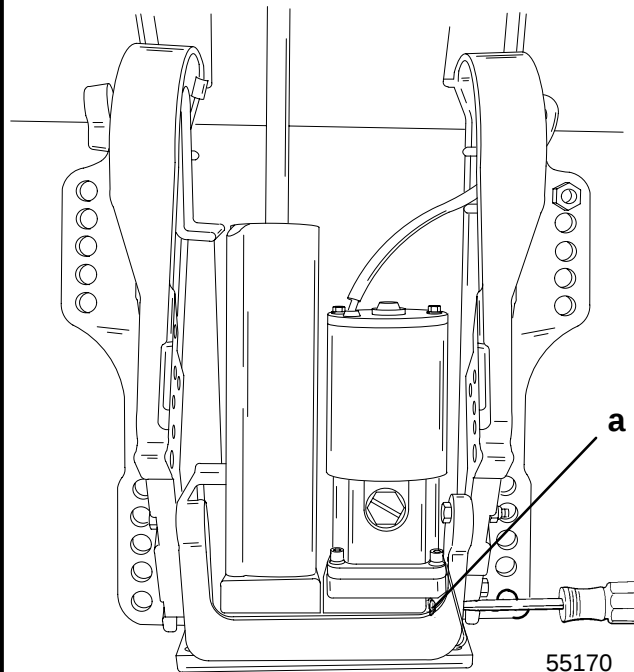
While operating "up" circuit, the cylinder rod will continue to tilt the outboard to a full "up" position for trailering.

## Tilting Outboard Up and Down Manually

### **⚠ WARNING**

Before loosening the manual release valve, make sure all persons are clear of engine as engine will drop to full "down" position when valve is loosened.

With power trim installed, the outboard can be raised or lowered manually by opening the manual release valve 3 to 4 turns (counterclockwise).

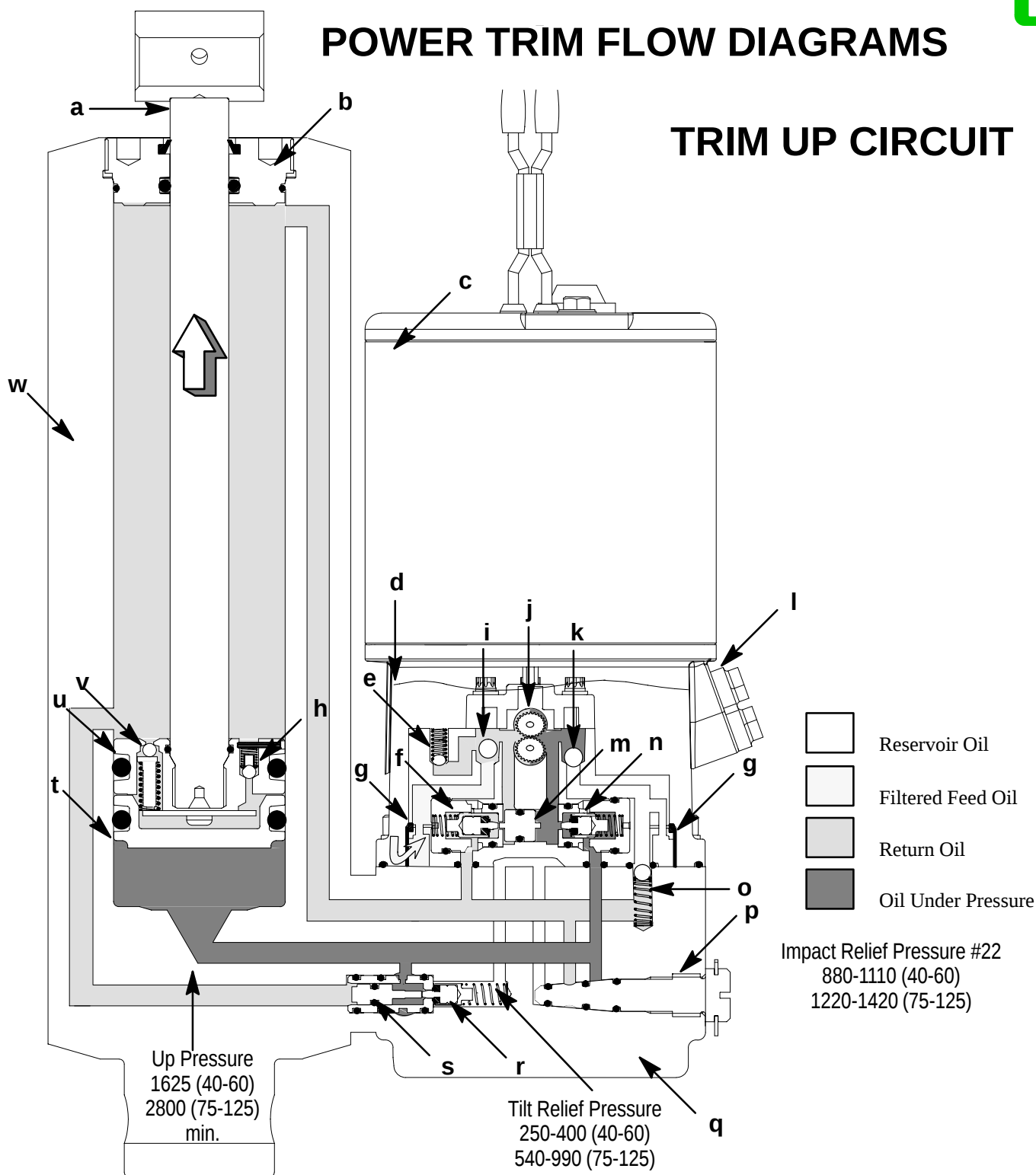


a - Manual Release Valve



# POWER TRIM FLOW DIAGRAMS

## TRIM UP CIRCUIT



- a - Piston Rod
- b - End Cap
- c - Electric Motor
- d - Reservoir Oil
- e - Down Pressure Regulating Valve
- f - Down Pressure Operated Valve
- g - Filter (2 shown for clarity)
- h - Shock Return Valve
- i - Up Circuit Suction Port
- j - Oil Pump
- k - Down Circuit Suction Port
- l - Oil Fill Cap

- m - Shuttle Valve
- n - Up Pressure Operated Valve
- o - Manifold Reverse Suction Valve
- p - Manual Release Valve
- q - Manifold
- r - Tilt Relief Valve
- s - Tilt Relief Piston
- t - Memory Piston
- u - Shock Piston
- v - Impact Relief Valve
- w - Cylinder

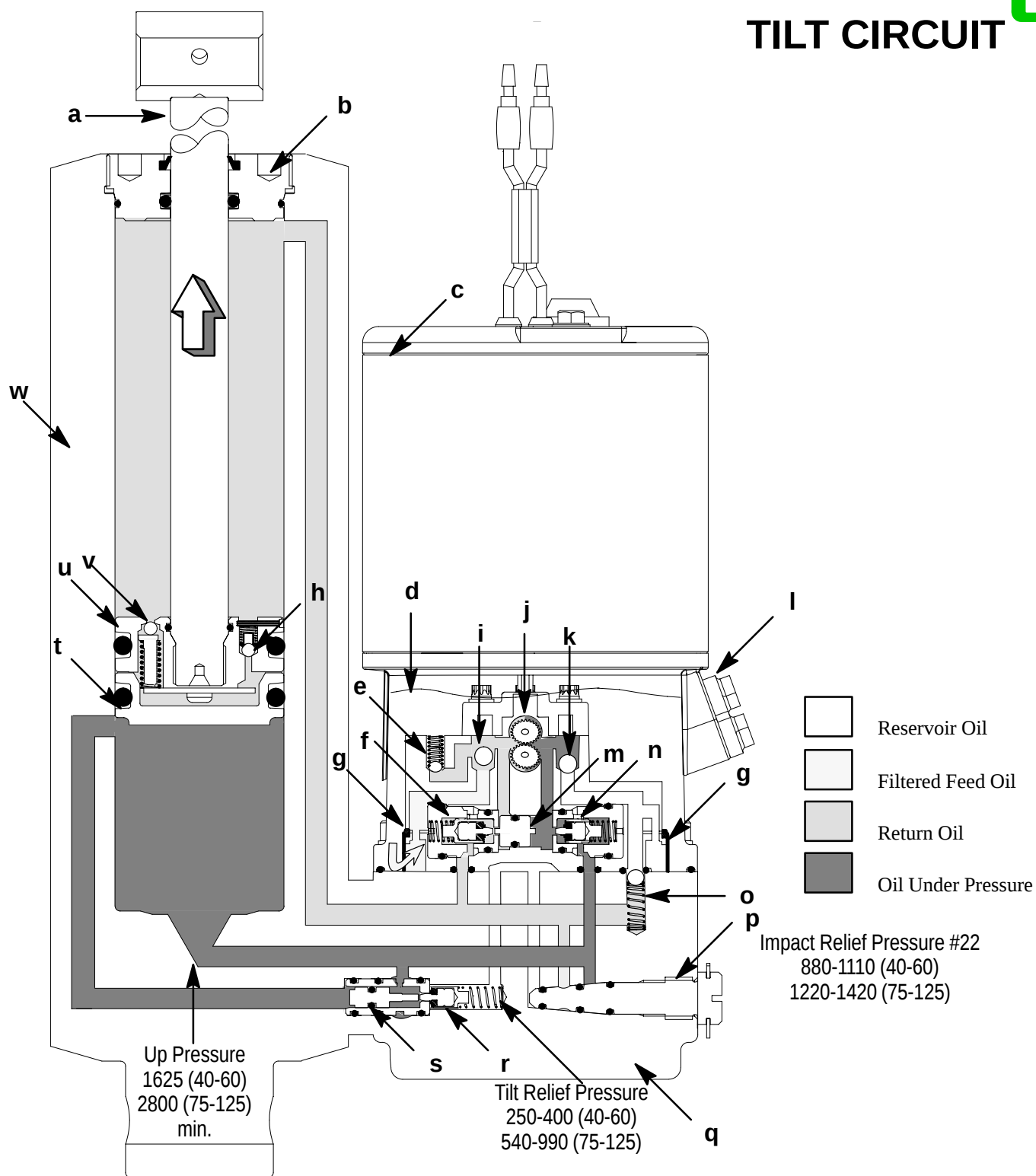


## Trim Up

When the trim switch is activated in the “up” position, the electric motor (c) begins to rotate the pump gears (j), the oil pump draws a small amount of oil through the filter (g) and through the up circuit suction port (i). The oil pump gear (j) rotation forces oil into the passages for the up circuit. Oil, under pressure, will slide the shuttle valve (m) against the down circuit pressure operated valve (f). The shuttle valve will mechanically open the down pressure operated valve, allowing oil from the down cavity of the trim cylinder, to flow into the oil pump. This returning oil, from the down cavity, will supply most of the oil required for the up circuit. Oil in the up circuit is blocked from returning into the reservoir by the ball inside the down circuit suction port (k). The pressure of the oil will force the up circuit pressure operated valve (n) to open, allowing the oil to enter the passages inside the manifold (q) leading to the trim cylinder (w) up cavity. Oil is blocked from all other passages by the closed manual tilt valve (p). Oil under pressure will enter the trim cylinder below the memory piston (t). With an increasing amount of oil entering the cylinder, the memory piston contacts the shock piston (u) and forces the piston rod (a) up and out, raising the outboard motor. Oil on the top of the shock piston exits through a passage running down along the side of the cylinder and enters the manifold passages. The oil is drawn back into the pump (j) through the open down pressure operated valve (f) and enters the pump as supply for the up circuit.



# TILT CIRCUIT



- a - Piston Rod
- b - End Cap
- c - Electric Motor
- d - Reservoir Oil
- e - Down Pressure Regulating Valve
- f - Down Pressure Operated Valve
- g - Filter (2 shown for clarity)
- h - Shock Return Valve
- i - Up Circuit Suction Port
- j - Oil Pump
- k - Down Circuit Suction Port
- l - Oil Fill Cap

- m - Shuttle Valve
- n - Up Pressure Operated Valve
- o - Manifold Reverse Suction Valve
- p - Manual Release Valve
- q - Manifold
- r - Tilt Relief Valve
- s - Tilt Relief Piston
- t - Memory Piston
- u - Shock Piston
- v - Impact Relief Valve
- w - Cylinder

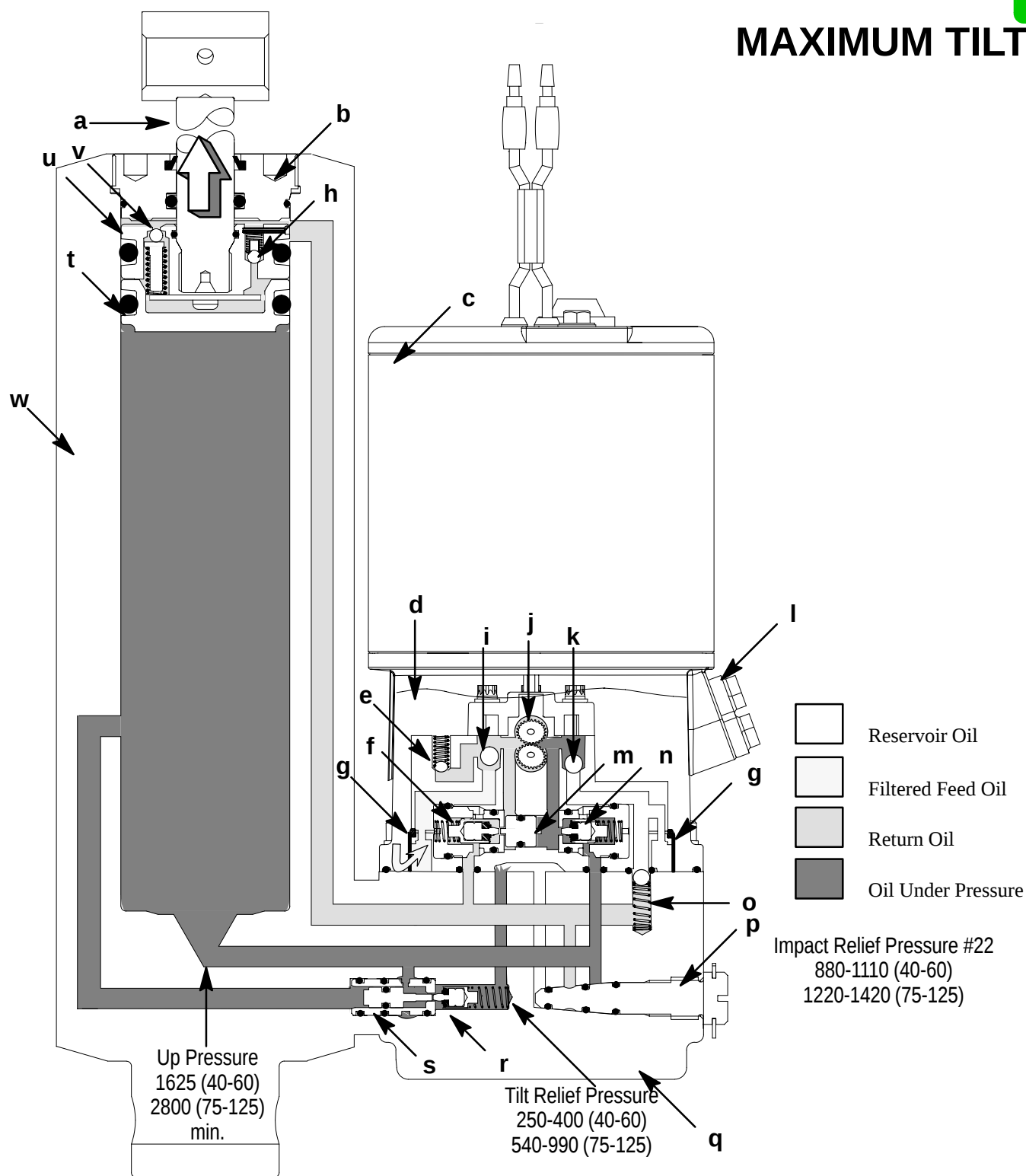


## Tilt Up

In the "up" mode, as the piston rod (a) extends from the cylinder (w), the memory piston (t) clears or uncovers the pressure relief passage. Oil from the up cavity will enter this passage and, if required, causes the tilt relief piston (s) to open the tilt pressure relief valve (r). This valve lowers the amount of pressure available to lift the outboard motor. With the engine in forward gear, and at high engine rpm, the oil pressure available will not be able to overcome the propeller thrust, limiting the trim range to below the pressure relief orifice. When the engine rpm's fall or if engine is not in forward gear, the oil pressure is available to extend the piston rod (a) up into the tilt range.



# MAXIMUM TILT



- a - Piston Rod
- b - End Cap
- c - Electric Motor
- d - Reservoir Oil
- e - Down Pressure Regulating Valve
- f - Down Pressure Operated Valve
- g - Filter (2 shown for clarity)
- h - Shock Return Valve
- i - Up Circuit Suction Port
- j - Oil Pump
- k - Down Circuit Suction Port
- l - Oil Fill Cap

- m - Shuttle Valve
- n - Up Pressure Operated Valve
- o - Manifold Reverse Suction Valve
- p - Manual Release Valve
- q - Manifold
- r - Tilt Relief Valve
- s - Tilt Relief Piston
- t - Memory Piston
- u - Shock Piston
- v - Impact Relief Valve
- w - Cylinder

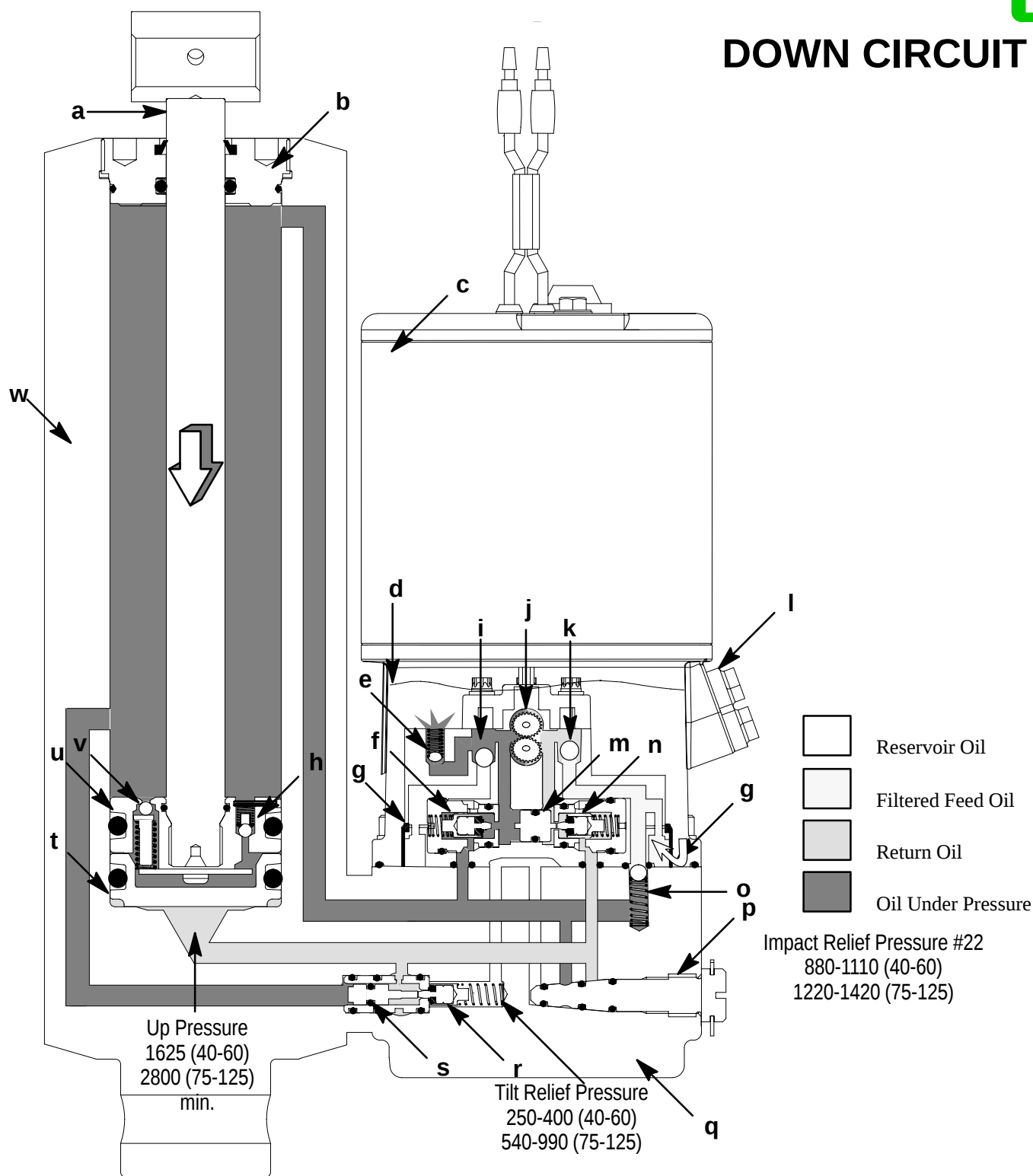


## Maximum Tilt

With the piston rod at maximum travel, and due to no rod movement, the pressure inside of the trim cylinder (w) will increase to the pressure required to move the tilt relief piston (s). The tilt relief piston's "pin" opens the tilt relief valve (r). Up pressure flows into the trim relief passage, and returns back into the reservoir.



# DOWN CIRCUIT



- a - Piston Rod
- b - End Cap
- c - Electric Motor
- d - Reservoir Oil
- e - Down Pressure Regulating Valve
- f - Down Pressure Operated Valve
- g - Filter (2 shown for clarity)
- h - Shock Return Valve
- i - Up Circuit Suction Port
- j - Oil Pump
- k - Down Circuit Suction Port
- l - Oil Fill Cap

- m - Shuttle Valve
- n - Up Pressure Operated Valve
- o - Manifold Reverse Suction Valve
- p - Manual Release Valve
- q - Manifold
- r - Tilt Relief Valve
- s - Tilt Relief Piston
- t - Memory Piston
- u - Shock Piston
- v - Impact Relief Valve
- w - Cylinder

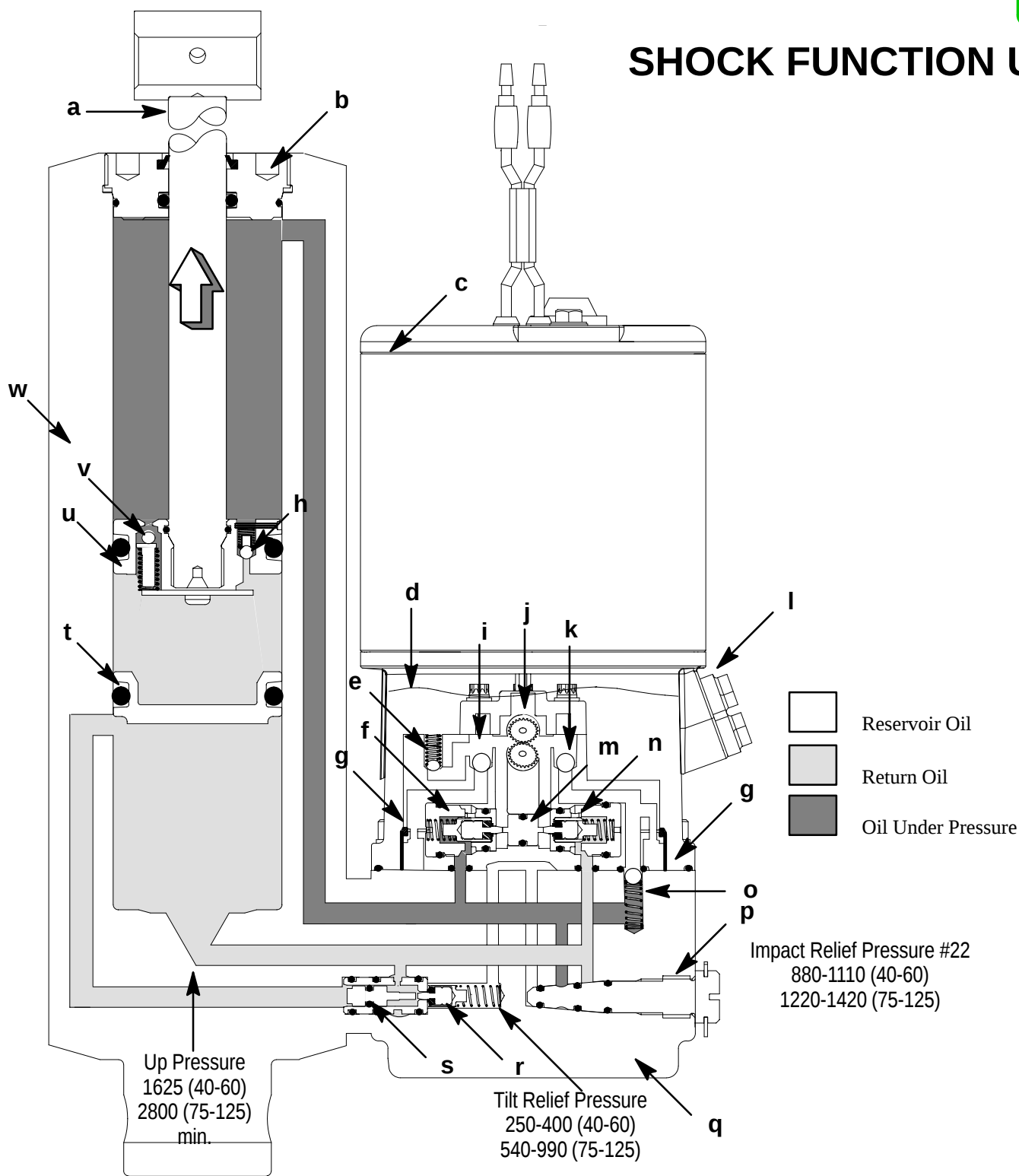


## Down Mode

When the trim switch is activated in the “down” position, the electric motor (c) will rotate the pump (j) in the opposite direction. With the pump gears rotating backwards, the flow of oil is reversed. Oil is drawn through the filter (g), through the down circuit suction port (k) and into the oil pump (j). The pump forces pressurized oil into the down passages, oil will slide the shuttle valve (m) into the up circuit pressure operated valve (n). The shuttle valve will mechanically open the up circuit pressure operated valve and allow oil, from the up cavity of the trim cylinder (w), to return into the oil pump. This returning oil, from the up cavity, will supply the oil required for the down circuit. The oil is blocked from returning into the reservoir by the ball inside the up circuit suction port (i). Oil, under pressure, opens the down pressure operated valve (f) and enters the down passages inside of the manifold (q). The manifold passage connects into the trim cylinder passage leading to the top of the cylinder. The cavity, inside the cylinder, above the shock piston (u) is the down cavity. As the down cavity fills with oil, the piston rod (a) retracts into the cylinder, lowering the outboard motor. Oil from the up cavity exits in the cylinder and is drawn back into the pump through the open up pressure operated valve (n). When the piston rod reaches full travel, the oil pressure inside the down circuit will rise until the down pressure relief valve (e) opens, bypassing oil back into the reservoir. When the trim button is released, and the oil pump stops supplying pressure, both of the pressure operated valves (f & n) will close and; if open, the down pressure regulating valve (e) will close. The closed valves will lock the fluid on either side of the shock piston (u) & memory piston (t), holding the outboard motor in position.



# SHOCK FUNCTION UP



- a - Piston Rod
- b - End Cap
- c - Electric Motor
- d - Reservoir Oil
- e - Down Pressure Regulating Valve
- f - Down Pressure Operated Valve
- g - Filter (2 shown for clarity)
- h - Shock Return Valve
- i - Up Circuit Suction Port
- j - Oil Pump
- k - Down Circuit Suction Port
- l - Oil Fill Cap

- m - Shuttle Valve
- n - Up Pressure Operated Valve
- o - Manifold Reverse Suction Valve
- p - Manual Release Valve
- q - Manifold
- r - Tilt Relief Valve
- s - Tilt Relief Piston
- t - Memory Piston
- u - Shock Piston
- v - Impact Relief Valve
- w - Cylinder

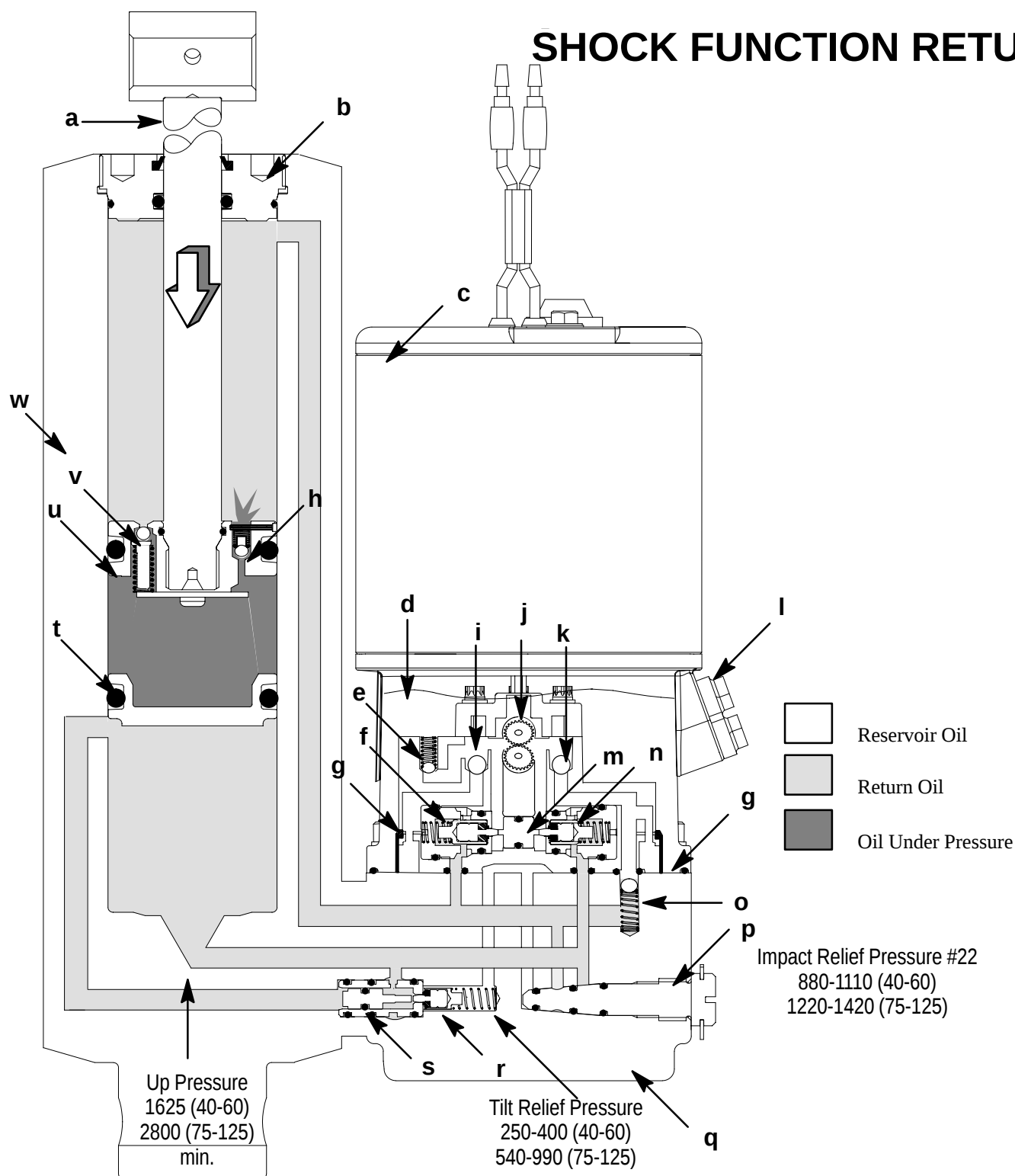


## Shock Function Up

Oil inside the down cavity is locked in a static position by the closed pressure operated valve (f), the manual release valve (p) and the manifold reverse suction valve (o). If the outboard strikes an underwater object while in forward gear the piston rod (a) will try to rapidly extend from the cylinder (w), the pressure increases inside the trim cylinder down cavity and connecting passages. When the pressure increases to the level required, the impact relief valves (v), located inside the shock piston (u), will open and allow the fluid to pass through the shock piston. As the fluid passes through the piston, the piston rod (a) will extend from the trim cylinder. The memory piston (t) is held in position by vacuum, created by the oil in the up cavity being locked in a static position. Therefore; oil passing through the shock piston is trapped between the memory piston (t) and shock piston (u).



# SHOCK FUNCTION RETURN



- a - Piston Rod
- b - End Cap
- c - Electric Motor
- d - Reservoir Oil
- e - Down Pressure Regulating Valve
- f - Down Pressure Operated Valve
- g - Filter (2 shown for clarity)
- h - Shock Return Valve
- i - Up Circuit Suction Port
- j - Oil Pump
- k - Down Circuit Suction Port
- l - Oil Fill Cap

- m - Shuttle Valve
- n - Up Pressure Operated Valve
- o - Manifold Reverse Suction Valve
- p - Manual Release Valve
- q - Manifold
- r - Tilt Relief Valve
- s - Tilt Relief Piston
- t - Memory Piston
- u - Shock Piston
- v - Impact Relief Valve
- w - Cylinder

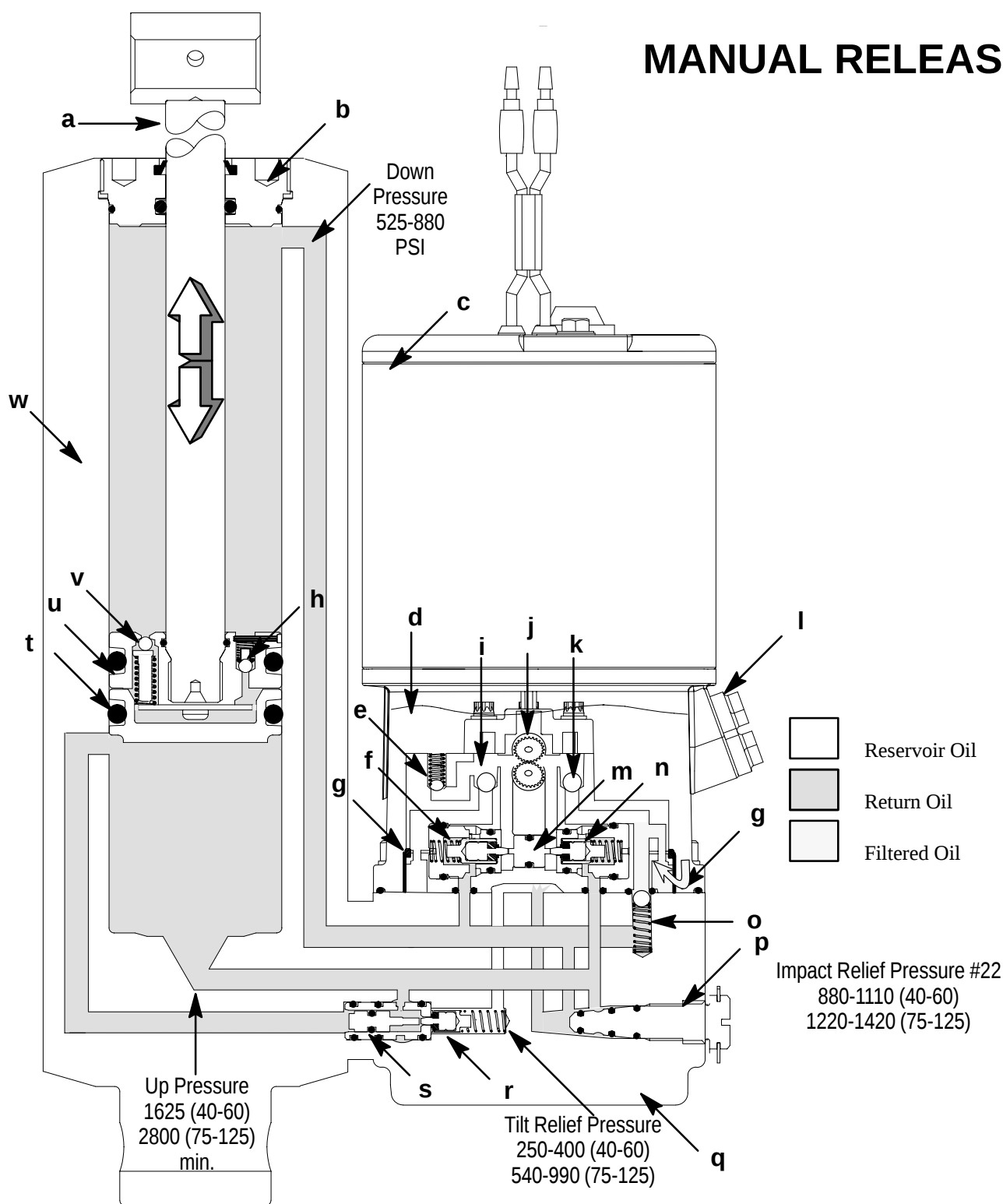


## Shock Function Return

After the engine clears the under water object, the weight of the engine will increase the oil pressure between the memory piston (t) and shock piston (u) to the level required to open the shock return valve (h), inside the shock piston, allowing the oil to bleed back through the shock piston into the down cavity. If required, additional oil will enter the down cavity through the manifold reverse suction valve (o). This will return the engine back against the memory piston (t) and into the original running position.



# MANUAL RELEASE



- a - Piston Rod
- b - End Cap
- c - Electric Motor
- d - Reservoir Oil
- e - Down Pressure Regulating Valve
- f - Down Pressure Operated Valve
- g - Filter (2 shown for clarity)
- h - Shock Return Valve
- i - Up Circuit Suction Port
- j - Oil Pump
- k - Down Circuit Suction Port
- l - Oil Fill Cap

- m - Shuttle Valve
- n - Up Pressure Operated Valve
- o - Manifold Reverse Suction Valve
- p - Manual Release Valve
- q - Manifold
- r - Tilt Relief Valve
- s - Tilt Relief Piston
- t - Memory Piston
- u - Shock Piston
- v - Impact Relief Valve
- w - Cylinder



## Manual Tilt

To manually tilt the outboard engine, the owner will need to back out the manual release valve (p) 3-4 turns. With the valve backed out, the internal passages inside the manifold are connected together. These passages connect both the cylinder down and up cavities together, along with the reservoir, allowing the engine to be raised or lowered. Piston rod (a) movement will continue until the manual release valve (p) is closed, locking the fluid inside of the cylinder and manifold.



# Troubleshooting

Support outboard with tilt lock pin when servicing power trim system.

**IMPORTANT:** After debris or failed components have been found (during troubleshooting procedure) it is recommended that unit be disassembled completely and ALL O-rings be replaced. Check ball valve components and castings must be cleaned using engine cleaner and compressed air or replaced prior to re-assembly.

**IMPORTANT:** Power trim system is pressurized. Outboard must be in the full "UP" position (trim rod fully extended) prior to fill/drain plug or manual release valve removal.

Refer to instructions following if disassembly is required when servicing.

Follow preliminary checks before proceeding to troubleshooting flow diagrams (following).

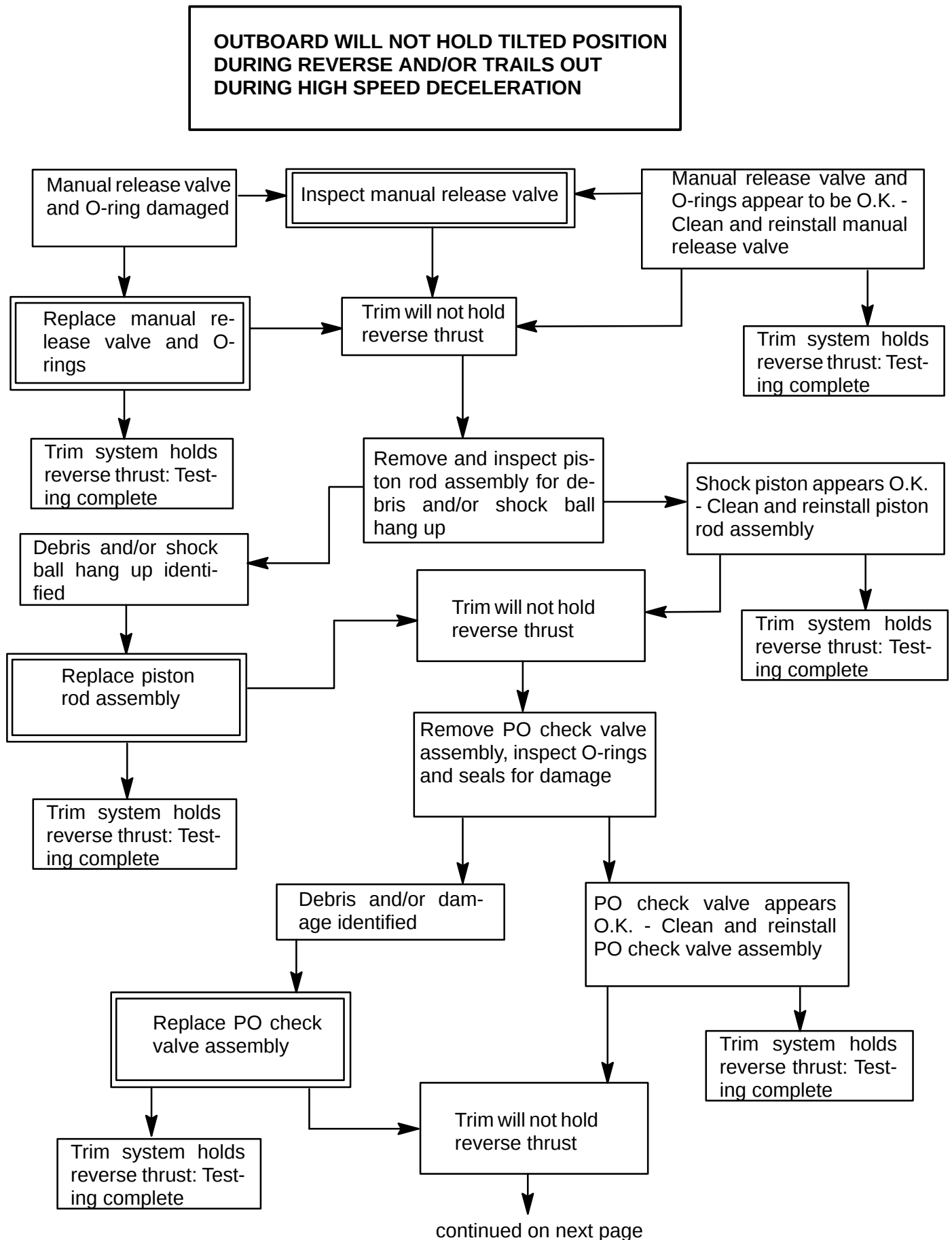
## Preliminary Checks

**IMPORTANT:** Operate Power Trim system after each check to see if problem has been corrected. If problem has not been corrected, proceed to next check.

1. Check that manual release valve is tightened to full right (clockwise) position.
2. Check trim pump fluid level with outboard in full "UP" position and fill if necessary. Refer to "Bleeding Power Trim Unit".
3. Check for external leaks in Power Trim system. Replace defective part(s) if leak is found.
4. Outboard not holding tilted position (falls down to trim position) indicates debris or defective components in trim assembly. Clean or replace components as required.

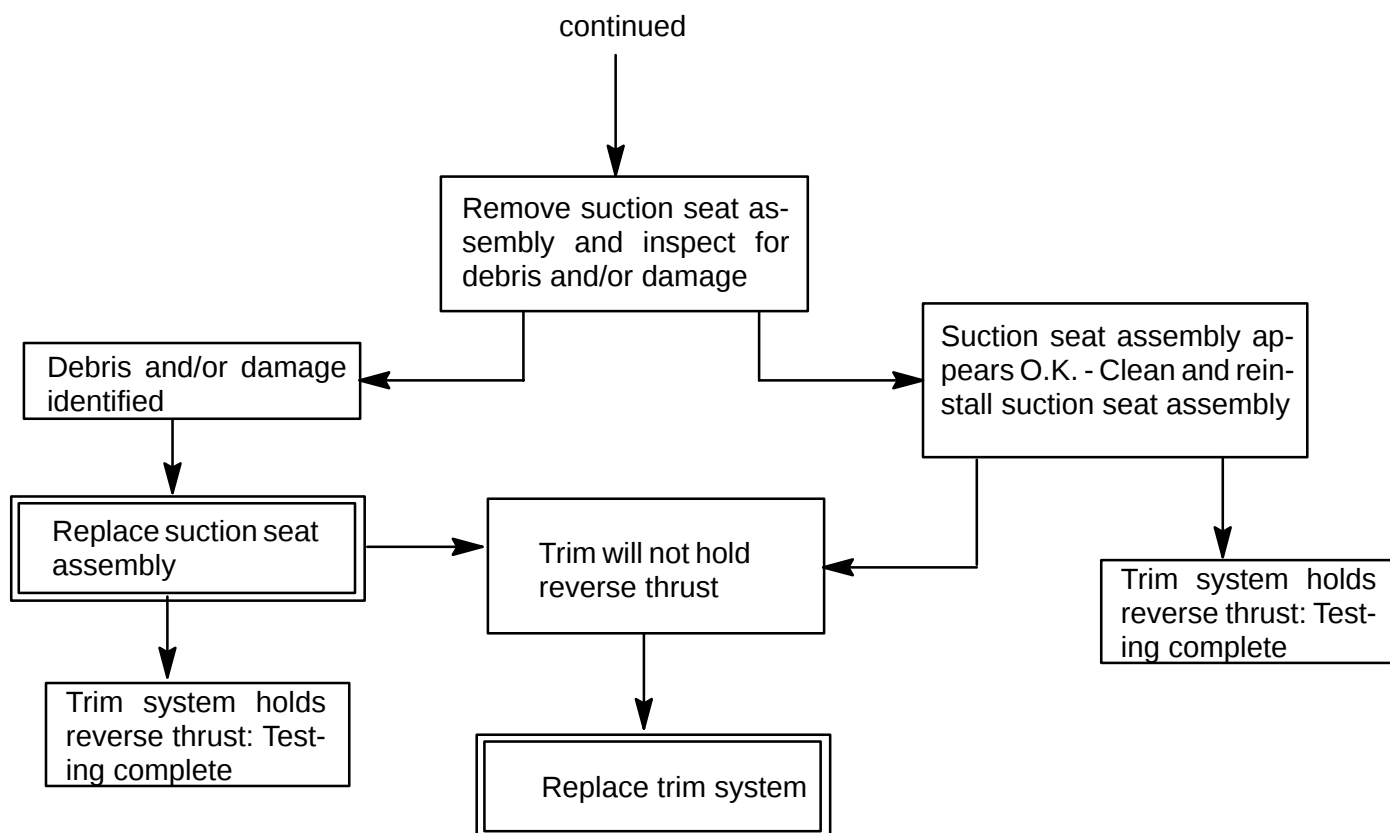


## Hydraulic System Troubleshooting Flow Chart



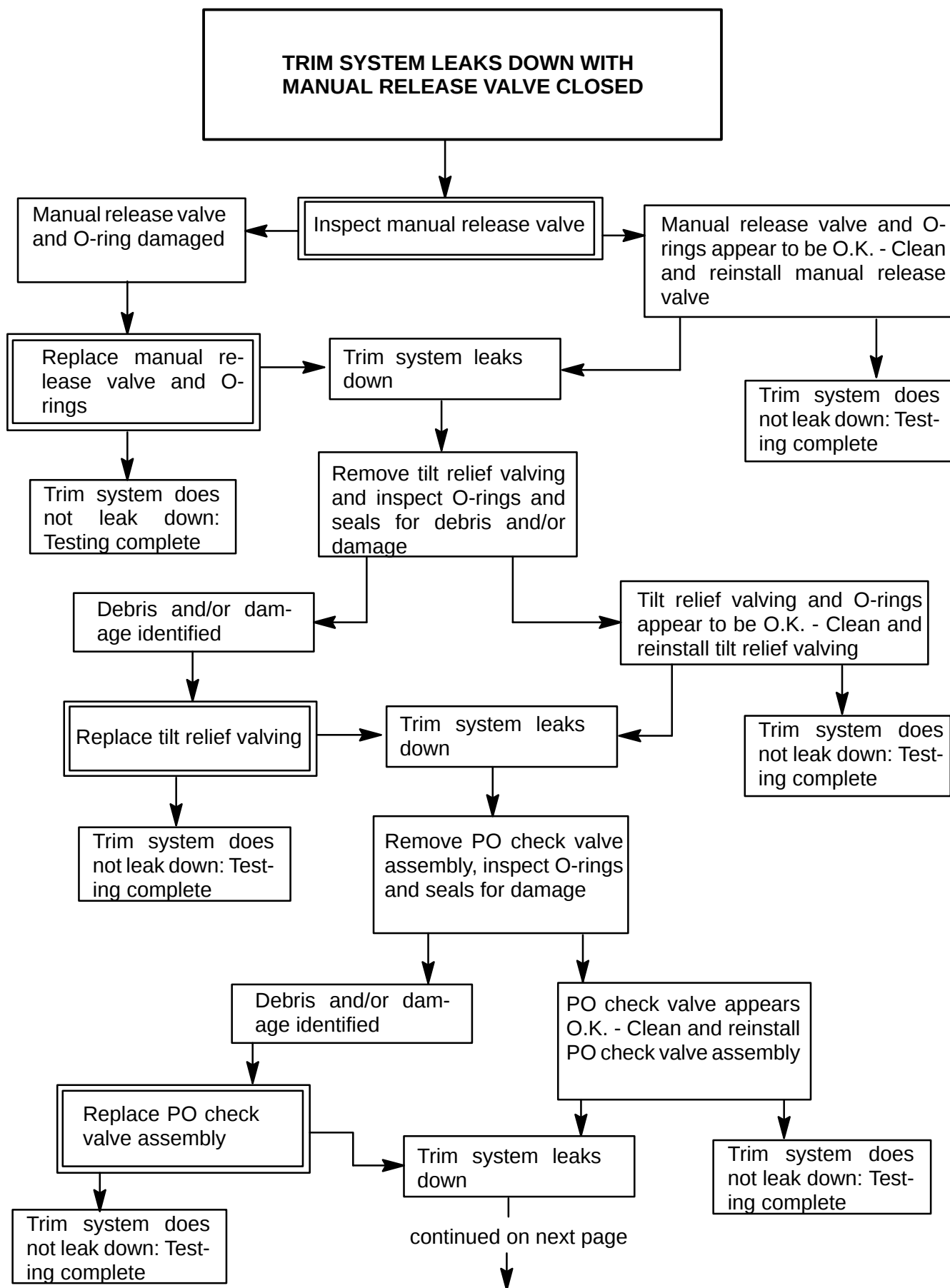


## Hydraulic System Troubleshooting Flow Chart



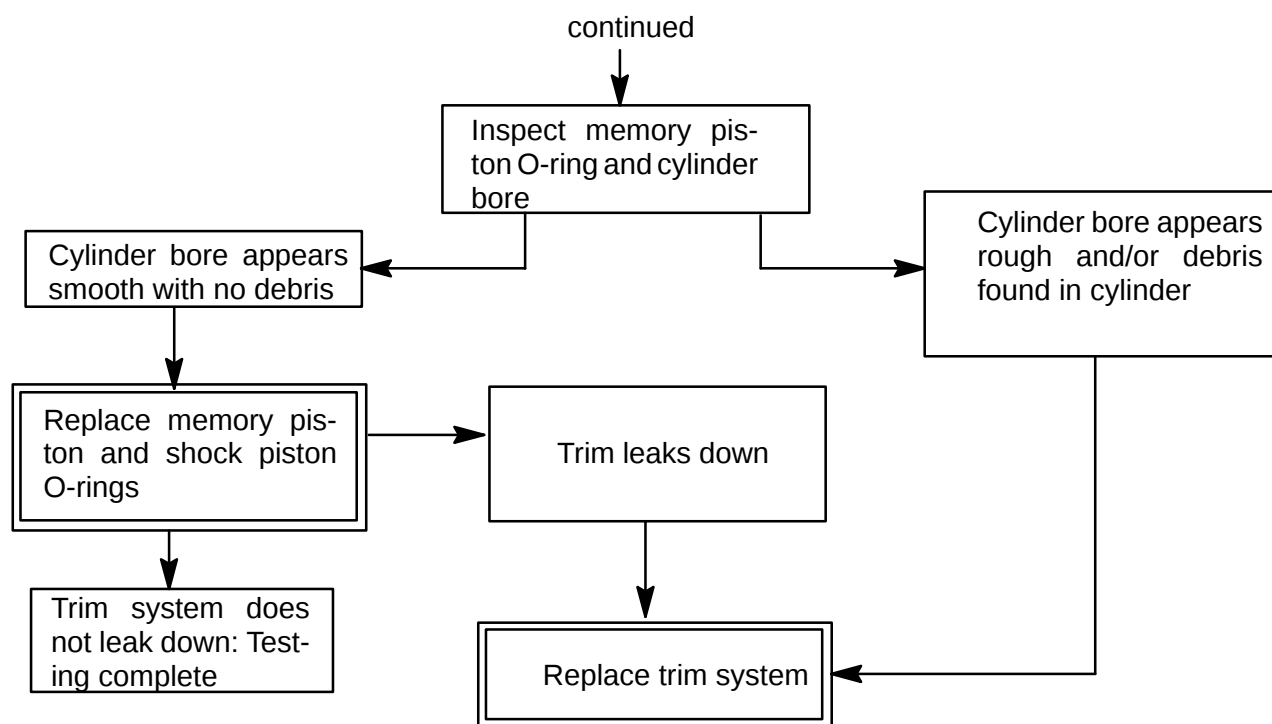


## Hydraulic System Troubleshooting Flow Chart



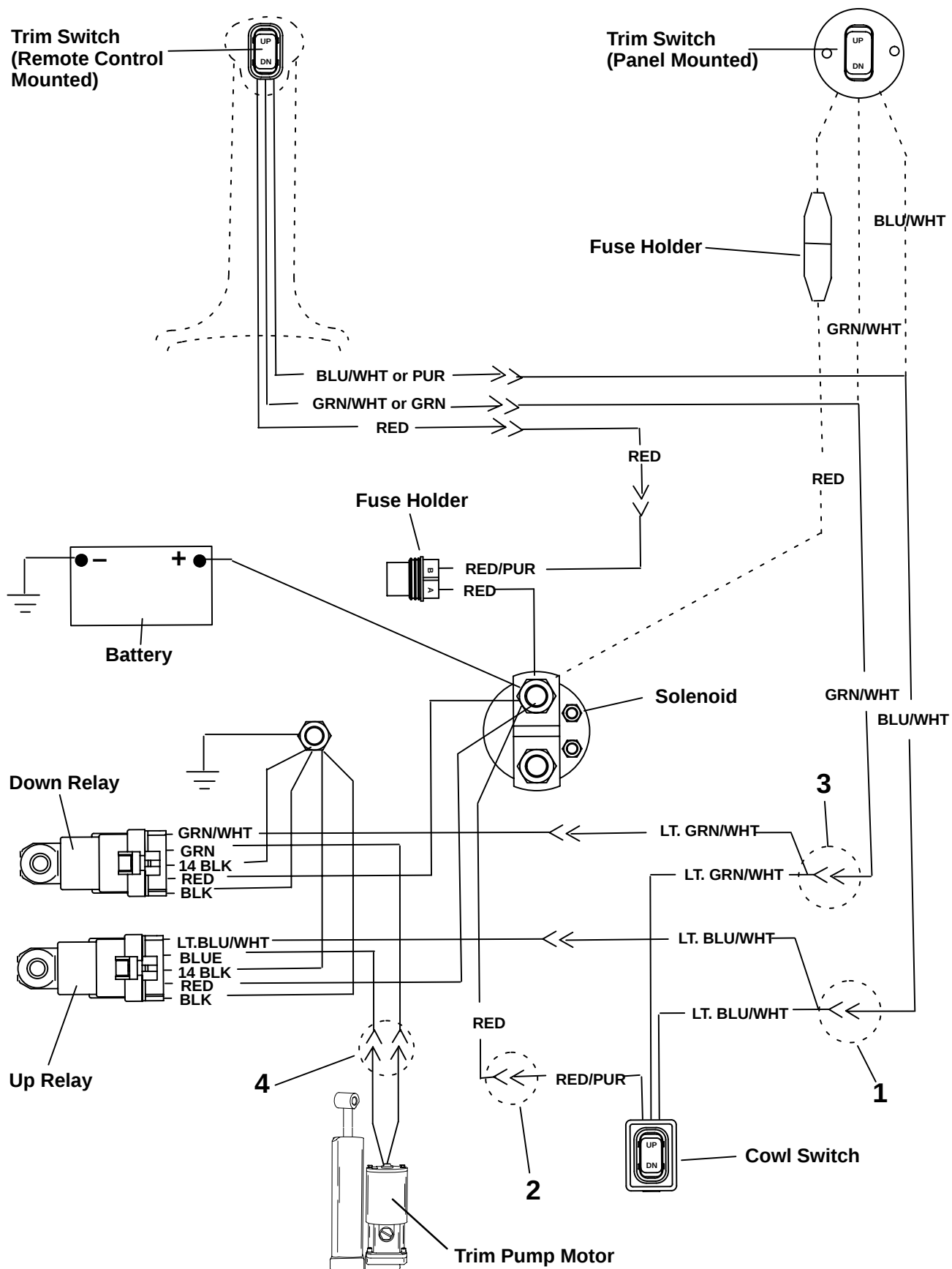


## Hydraulic System Troubleshooting Flow Chart





## Troubleshooting the Power Trim Electrical System





## Troubleshooting the Power Trim Electrical System

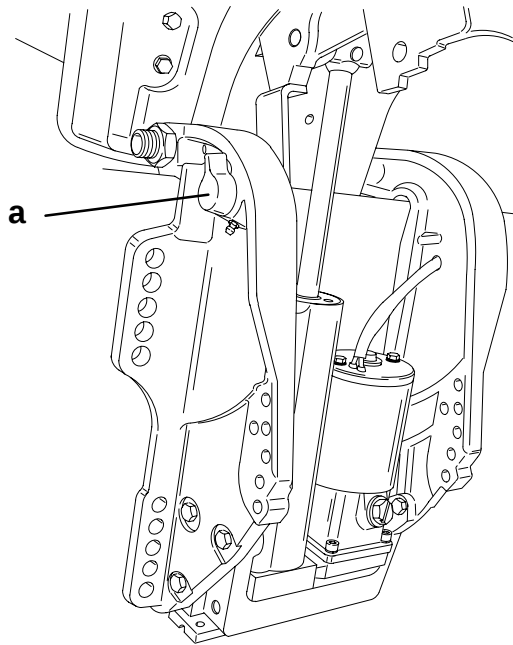
Refer to wiring diagram on preceding page for location of wire connections.

| Problem                                                                             | Possible Cause                                                                                                                                                                             | Remedy                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Trim Switch "UP" is inoperative, but the Cowl Switch "UP" does operate.             | 1. Open wire between Wire Connection (1) and Trim Switch.<br>2. Faulty Trim Switch.                                                                                                        | 1. Check for an open connection or cut wire.<br>2. Replace.                                                                                                                                                       |
| Cowl Switch "UP" is inoperative, but the Trim Switch "UP" does operate.             | 1. Open wire between Wire Connection (2) and Solenoid.<br>2. Faulty Cowl Switch.                                                                                                           | 1. Check for an open connection or cut wire.<br>2. Replace.                                                                                                                                                       |
| Trim Switch "UP" and Cowl Switch "UP" are both inoperative.                         | 1. Open wire between Wire Connection (1) and the Up Relay.<br>2. Open BLK wire between ground and UP Relay.<br>3. Open RED wire between Solenoid and Up Relay.<br>4. Faulty Up Relay .     | 1. Check for an open connection.<br>2. Check for an open connection.<br>3. Check for an open connection.<br>4. Replace.                                                                                           |
| Trim Switch "DOWN" is inoperative, but the Cowl Switch "DOWN" does operate.         | 1. Open wire between Wire Connection (3) and Trim Switch.<br>2. Faulty Trim Switch.                                                                                                        | 1. Check for an open connection or cut wire.<br>2. Replace.                                                                                                                                                       |
| Cowl Switch "DOWN" is inoperative, but the Trim Switch "DOWN" does operate.         | 1. Open wire between Wire Connection (2) and Solenoid.<br>2. Faulty Cowl Switch.                                                                                                           | 1. Check for an open connection or cut wire.<br>2. Replace.                                                                                                                                                       |
| Trim Switch "DOWN" and Cowl Switch "DOWN" are both inoperative.                     | 1. Open wire between Wire Connection (3) and the Up Relay.<br>2. Open BLK wire between ground and Down Relay.<br>3. Open RED wire between Solenoid and Down Relay.<br>4. Faulty Down Relay | 1. Check for an open connection.<br>2. Check for an open connection.<br>3. Check for an open connection.<br>4. Replace.                                                                                           |
| Trim Switch "UP" and "DOWN" are both inoperative, but the Cowl Switch does operate. | 1. 20 AMP Fuse blown.<br>2. Faulty trim switch.<br>3. Wire is open between fuse holder and solenoid.<br>4. Wire is open between fuse holder and trim switch.                               | 1. Replace fuse. Locate the cause of the blown fuse. Check electrical wiring for a shorted circuit.<br>2. Replace<br>3. Check for an open connection or cut wire.<br>4. Check for a loose or corroded connection. |
| Trim Switch and Cowl Switch are both inoperative.                                   | 1. One of the Trim Pump Motor wires is open between the motor and the Relays.<br>2. Faulty trim pump motor.                                                                                | 1. Check wire connections (4) for loose or corroded condition.<br>2. If voltage is present at connections (4) when the appropriate trim button is pressed, then motor is faulty. Replace motor.                   |
| Trim system operates (motor runs) without pressing the switches.                    | 1. The Trim or Cowl switch is shorted.                                                                                                                                                     | 1. Replace.                                                                                                                                                                                                       |



## Power Trim System Removal

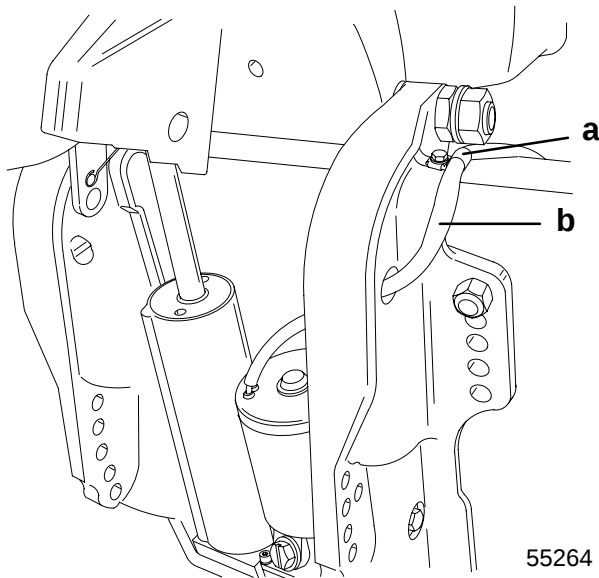
1. Tilt outboard to the full up position and support with tilt lock pin.



55464

a - Tilt Lock Pin

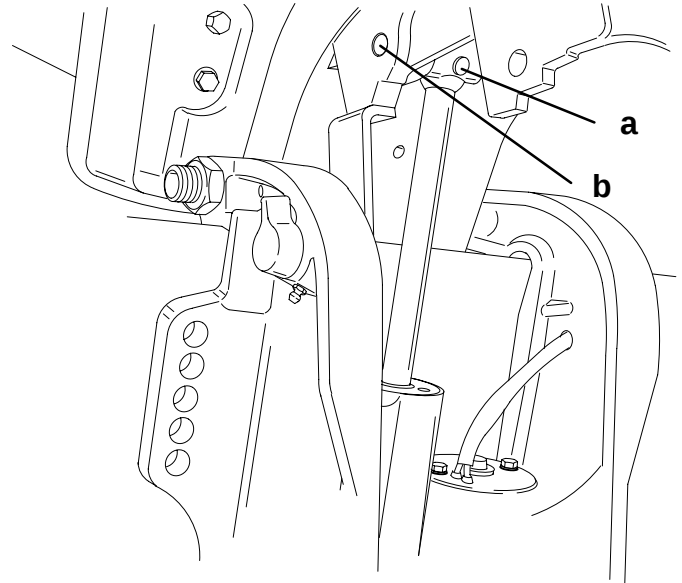
2. Disconnect the power trim wire harness and remove clamp.



55264

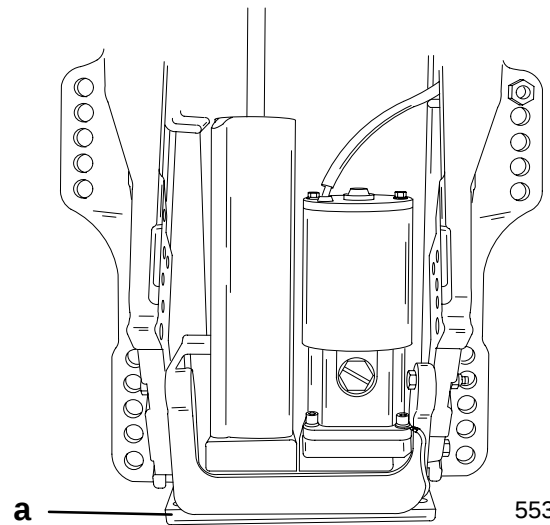
a - Power Trim Wire Harness Clamp  
b - Harness

3. Remove the trilobe pin.
4. Drive out the upper pivot pin.



a - Trilobe Pin  
b - Upper Pivot Pin

5. Remove the sacrificial anode.

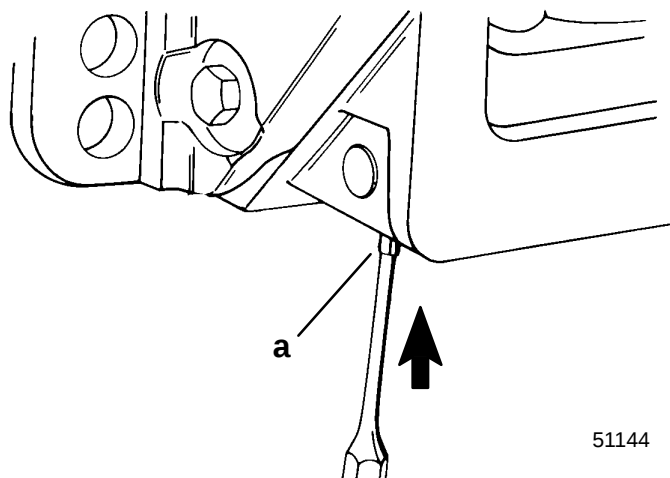


55331

a - Sacrificial Anode



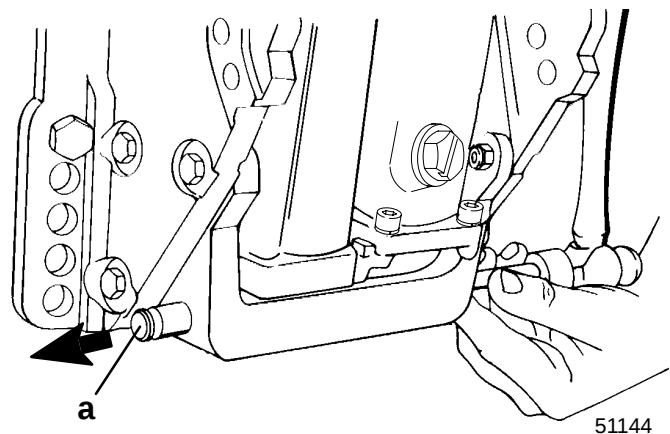
6. Use suitable punch to remove (Drive Up) lower pin. Retain dowel pin.



51144

a - Dowel Pin

7. Use suitable punch to drive out lower pivot pin.



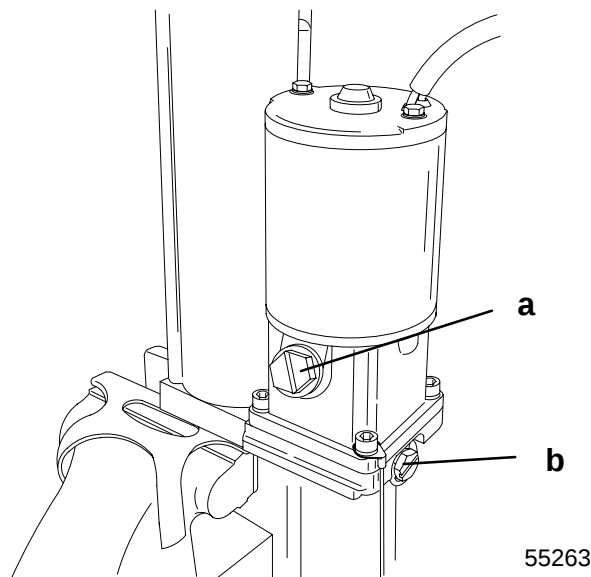
51144

a - Lower Pivot Pin

## Power Trim Disassembly

**IMPORTANT:** Power trim system is pressurized. Trim rod must be in the full "UP" position (fully extended) prior to fill/drain plug, or manual release valve removal.

1. Remove reservoir cap.
2. Remove manual release valve assembly to drain oil.



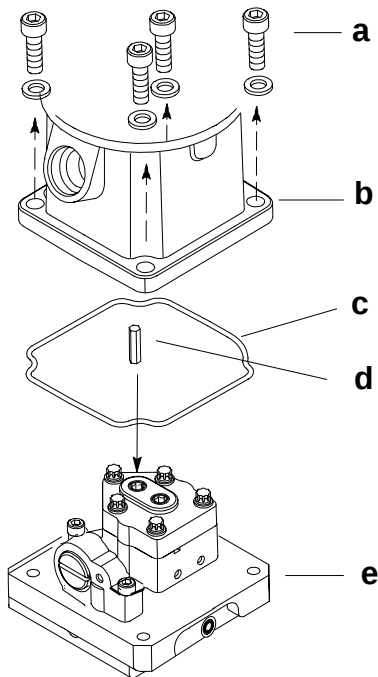
55263

a - Reservoir Cap  
b - Manual Release Valve



## Trim Motor Removal

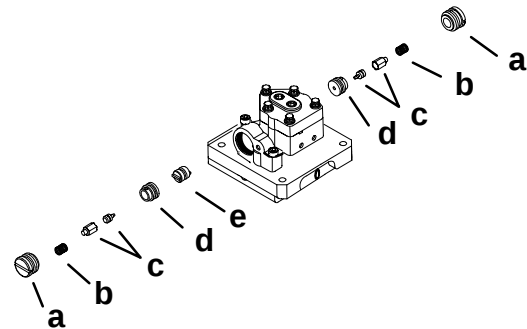
1. Secure power trim assembly in a soft jaw vise.
2. Remove four (4) screws to remove motor/reservoir. Remove reservoir seal and coupler.



- a - Screw (4)
- b - Reservoir
- c - Reservoir Seal
- d - Coupler
- e - Manifold Assembly

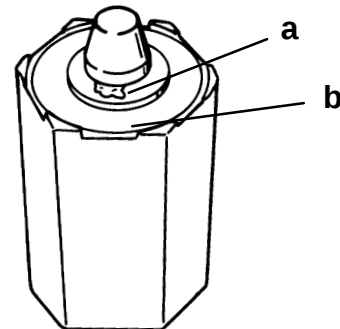
## Pump and Components Removal

1. Remove pressure operated plugs on pump. Remove spring and check valve/poppet (both sides). Use special tool CG 41-11 and special tool CG 41-14 with 5/16" end to remove spool.



- a - Plug (2)
- b - Spring (2)
- c - Check Valve/Poppet (2)
- d - Seat (2)
- e - Spool

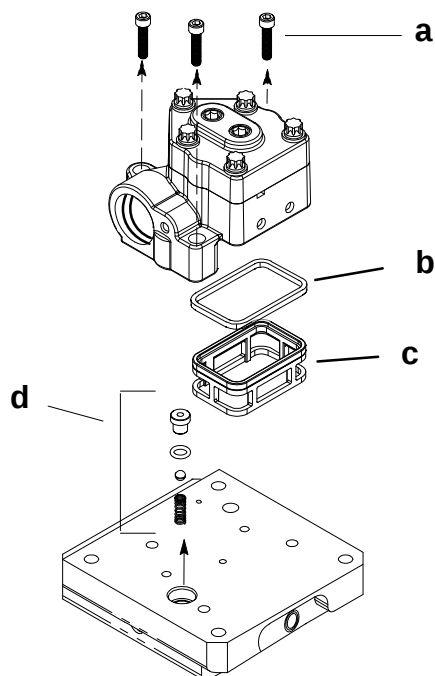
**IMPORTANT: Inspect poppet assembly for debris in the area shown. If debris is found on poppet, replace poppet.**



- a - Debris Under Valve Tip
- b - Rubber Seat



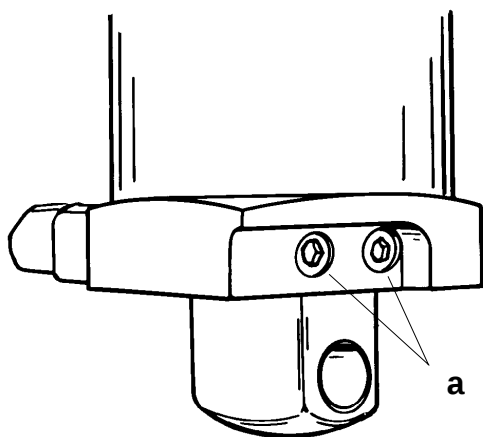
2. Remove three (3) screws to remove pump. Remove filter and filter seal under pump. Remove suction seat assembly.



- a - Screws (3)
- b - Filter Seal
- c - Filter
- d - Suction Seat Assembly

## Manifold Removal

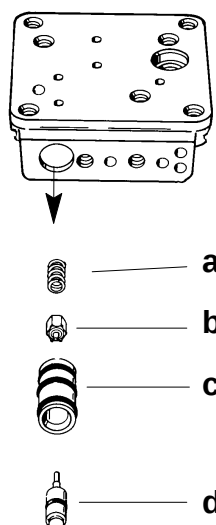
1. Remove two (2) screws to remove manifold from cylinder.



51146

- a - Screw (2)

2. Remove tilt relief components.

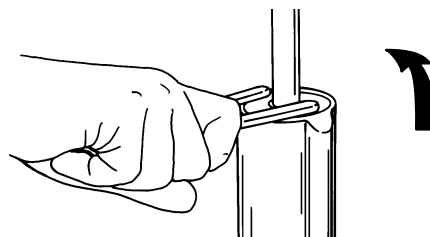


51008

- a - Spring
- b - Poppet
- c - Spool Housing
- d - Trim Limit Spool

## Shock Rod Removal

1. Unscrew end cap assembly from cylinder using spanner wrench [1/4 in. x 5/16 in. (6.4mm x 8mm) long pegs].



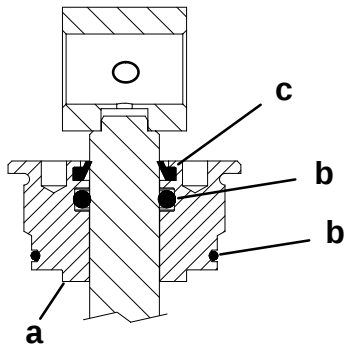
2. Remove shock rod assembly from cylinder.





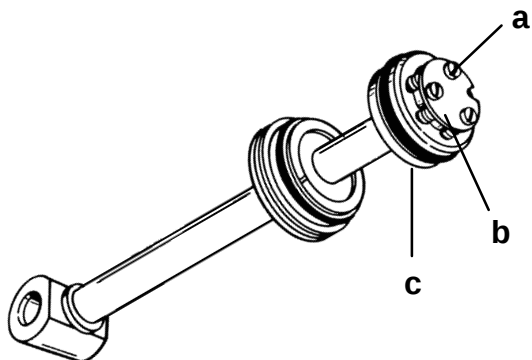
## Shock Rod Disassembly

**NOTE:** The only serviceable items on the shock rod assembly are the O-rings and wiper ring. If shock rod requires any other repair, replace shock rod assembly.



- a - End Cap
- b - O-ring
- c - Wiper Ring

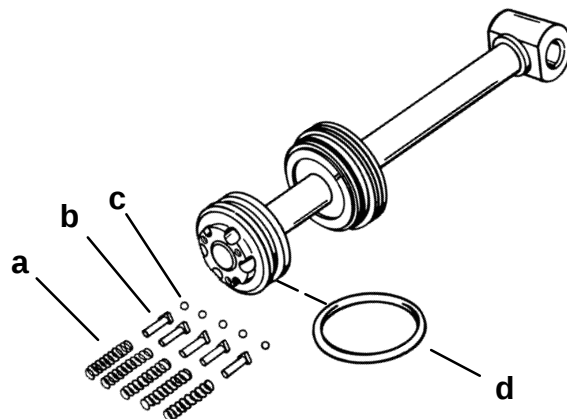
1. Place shock rod assembly on clean work surface.
2. Remove three (3) screws and remove plate from shock rod piston.



51143

- a - Screw (3)
- b - Plate
- c - Shock Rod Piston

3. Remove check ball components from shock rod piston.
4. Remove o-ring from shock rod piston.



51147

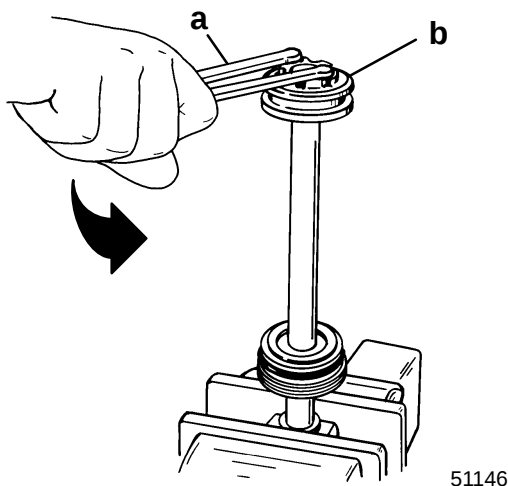
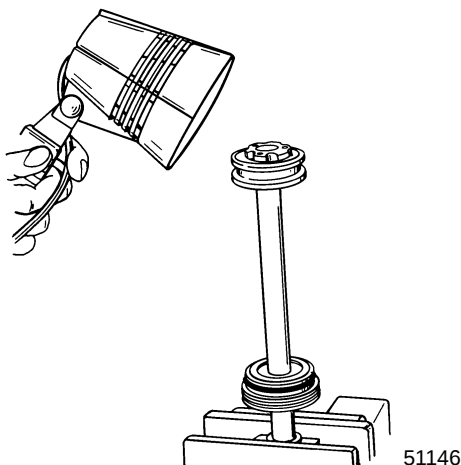
- a - Spring (5)
- b - Seat (5)
- c - Ball (5)
- d - O-ring



## ⚠ CAUTION

**When removing shock piston, spanner wrench must have 1/4 in. x 5/16 in. long pegs to avoid damage to shock piston.**

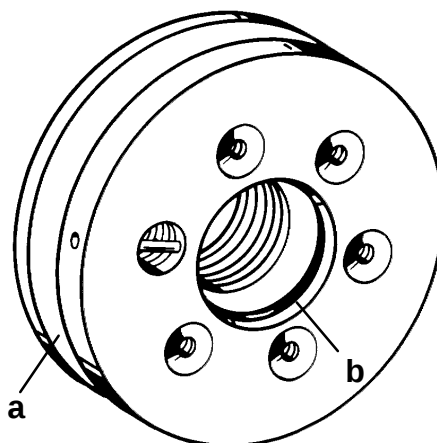
5. Place shock rod into soft jawed vise and apply heat to loosen piston using torch lamp (P/N 91-63209).
6. Loosen shock rod piston using spanner wrench [1/4 in. x 5/16 in. (6.4mm x 8mm) long pegs].
7. Allow shock rod piston to cool. Remove from shock rod.



- a - Spanner Wrench  
b - Shock Rod Piston

8. Inspect check valve for debris; clean debris from check valve if found. If debris cannot be cleaned from check valve, replace shock piston as an assembly.
9. Clean shock and components with compressed air.

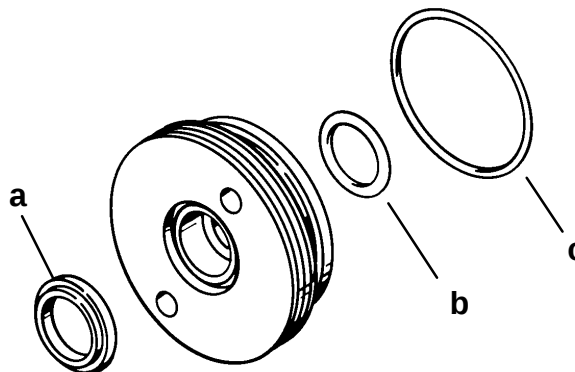
10. Remove inner o-ring from shock rod piston.



51199

- a - Shock Piston  
b - O-ring

11. Remove cylinder end cap assembly from shock rod.
12. Inspect shock. If wiper (located in cap) has failed to keep rod clean, replace wiper.
13. Place end cap on clean work surface.
14. Remove rod wiper, inner o-ring, and outer o-ring.



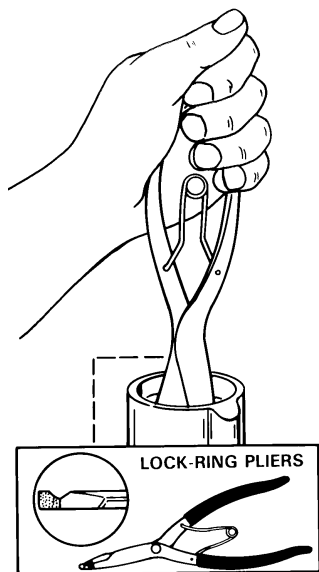
51145

- a - Rod Wiper  
b - Inner O-ring  
c - Outer O-ring



## Memory Piston Removal

1. Remove memory piston from cylinder using one of two methods:
  - a. Using lock ring pliers (Craftsman P/N 4735) or suitable tool.



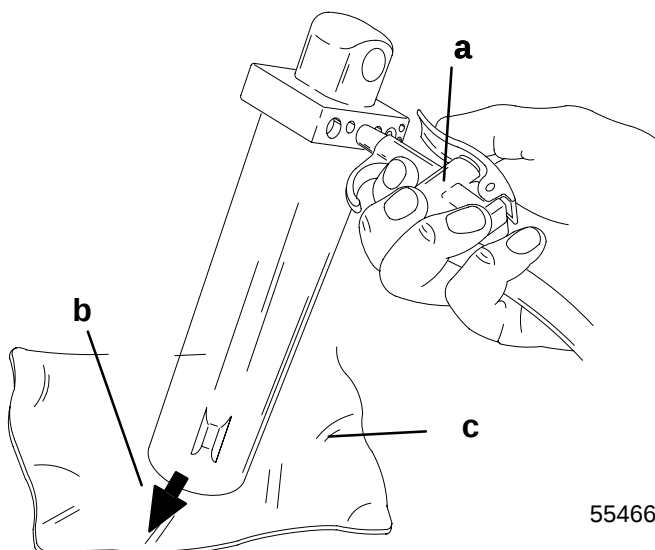
51144

- b. Blowing compressed air into manual release valve hole using adaptor (P/N 91-822778A3).

### **⚠ WARNING**

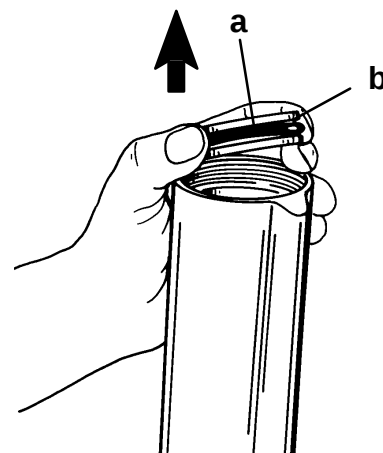
Memory piston cup may be expelled at a high velocity when air pressure is applied. Failure to place cylinder as shown below could result in personal injury.

**NOTE:** Point cylinder opening down and away. Use a shop rag or towel to avoid damage to the memory piston.



55466

2. Remove o-ring from memory piston.



51144



## Cleaning/Inspection/Repair

**IMPORTANT:** Components must be dirt and lint free. Slightest amount of debris in Power Trim system could cause system to malfunction.

Clean shock rod and components with parts cleaner and dry with compressed air.

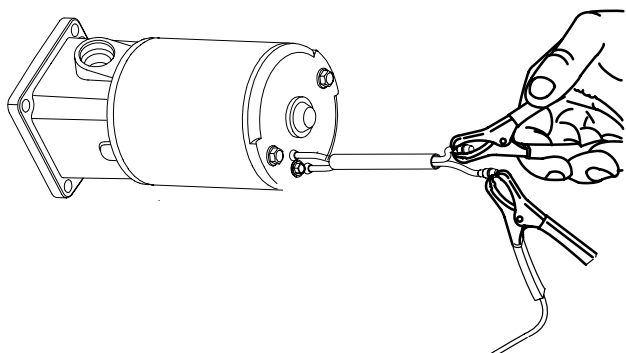
It is recommended that all O-rings in trim system be replaced. Use O-Ring Kit 25-827668A1.

Lubricate all o-rings with Quicksilver Power Trim Fluid (92-90100A12). If not available, use automotive (ATF) automatic transmission fluid.

## Trim Motor Electrical Tests

1. Connect a 12 volt supply to motor leads. If motor fails to run, replace pump motor.

**IMPORTANT:** Trim Motor is not serviceable. If motor fails to run, replace motor assembly.

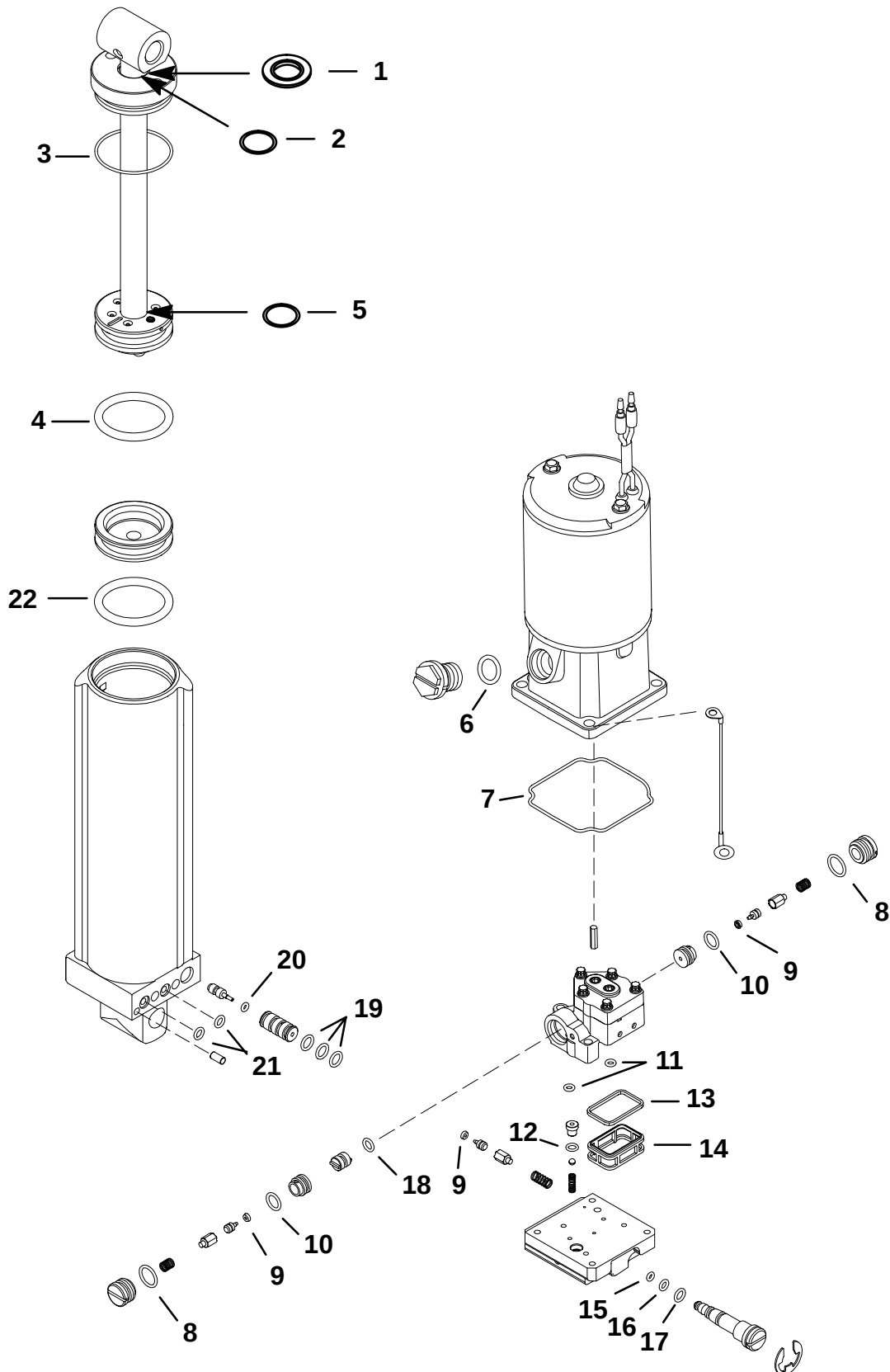




# Reassembly

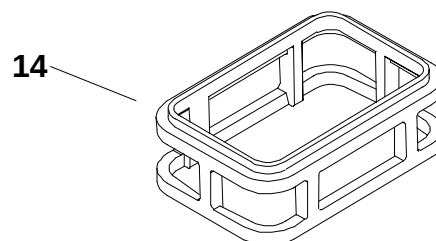
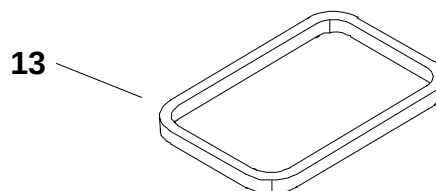
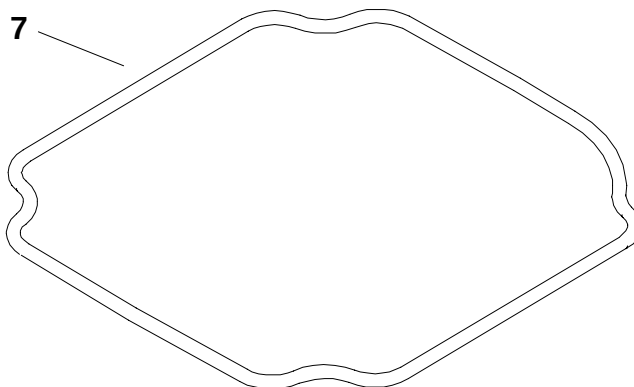
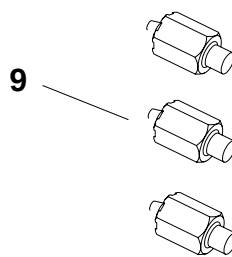
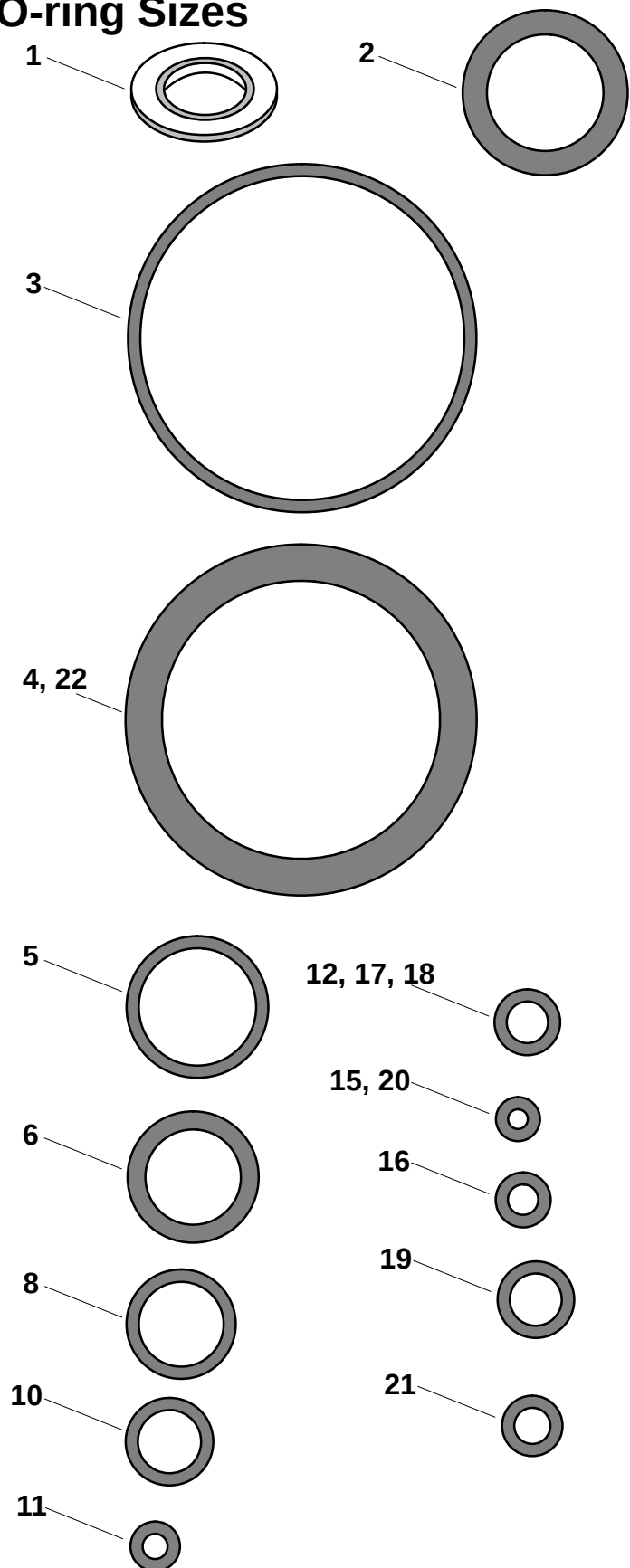
## O-Ring and Seal Placement

O-Rings and Seals are part of O-Ring Kit 25-809880A1.

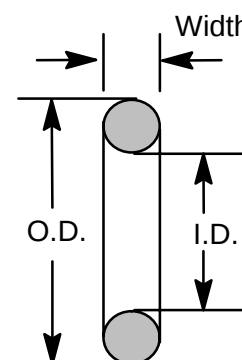




# O-ring Sizes



## Cutaway View of O-Ring



O-RINGS SHOWN ARE ACTUAL SIZE



## O-ring Description and Sizes

| O-Ring        | Description      | O-Ring I.D.          | O-Ring O.D.          | O-Ring Width         |
|---------------|------------------|----------------------|----------------------|----------------------|
| <b>1</b>      | Wiper Ring       |                      |                      |                      |
| <b>2</b>      | Cyl. Cap, Inner  | 0.671 in. (17.04 mm) | 0.949 in. (24.10 mm) | 0.139 in. (3.53 mm)  |
| <b>3</b>      | Cyl. Cap         | 1.864 in. (47.34 mm) | 2.004 in. (50.90 mm) | 0.07 in. (1.78 mm)   |
| <b>4</b>      | Shock Piston     | 1.6 in. (40.64 mm)   | 2.02 in. (53.086 mm) | 0.21 in. (5.334 mm)  |
| <b>5</b>      | Piston Bolt      | 0.676 in. (17.17 mm) | .816 in. (20.726 mm) | 0.07 in. (1.78 mm)   |
| <b>6</b>      | Reservoir Plug   | 0.549 in. (13.94 mm) | 0.755 in. (19.17 mm) | 0.103 in. (2.616 mm) |
| <b>7</b>      | Motor Seal       |                      |                      |                      |
| <b>8 (2)</b>  | P.O. Check Plug  | 0.489 in. (12.42 mm) | 0.629 in. (15.97 mm) | 0.07 in. (1.78 mm)   |
| <b>9 (3)</b>  | Poppet Assy.     |                      |                      |                      |
| <b>10 (2)</b> | P.O. Check Seat  | 0.364 in. (9.25 mm)  | 0.504 in. (12.80 mm) | 0.07 in. (1.78 mm)   |
| <b>11 (2)</b> | Pump Port        | 0.145 in. (3.683 mm) | 0.285 in. (7.239 mm) | 0.07 in. (1.78 mm)   |
| <b>12</b>     | Suction Seat     | 0.239 in. (6.07 mm)  | 0.379 in. (9.626 mm) | 0.07 in. (1.78 mm)   |
| <b>13</b>     | Filter Seal      |                      |                      |                      |
| <b>14</b>     | Filter           |                      |                      |                      |
| <b>15</b>     | Manual Release   | 0.114 in. (2.90 mm)  | 0.254 in. (6.451 mm) | 0.07 in. (1.78 mm)   |
| <b>16</b>     | Manual Release   | 0.176 in. (4.47 mm)  | 0.316 in. (8.026 mm) | 0.07 in. (1.78 mm)   |
| <b>17</b>     | Manual Release   | 0.239 in. (6.07 mm)  | 0.379 in. (9.626 mm) | 0.07 in. (1.78 mm)   |
| <b>18</b>     | Spool            | 0.239 in. (6.07 mm)  | 0.379 in. (9.626 mm) | 0.07 in. (1.78 mm)   |
| <b>19 (3)</b> | Spool Housing    | 0.301 in. (7.645 mm) | 0.441 in. (11.20 mm) | 0.07 in. (1.78 mm)   |
| <b>20</b>     | Trim Limit Spool | 0.114 in. (2.895 mm) | 0.254 in. (6.451 mm) | 0.07 in. (1.78 mm)   |
| <b>21 (2)</b> | Manifold         | 0.208 in. (5.283 mm) | 0.348 in. (8.839 mm) | 0.07 in. (1.78 mm)   |
| <b>22</b>     | Memory Piston    | 1.6 in. (40.64 mm)   | 2.02 in. (53.086 mm) | 0.21 in. (5.334 mm)  |

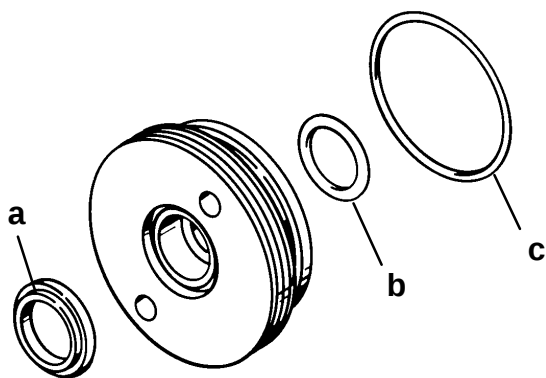


## Power Trim Reassembly

**IMPORTANT:** Lubricate all o-rings with Quicksilver Power Trim Fluid (92-90100A12). If not available, use automotive (ATF) automatic transmission fluid.

### Shock Rod Reassembly

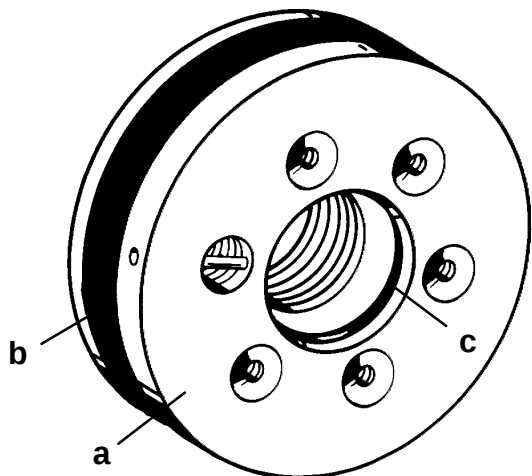
1. Install lubricated o-rings to end cap.
2. Install rod wiper.



51145

- a - Rod Wiper
- b - Inner O-ring
- c - Outer O-ring

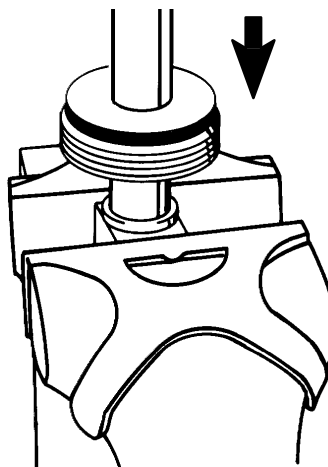
3. Install lubricated o-rings to shock piston.



51199

- a - Shock Piston
- b - O-ring
- c - O-ring

4. Clamp shock rod in soft jawed vise.
5. Position cylinder end cap onto rod as shown.

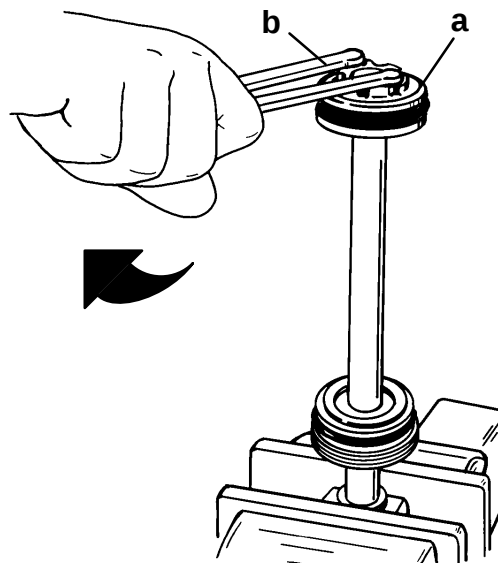


51146

### CAUTION

When installing shock rod piston, spanner wrench must have 1/4 in. x 5/16 in. (6.4mm x 8mm) long pegs to avoid damage to shock rod piston.

6. Apply Loctite Grade "A" (271) to threads on shock rod.
7. Install shock rod piston.
8. Tighten shock rod piston securely using spanner wrench (1/4 in. x 5/16 in. long pegs). If a torquing type spanner tool is used to tighten shock piston, then torque to 90 lb. ft. (122 N·m).

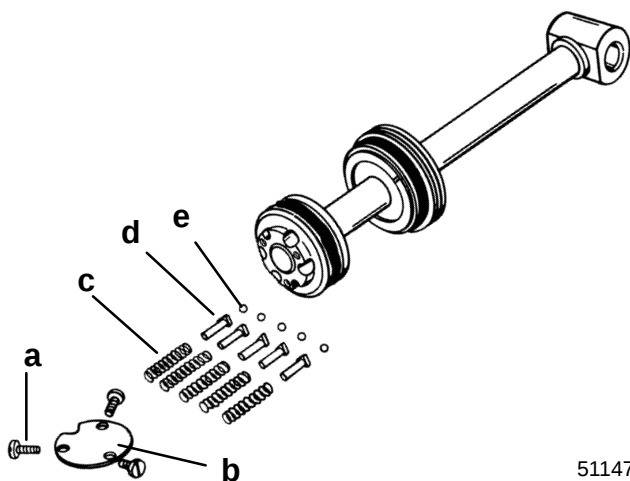


51146

- a - Shock Rod Piston - Torque to 90 lb. ft. (122 N·m)
- b - Spanner Wrench



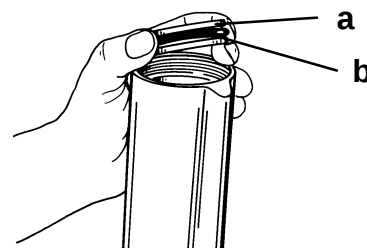
9. Remove shock rod assembly from vise.
10. Install ball, seat, and spring (five sets) to shock rod piston.
11. Secure components with plate. Torque screws to 35 lb. in. (4.0 Nm).



- a - Screws (3) Torque to 35 lb. in. (4.0 N·m)  
b - Plate  
c - Springs (5)  
d - Seats (5)  
e - Balls (5)

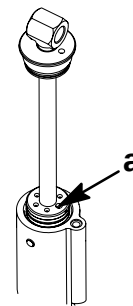
## Shock Rod Installation

1. Place trim cylinder in soft jawed vice.
2. Install lubricated O-ring to memory piston and place into cylinder. Push memory piston all the way to bottom.



- a - Memory Piston  
b - O-ring

3. Fill cylinder three inches (76.2mm) from top of cylinder using Quicksilver Power Trim and Steering Fluid. If not available, use automotive (ATF) automatic transmission fluid.
4. Install shock rod into cylinder until power trim fluid flows through oil blow off ball passage. Fill remaining cylinder to just below the cylinder threads.

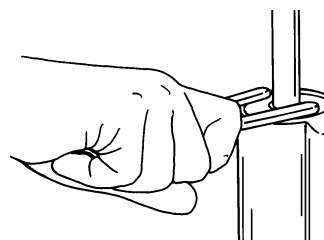


- a - Oil Blow Off Ball Passage

### **CAUTION**

**End cap must not make contact with shock rod piston when tightening. Shock rod piston must be positioned in cylinder deep enough to avoid contact.**

5. Tighten end cap securely using spanner wrench [1/4 in. x 5/16 in. (6.4mm x 8mm) long pegs]. If a torquing type spanner tool is used to tighten end cap, then torque to 45 lb. ft. (61.0 N·m).

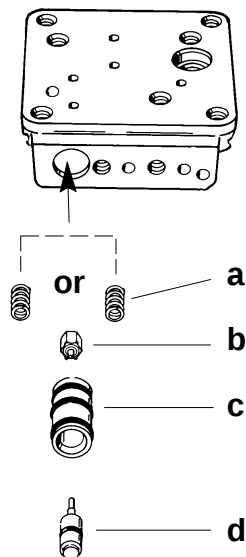




## Trim Limit Assembly Installation

1. Lubricate all O-rings. Install spring, poppet spool housing and trim limit spool into manifold.

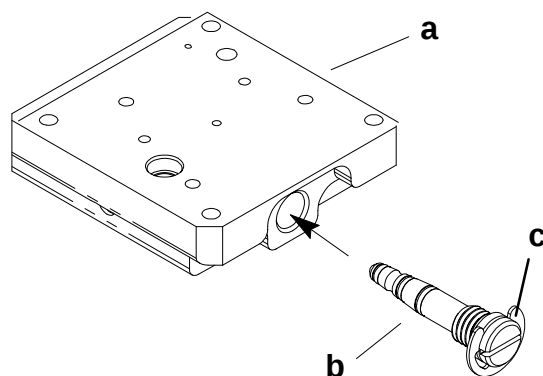
**NOTE:** There are two different size springs used in this manifold. The heavy spring is used on 75 to 125 HP engines. The light spring is used on 40 to 60 HP engines.



- a - Spring
- b - Poppet
- c - Spool Housing
- d - Trim Limit Spool

## Manual Release Valve Installation

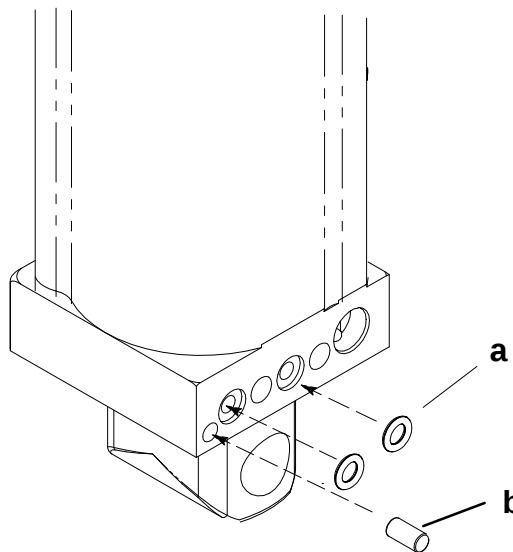
1. Install "E" clip (if removed) and lubricate O-rings to manual release valve.
2. Install manual release valve assembly into manifold.



- a - Manifold
- b - Manual Release Valve
- c - E Clip

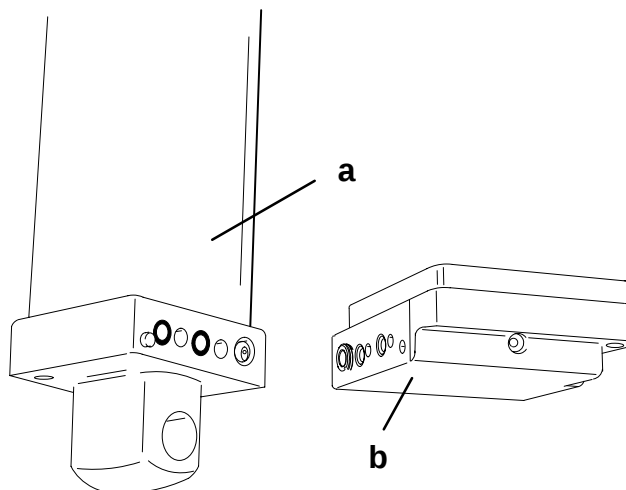
## Manifold Installation

1. Install dowel pin and two (2) lubricated O-rings into trim cylinder.



- a - O-Rings (2)
- b - Dowel Pin

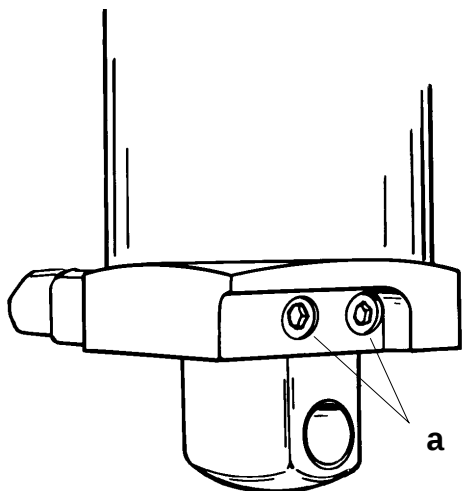
2. Align the trim cylinder and pump/reservoir assembly together.



- a - Trim Cylinder Assembly
- b - Reservoir/Manifold Assembly



3. Install the two (2) long screws and torque to 100 lb. in. (11 N·m).

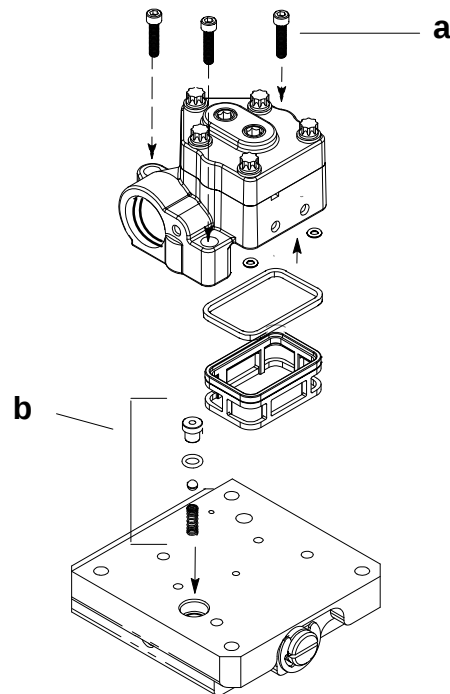


51146

a - Screws (2) Torque to 100 lb. in. (11 N·m)

## Oil Pump Installation

1. Install spring, ball, lubricated O-ring and plastic seat to manifold.
2. Check to see that O-rings are placed on bottom of pump.
3. Install filter and filter seal under pump. Install pump onto manifold. Torque screws to 70 lb. in. (7.7 N·m).



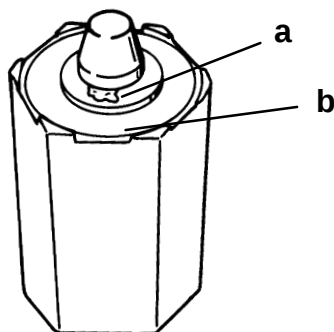
a - Screws (3) Torque to 70 lb. in. (7.7 N·m)

b - Suction Seat Assembly



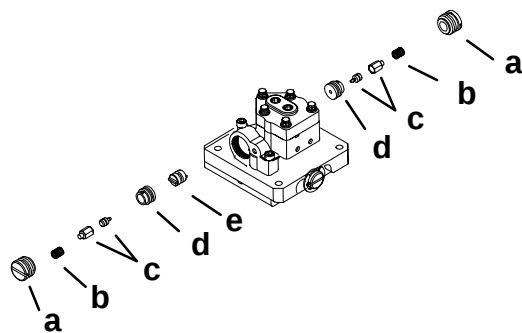
## Pressure Operated Assembly Installation

**IMPORTANT:** Inspect poppet assembly for debris in the area shown. If debris is found on poppet replace poppet.



a - Debris Under Valve Tip  
b - Rubber Seat

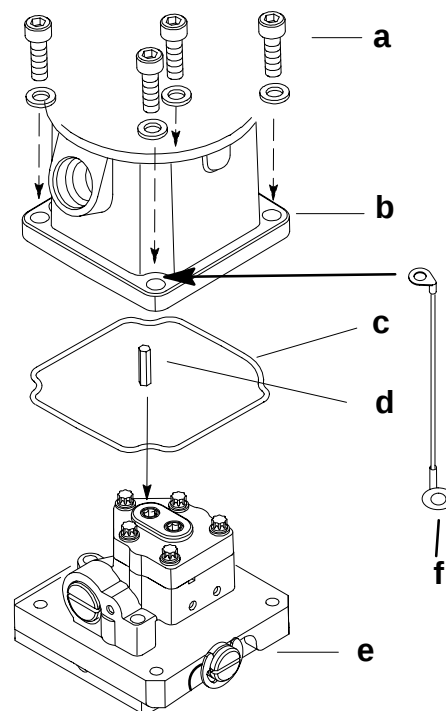
1. Lubricate o-rings.
2. Install spool, seat with O-ring, check valve/poppet, spring and plug with O-ring into pump. Repeat for other side. Torque plugs to 120 lb. in. (13.5 N-m).



a - Plugs (2) Torque to 120 lb. in. (13.5 N-m)  
b - Springs (2)  
c - Check Valve/Poppet (2)  
d - Seats (2)  
e - Spool

## Reservoir/Motor Installation

3. Install coupler into top of pump. Make sure reservoir seal is in the reservoir groove and place reservoir onto pump/manifold assembly. Install ground strap under screw shown Torque screws to 80 lb. in. (9 N-m).



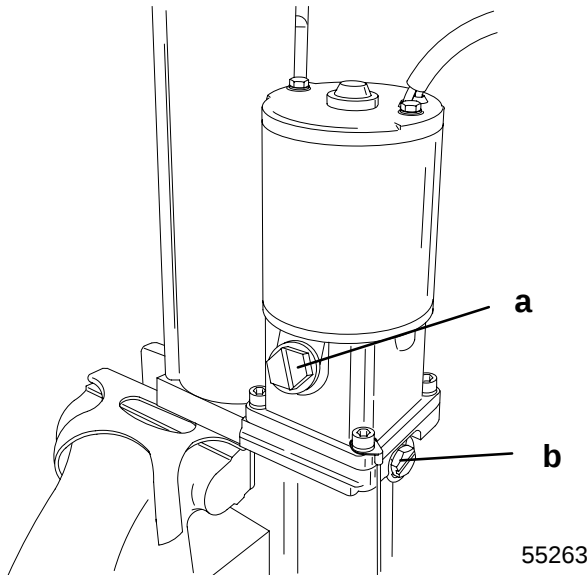
a - Screw (4) Torque to 80 lb. in. (9 N-m)  
b - Reservoir  
c - Reservoir Seal  
d - Coupler  
e - Manifold Assembly  
f - Ground Strap

4. Fill reservoir to bottom of fill hole using Quicksilver Power Trim Fluid (92-901000A12). If not available, use automotive (ATF) automatic transmission fluid.



## Bleeding Power Trim Unit

1. Secure power trim unit in soft jawed vise.
2. Add power trim fluid until even with the bottom of the fill hole. Reinstall plug.
3. Close the manual release valve. (Turn full clockwise).

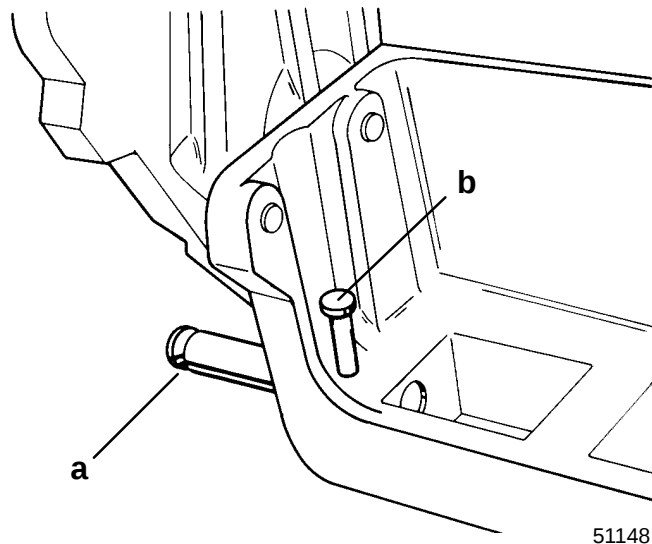


a - Reservoir Plug/Fill Hole  
b - Manual Release Valve

4. Using a 12 volt power supply, connect the positive lead to (blue) trim motor wire and negative lead to (green) trim motor wire and drive shock rod to the up position. Repeat for three times.
5. Connect the positive lead to the (green) trim motor wire, and the negative lead to the (blue) trim motor wire and drive the shock rod to the down position.
6. Recheck fluid level, add fluid if required and repeat cycle until fluid level stays even with the bottom of the fill hole.

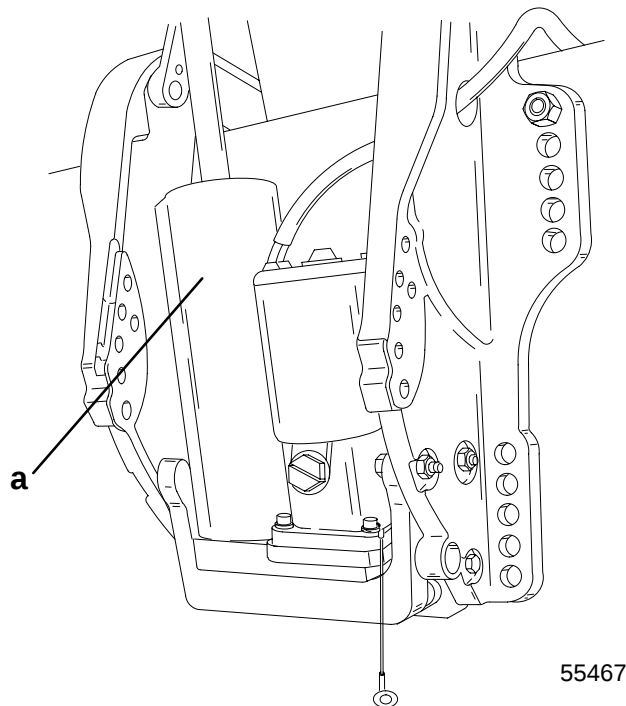
## Installation of Power Trim System

1. Lubricate lower pivot pin, mounting holes with 2-4-C Marine Lubricant.
2. Start lower pivot pin into pivot pin bore and position lower dowel pin (Retained) in its respective hole.



a - Lower Pivot Pin  
b - Lower Dowel Pin

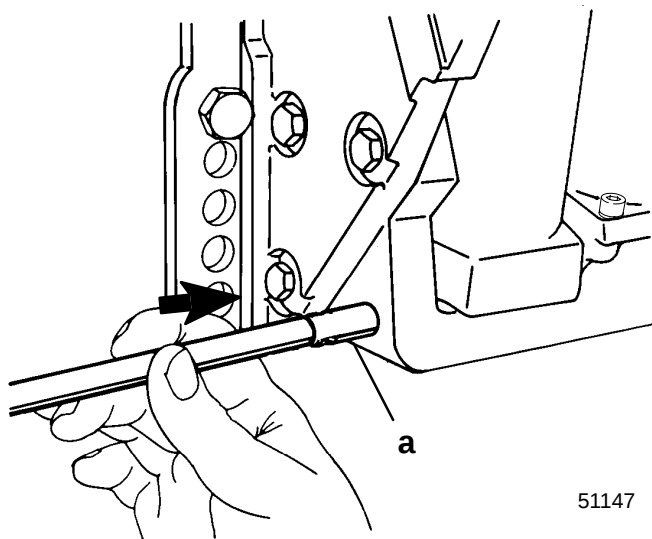
3. Position trim cylinder assembly (Bottom First) between clamp brackets.



a - Trim Cylinder Assembly

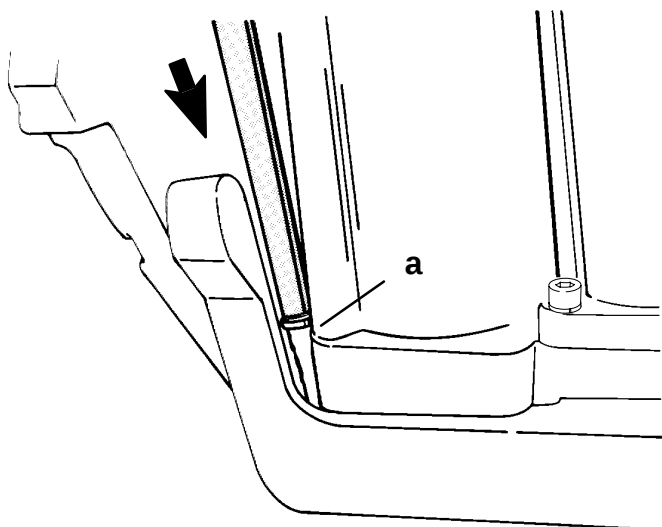


4. Apply 2-4-C Marine Lubricant (92-90018A12) to lower pivot pin. Using a suitable punch, drive lower pivot pin into clamp bracket and trim cylinder assembly until pivot pin is flush with outside surface.



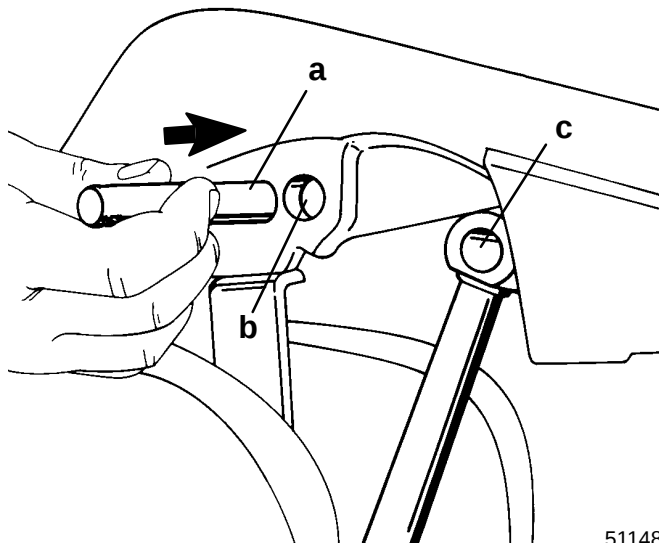
a - Lower Pivot Pin

5. Using a suitable punch, drive lower dowel pin into its hole until seated.



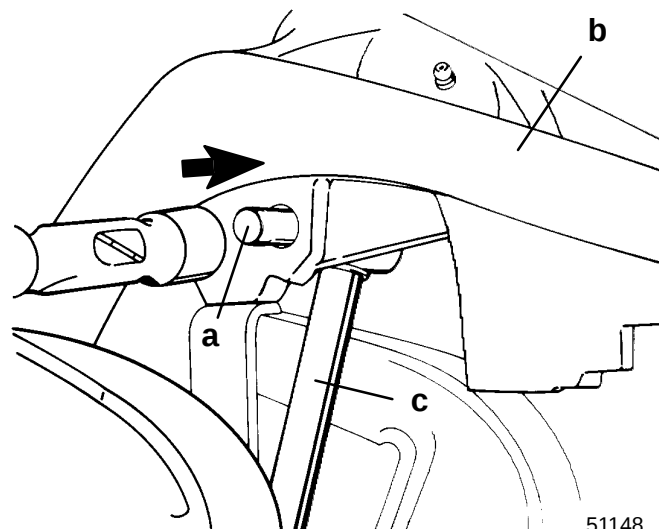
a - Lower Dowel Pin

6. Apply 2-4-C Marine Lubricant (92-90018A12) to surface of upper pivot pin, pivot pin bore and trim ram bore.



a - Pivot Pin  
b - Pivot Pin Bore  
c - Trim Ram Bore

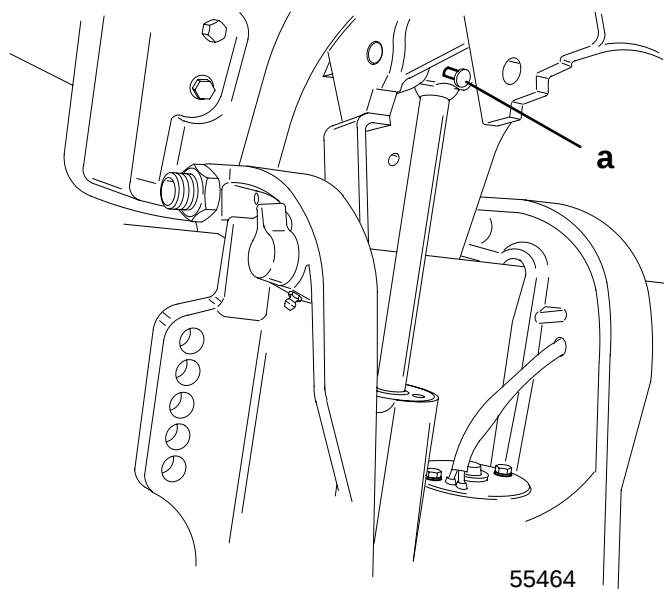
7. Using a suitable mallet, drive upper pivot pin into swivel bracket and through trim ram until pivot pin is flush with swivel bracket.



a - Pivot Pin  
b - Swivel Bracket  
c - Trim Ram

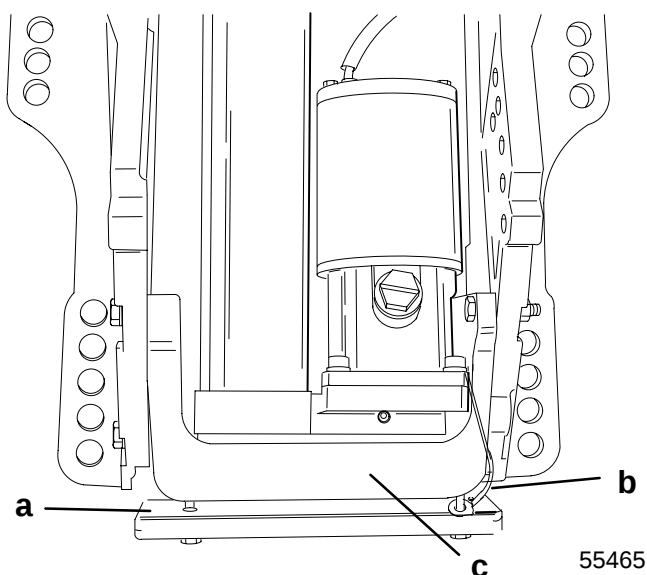


8. Drive trilobe pin (a) into its hole until seated.



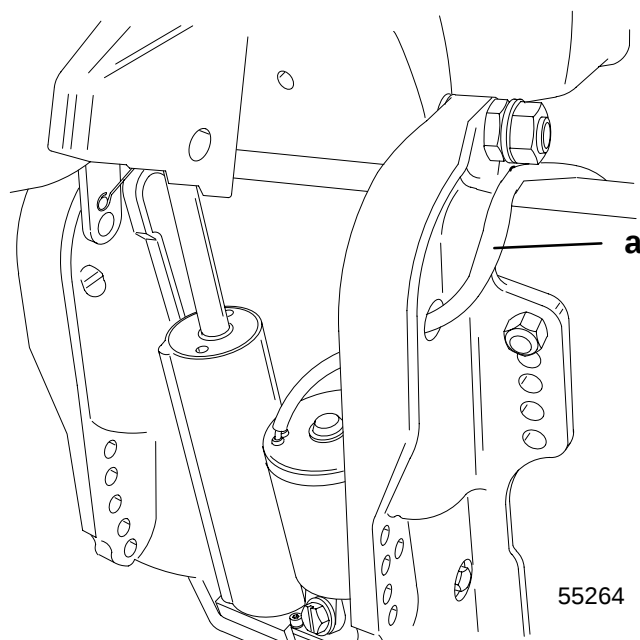
a - Trilobe Pin

9. Install sacrificial aluminum anode to reservoir bracket placing ground strap between bracket and anode as shown.



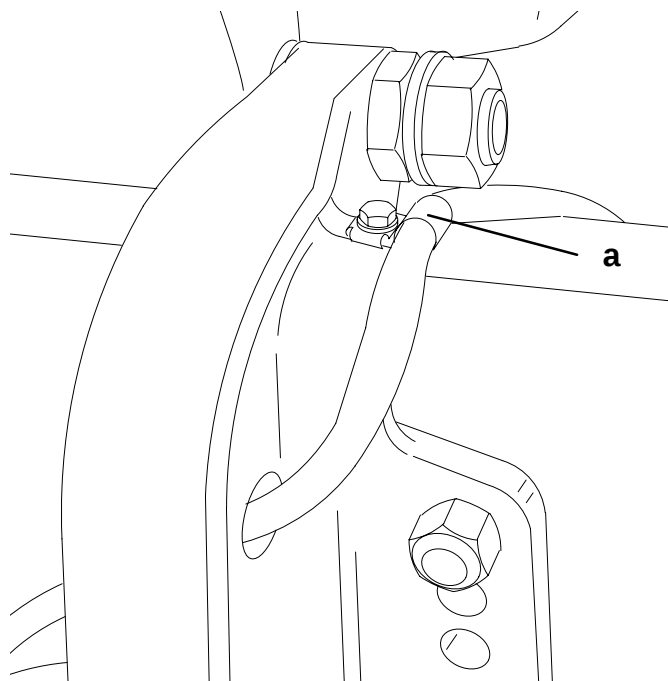
a - Sacrificial Anode  
b - Ground Strap  
c - Bracket

10. Route trim harness through clamp bracket and cowling.



a - Trim Harness

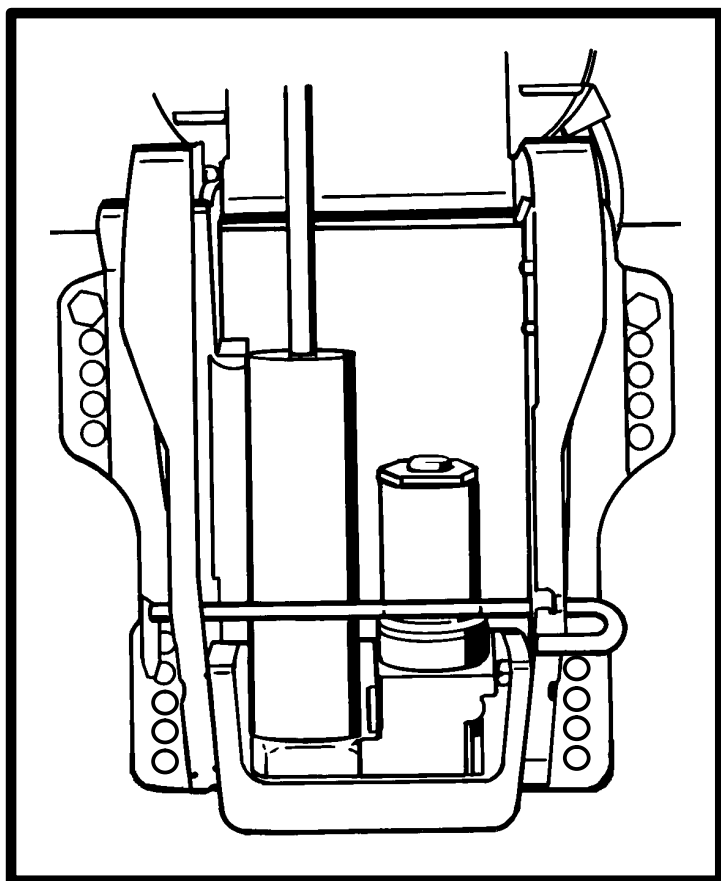
11. Secure trim harness with clamp as shown.



a - Clamp



# MID-SECTION



5  
F

**MANUAL TILT SYSTEM  
(DESIGN I, II, III)**



# Table of Contents

## Page

|                                                          |       |
|----------------------------------------------------------|-------|
| Manual Tilt System Components (Design One and Two) ..... | 5F-1  |
| Quicksilver Lubricant/Sealant Application Points .....   | 5F-1  |
| Torque Specification .....                               | 5F-1  |
| Manual Tilt System Components (Design Three) .....       | 5F-2  |
| Quicksilver Lubricant/Sealant Application Points .....   | 5F-2  |
| Torque Specification .....                               | 5F-2  |
| Manual Tilt Flow Diagrams Design 1 .....                 | 5F-3  |
| Manual Tilt Flow Diagrams Design 2 .....                 | 5F-8  |
| Manual Tilt Flow Diagrams Design 3 .....                 | 5F-13 |
| Hydraulic System Troubleshooting .....                   | 5F-18 |
| Troubleshooting Flow Chart .....                         | 5F-19 |
| Manual Tilt System Removal .....                         | 5F-21 |
| Manual Tilt System Disassembly .....                     | 5F-22 |
| Accumulator Removal .....                                | 5F-22 |
| Shock Rod Removal .....                                  | 5F-23 |
| Shock Rod Disassembly .....                              | 5F-24 |
| Valve Block Removal .....                                | 5F-26 |
| Valve Block Disassembly .....                            | 5F-27 |
| Manual Tilt System Cleaning and Inspection .....         | 5F-28 |
| Manual Tilt System Reassembly .....                      | 5F-28 |
| Valve Block Reassembly .....                             | 5F-28 |
| Valve Block Installation .....                           | 5F-30 |
| Shock Rod Reassembly .....                               | 5F-30 |
| Shock Rod Installation .....                             | 5F-32 |
| Instructions for Making Retaining Tool .....             | 5F-33 |
| Bleeding Manual Tilt System .....                        | 5F-34 |
| Manual Tilt System Installation .....                    | 5F-35 |

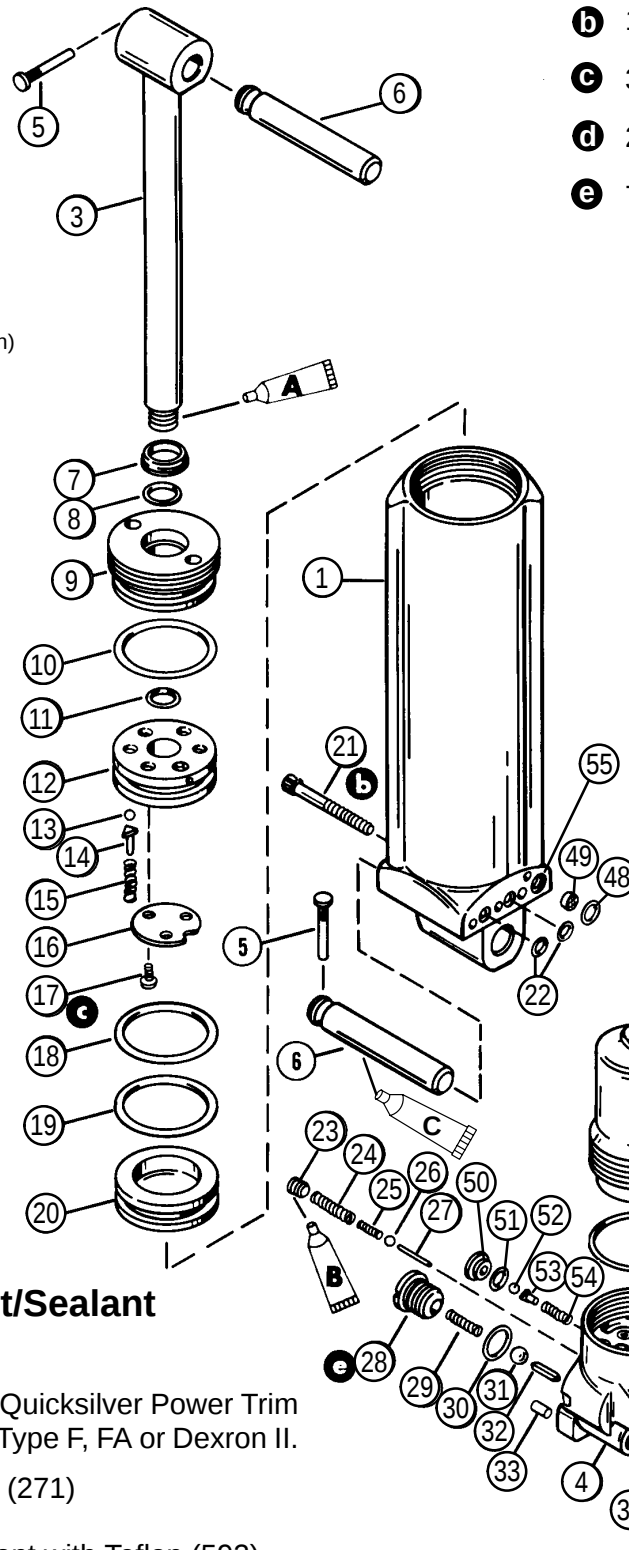


# Manual Tilt System Components (Design One and Two)

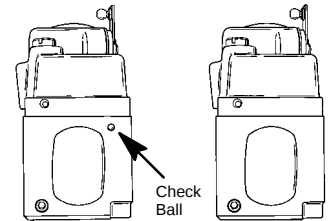
- 1 - Shock Rod Cylinder
  - 2 - Accumulator
  - 3 - Shock Rod
  - 4 - Valve Block
  - 5 - Dowel Pin
  - 6 - Pivot Pin
  - 7 - Rod Wiper
  - 8 - O-ring .671 in. I.D.
  - 9 - Cylinder Cap
  - 10 - O-ring 1.864 in I.D
  - 11 - O-ring .614 in. I.D.
  - 12- Shock Rod Piston
  - 13- Ball (5)
  - 14- Spring Seat (5)
  - 15- Spring (5)
  - 16- Retaining Plate
  - 17- Screw (3)
  - 18- O-ring 1.600 in. I.D. (Shock Piston)
  - 19- O-ring 1.600 in. I.D. (Memory Piston)
  - 20- Memory Piston
  - 21- Screw (2)
  - 22- O-ring .208 in. I.D. (2)
  - 23- Pipe Plug
  - 24- Spring (Large)
  - 25- Spring (Small)
  - 26- Ball
  - 27- Plunger
  - 28- Screw Plug (2)
  - 29- Spring (2)
  - 30- O-ring (2)
  - 31- Ball (2)
  - 32- Push Rod (2)
  - 33- Dowel Pin
  - 34- Spool
  - 35- Spring
  - 36- O-ring .301 in I.D.
  - 37- Screw Plug
  - 38- O-ring .301 in. I.D.
  - 39- Cam Shaft
  - 40- Insulator
  - 41- Retainer Plate
  - 42- Screw
  - 43- O-ring 2.114 in. I.D.
  - 44- Push Rod
  - 45- Ball
  - 46- Flat Spring
  - 47- Screw
- Design One Only**
- 48- O-ring
  - 49- Filter
  - 50- Valve Seat
  - 51- O-ring .364 in. I.D.
  - 52- Ball
  - 53- Spring Guide
  - 54- Spring
  - 55- Hole in Cylinder

## Torque Specification

- a** 35 lb. ft. (47 N·m)
- b** 100 lb. in. (11.2 N·m)
- c** 35 lb. in. (4.0 N·m)
- d** 27 lb. in. (3.0 N·m)
- e** 75 lb. in. (8.5 N·m)



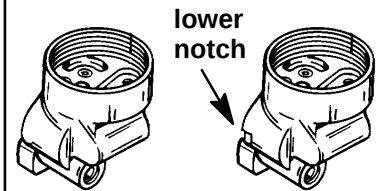
Bottom of Valve Block/Cylinder



DESIGN 1

DESIGN 2

Side of Valve Block

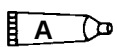


DESIGN 1

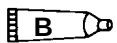
DESIGN 2

## Quicksilver Lubricant/Sealant Application Points

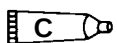
Lubricate ALL O-rings using Quicksilver Power Trim and Steering Fluid or; (ATF) Type F, FA or Dexron II.



Loctite Grade "A" (271)



Loctite Pipe Sealant with Teflon (592)



Special Lubricant 101

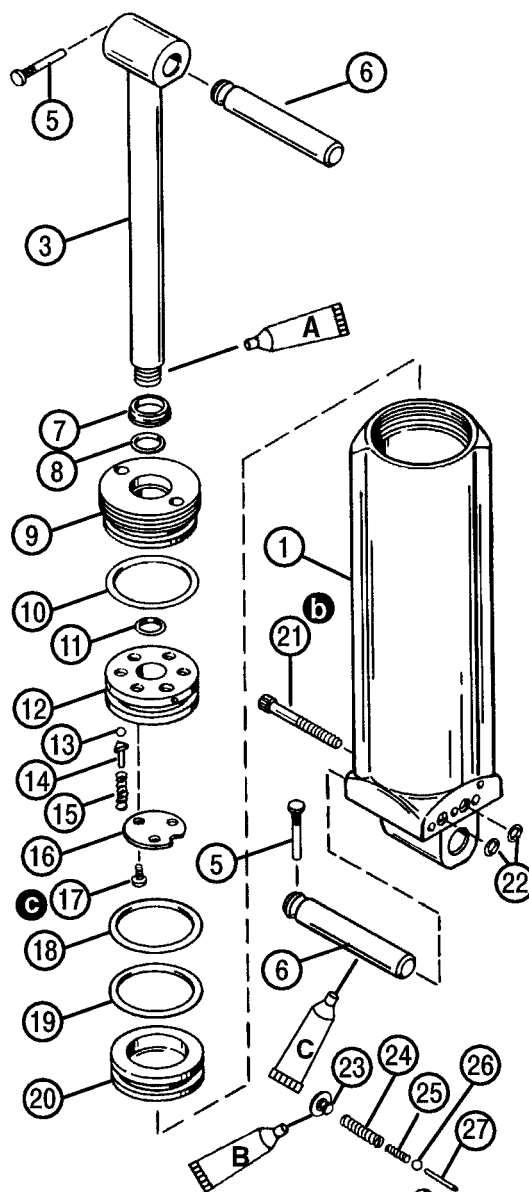
**NOTE:** NOTE: It is recommended that **ALL** O-rings be replaced when servicing tilt system.

26153



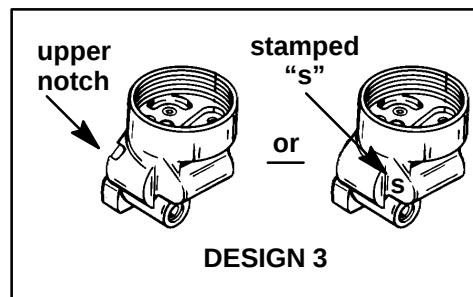
# Manual Tilt System Components (Design Three)

- 1 - Shock Rod Cylinder
- 2 - Accumulator
- 3 - Shock Rod
- 4 - Valve Block
- 5 - Dowel Pin
- 6 - Pivot Pin
- 7 - Rod Wiper
- 8 - O-ring .671 in. I.D.
- 9 - Cylinder Cap
- 10 - O-ring 1.864 in. I.D.
- 11 - O-ring .614 in. I.D.
- 12 - Shock Rod Piston
- 13 - Ball (5)
- 14 - Spring Seat (5)
- 15 - Spring (5)
- 16 - Retaining Plate
- 17 - Screw (3)
- 18 - O-ring 1.600 in. I.D. (Shock Piston)
- 19 - O-ring 1.600 in. I.D. (Memory Piston)
- 20 - Memory Piston
- 21 - Screw (2)
- 22 - O-ring .208 in. I.D. (2)
- 23 - Plug
- 24 - Spring (Large)
- 25 - Spring (Small)
- 26 - Ball
- 27 - Plunger
- 28 - Screw Plug (2)
- 29 - Spring (2)
- 30 - O-ring (2)
- 31 - Ball (2)
- 32 - Push Rod (2)
- 33 - Dowel Pin
- 34 - Spool
- 35 - Spring
- 36 - O-ring .301 in I.D.
- 37 - Screw Plug
- 38 - O-ring .301 in. I.D.
- 39 - Cam Shaft
- 40 - Insulator
- 41 - Retainer Plate
- 42 - Screw
- 43 - O-ring 2.114 in. I.D.
- 44 - Push Rod
- 45 - Ball
- 46 - Flat Spring
- 47 - Screw



## Torque Specification

- a** 35 lb. ft. (47 N·m)
- b** 100 lb. in. (11.2 N·m)
- c** 35 lb. in. (4.0 N·m)
- d** 27 lb. in. (3.0 N·m)
- e** 75 lb. in. (8.5 N·m)

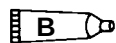


## Quicksilver Lubricant/Sealant Application Points

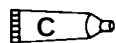
Lubricate ALL O-rings using Quicksilver Power Trim and Steering Fluid or; (ATF) Type F, FA or Dexron II.



Loctite Grade "A" (271)

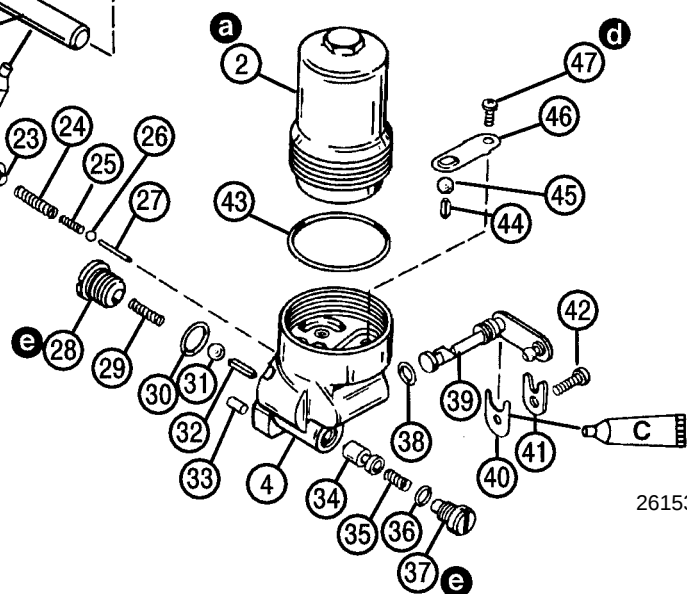


Loctite Pipe Sealant with Teflon (592)



Special Lubricant 101

**NOTE:** It is recommended that **ALL** O-rings be replaced when servicing tilt system.



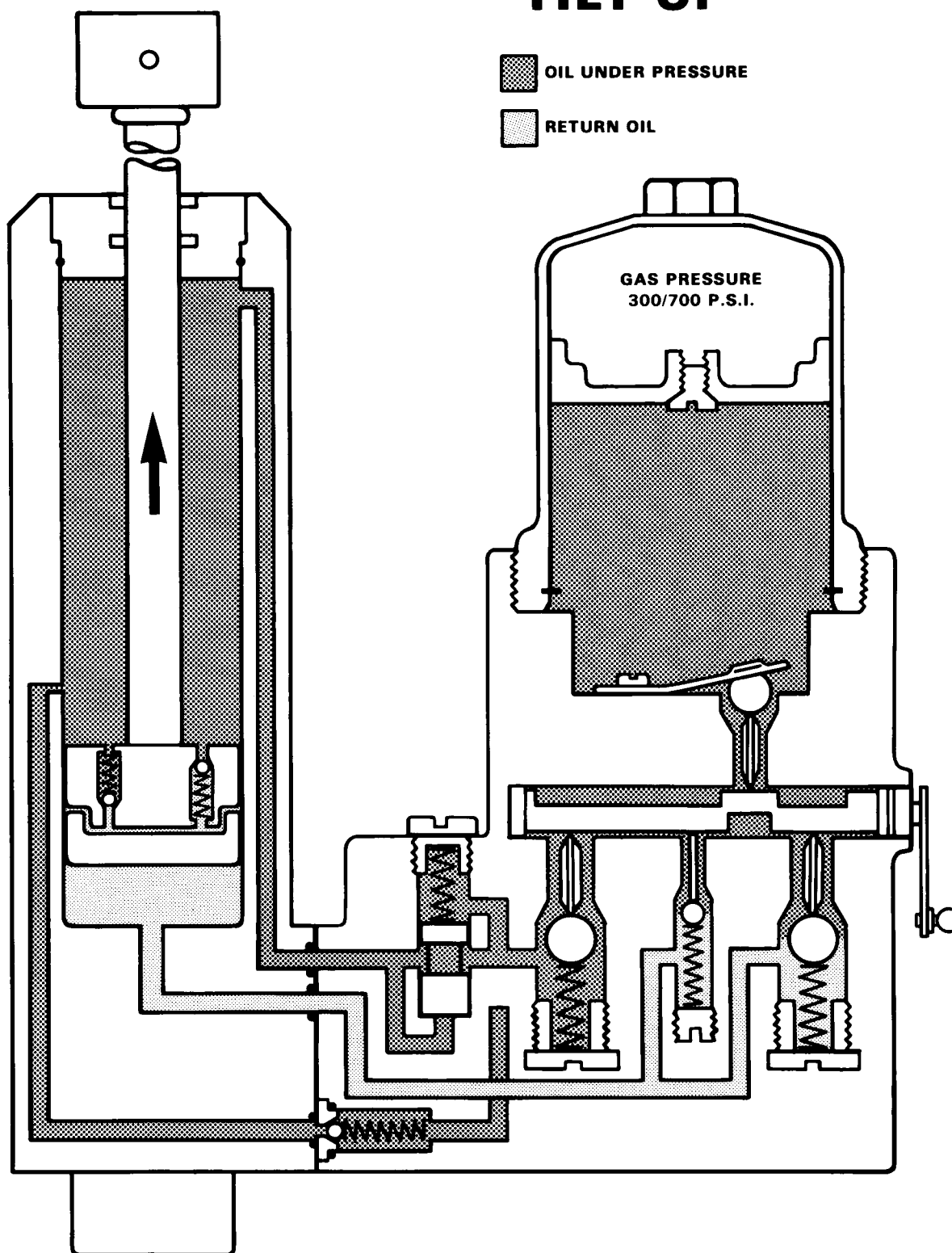
26153



# Manual Tilt Flow Diagrams

## Design 1

### TILT UP

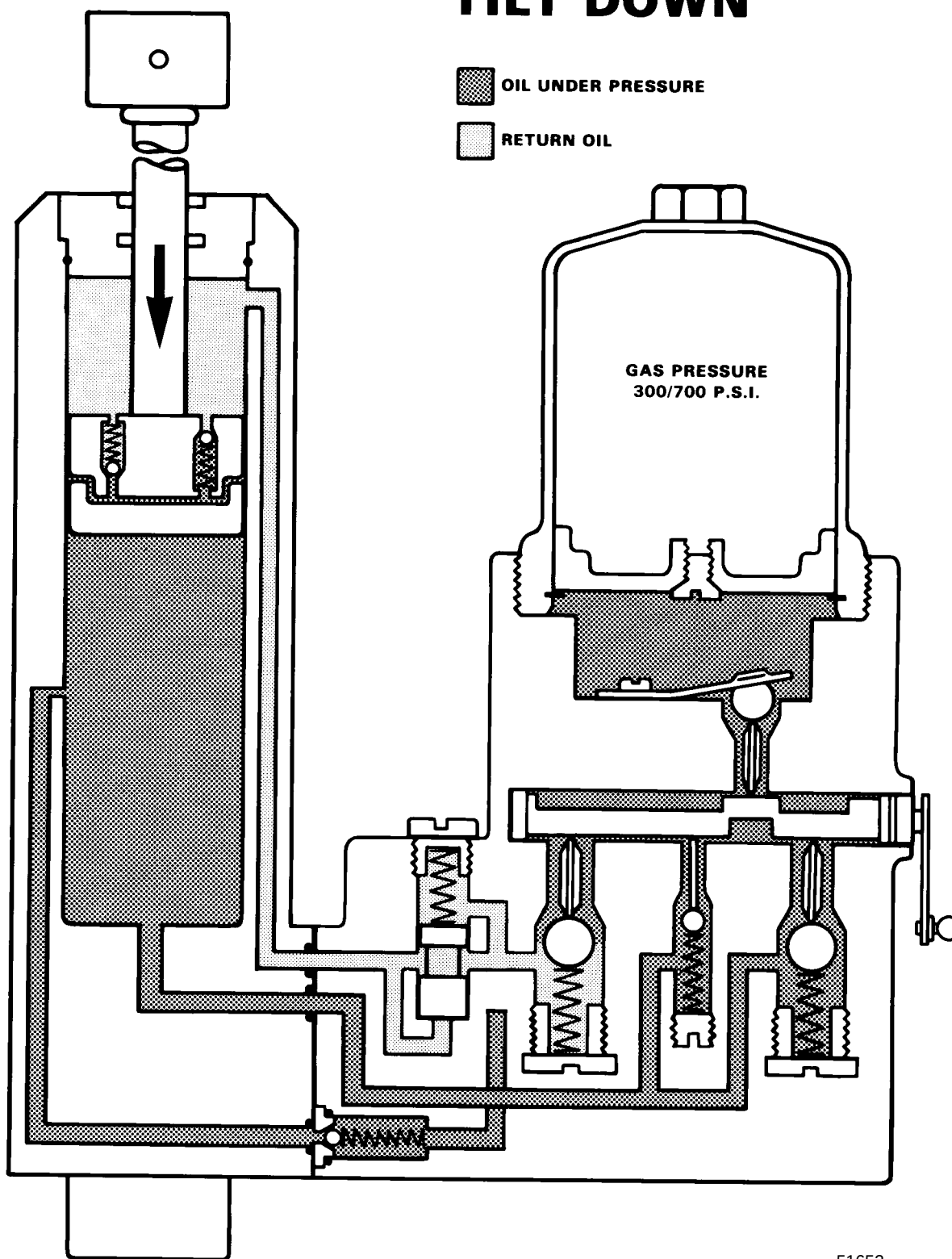


51651



# Design 1

## TILT DOWN

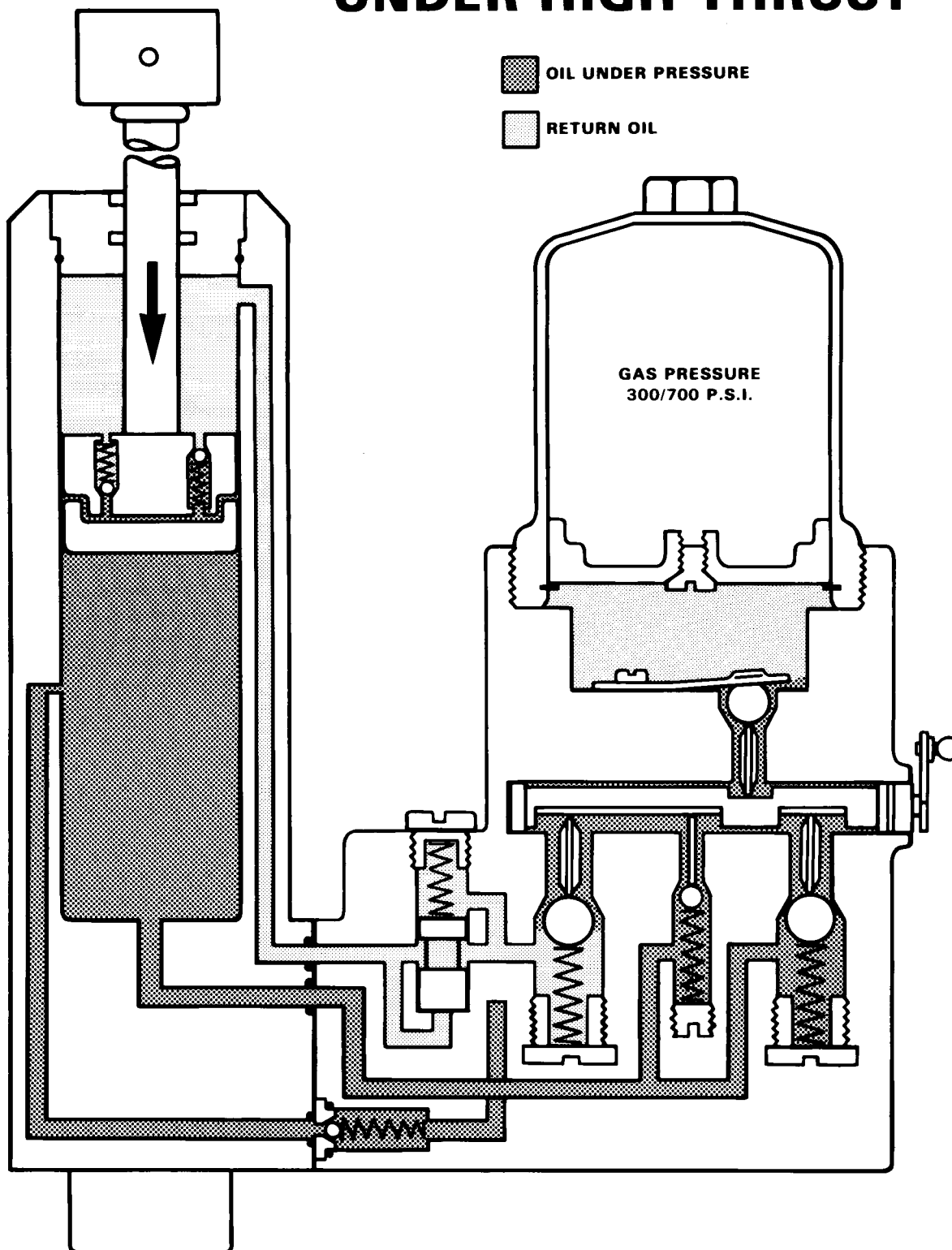


51652



## Design 1

### SLOW TILT DOWN UNDER HIGH THRUST

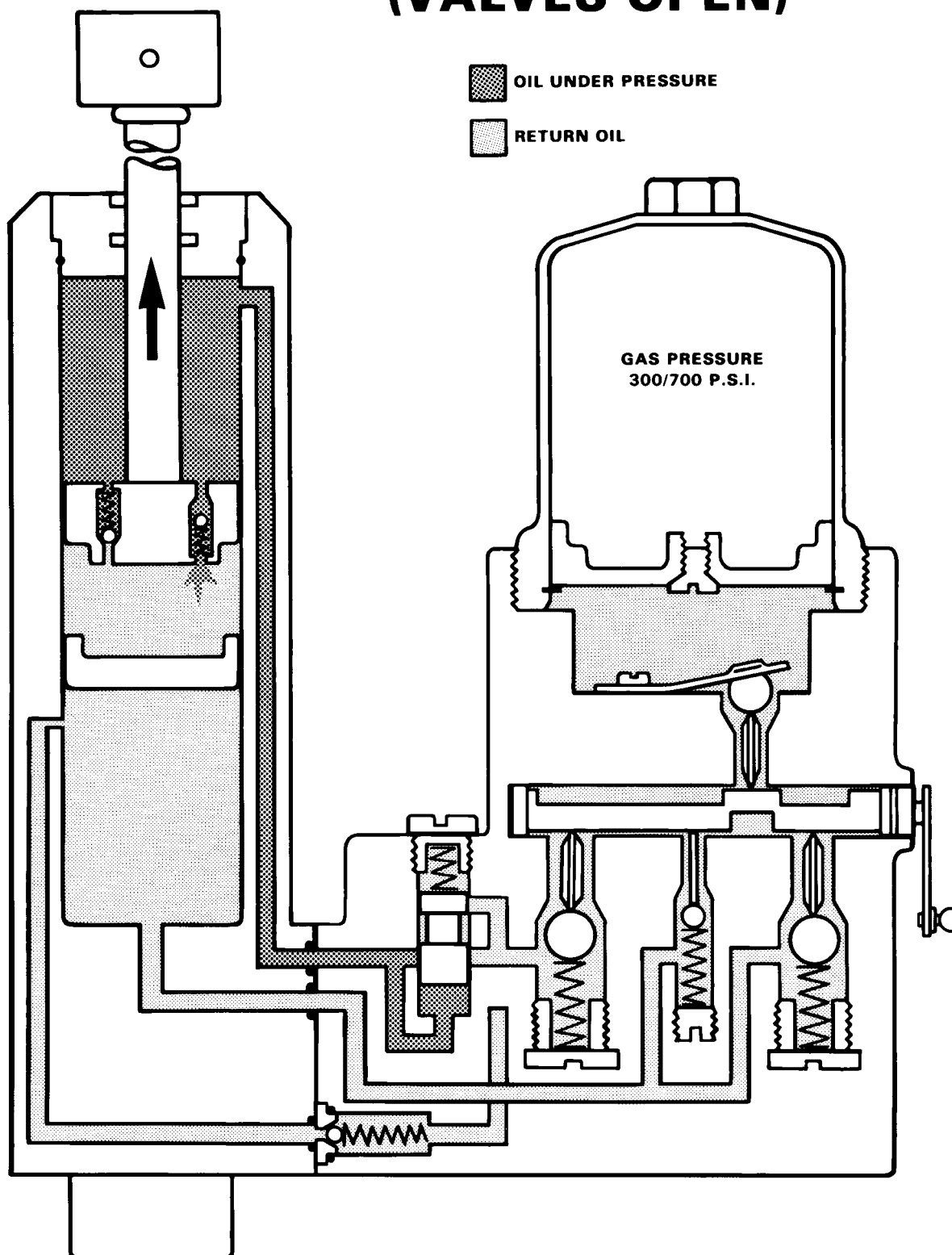


51653



## Design 1

### UNDER WATER STRIKE (VALVES OPEN)

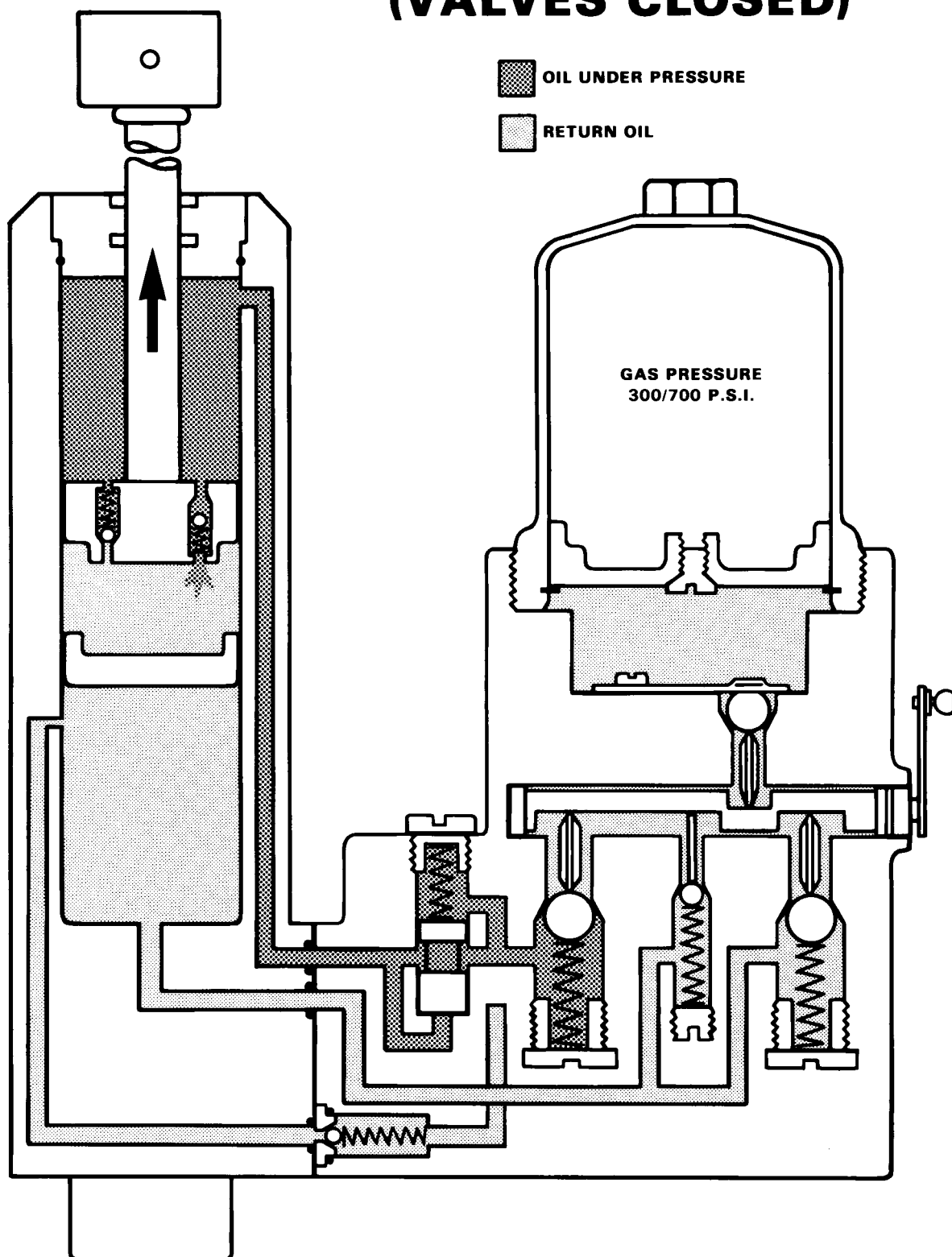


51654



## Design 1

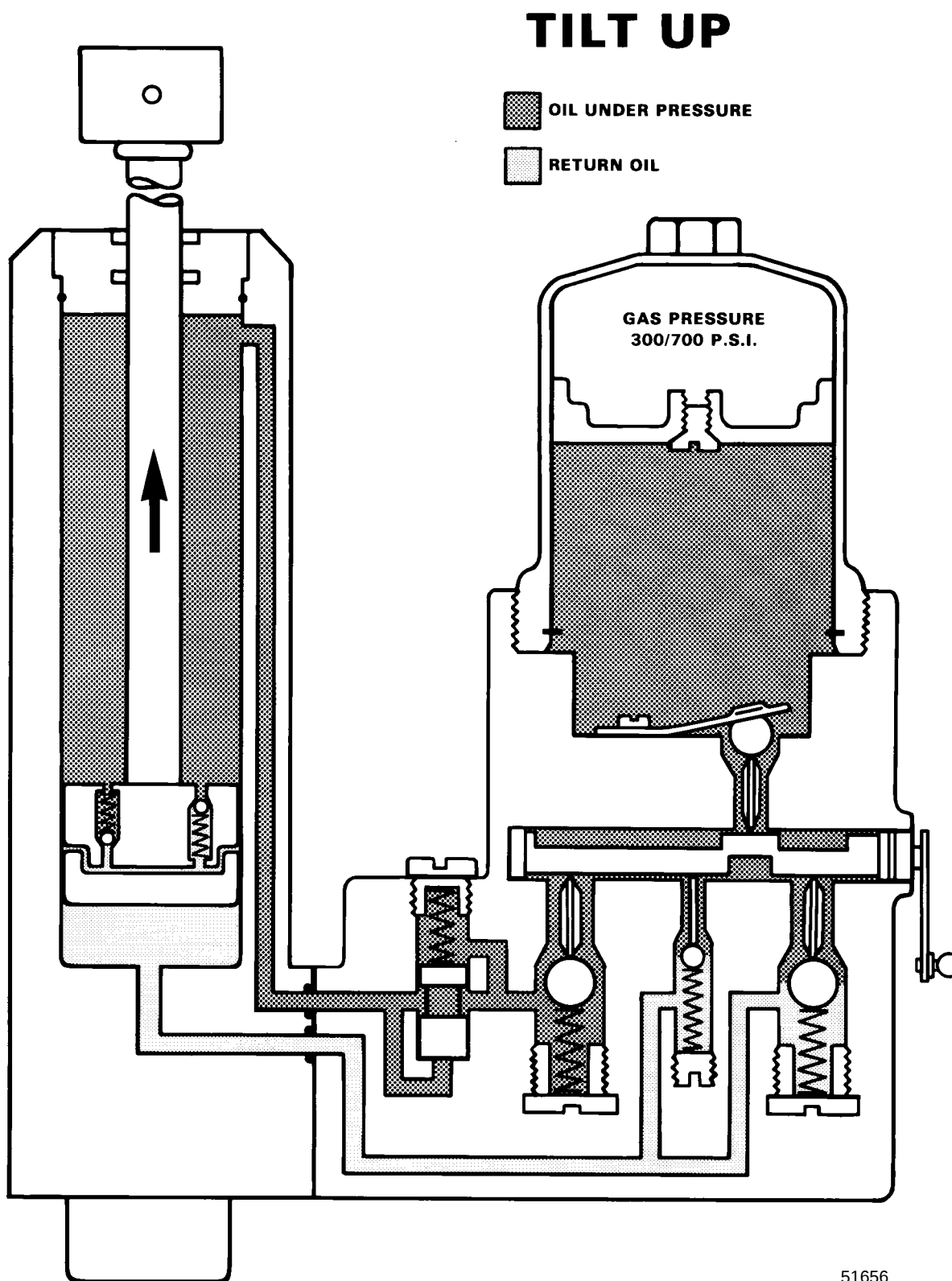
### SHOCK FUNCTION (VALVES CLOSED)



51655



# Manual Tilt Flow Diagrams Design 2

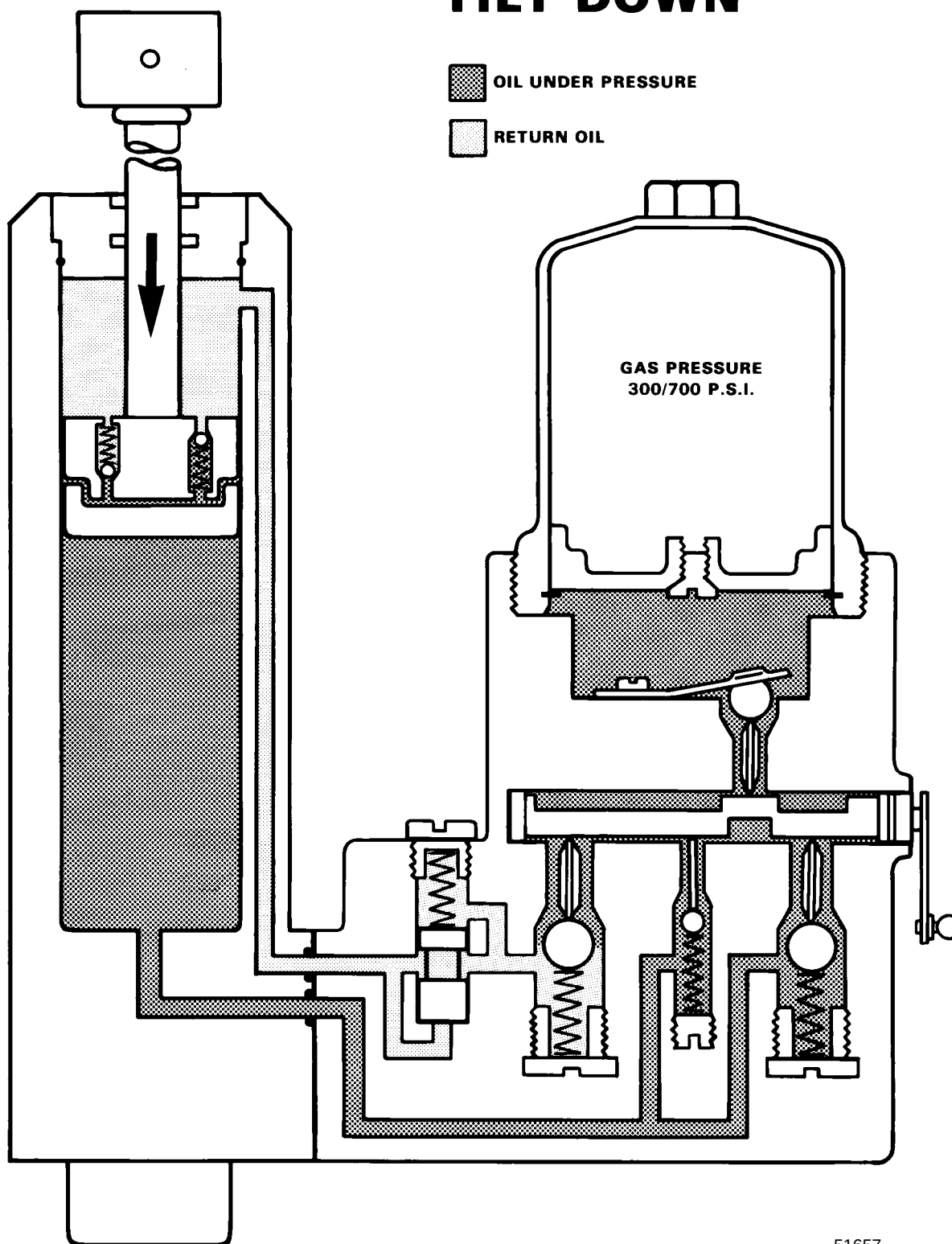


51656



## Design 2

### TILT DOWN

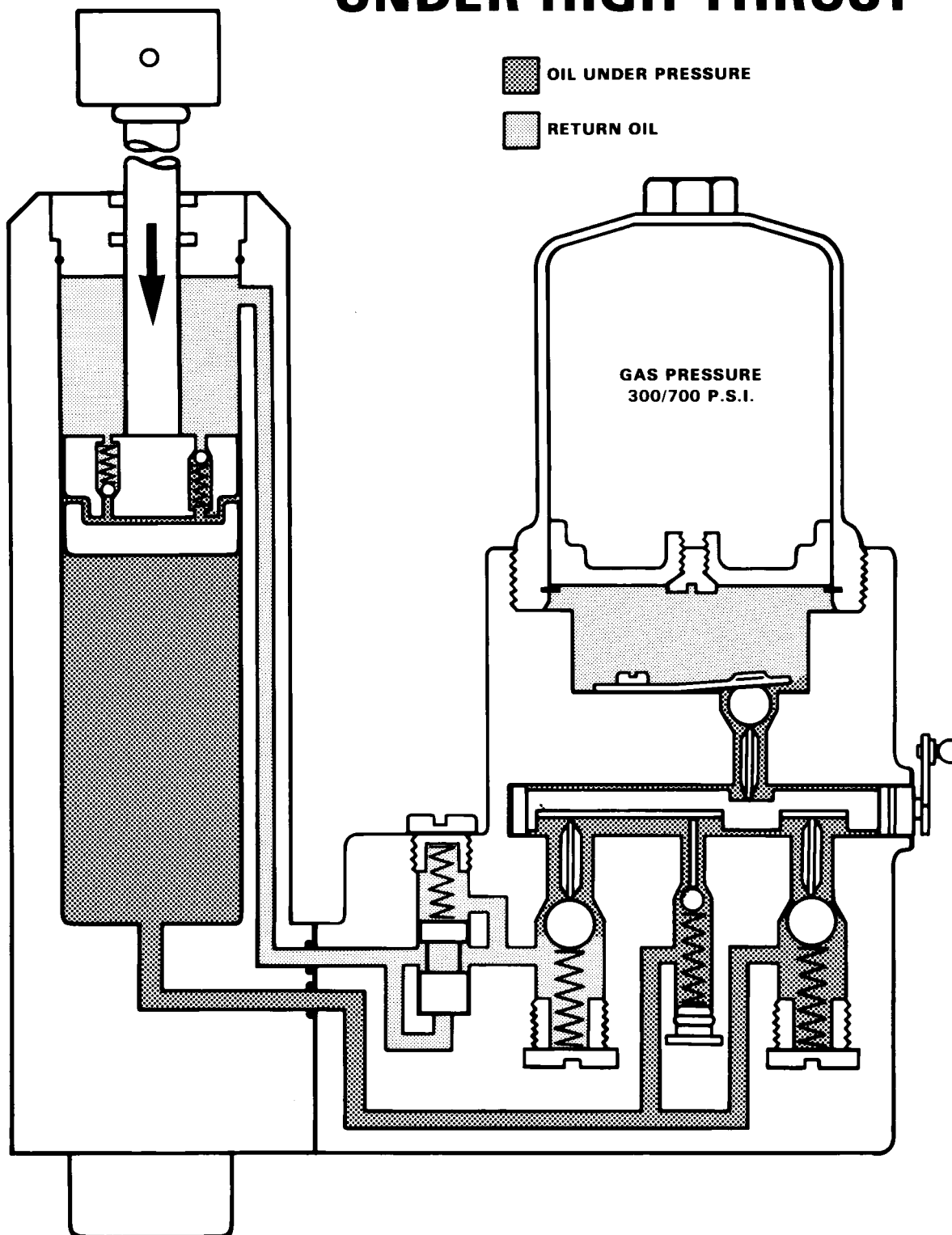


51657



## Design 2

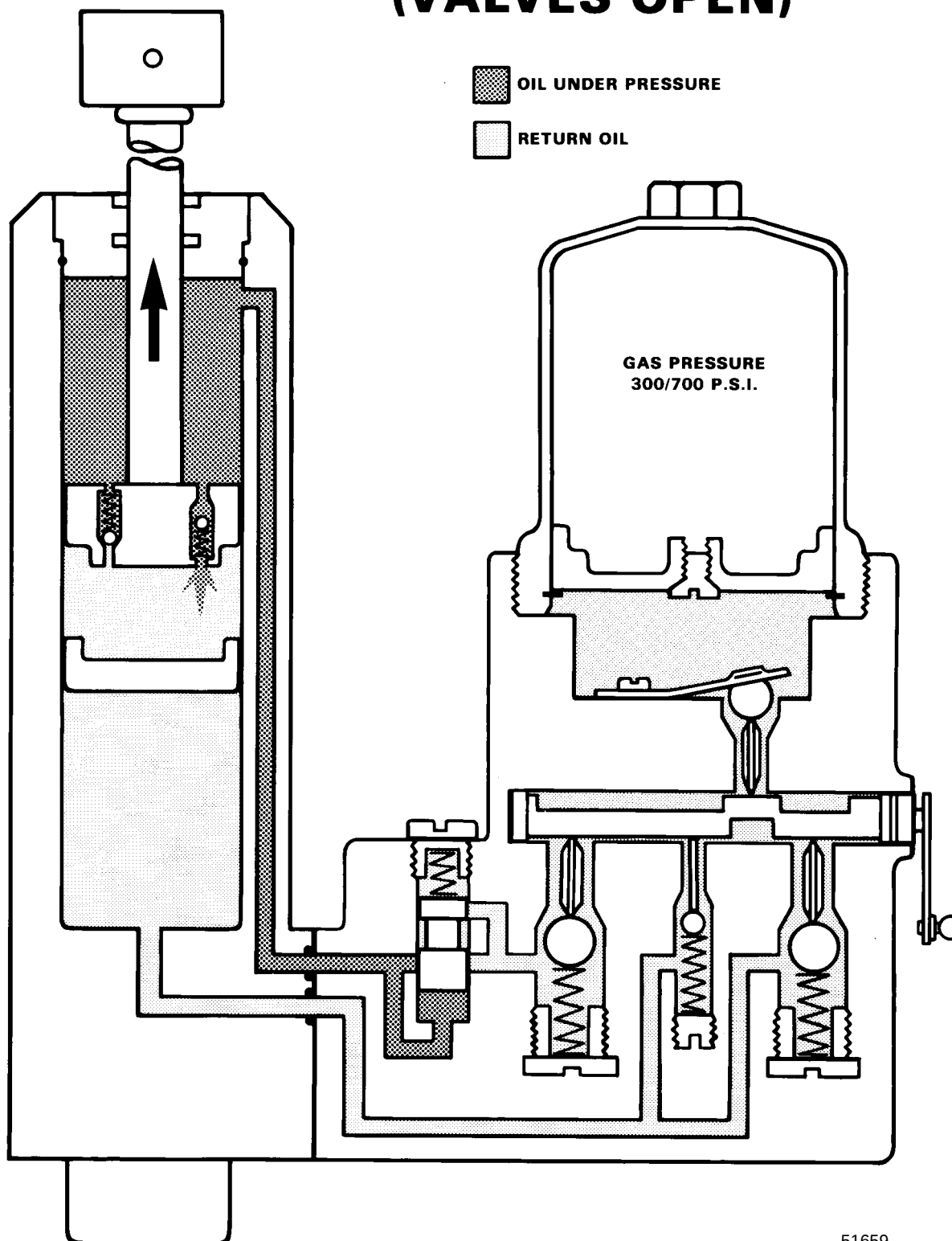
### SLOW TILT DOWN UNDER HIGH THRUST



51658



## UNDER WATER STRIKE (VALVES OPEN)

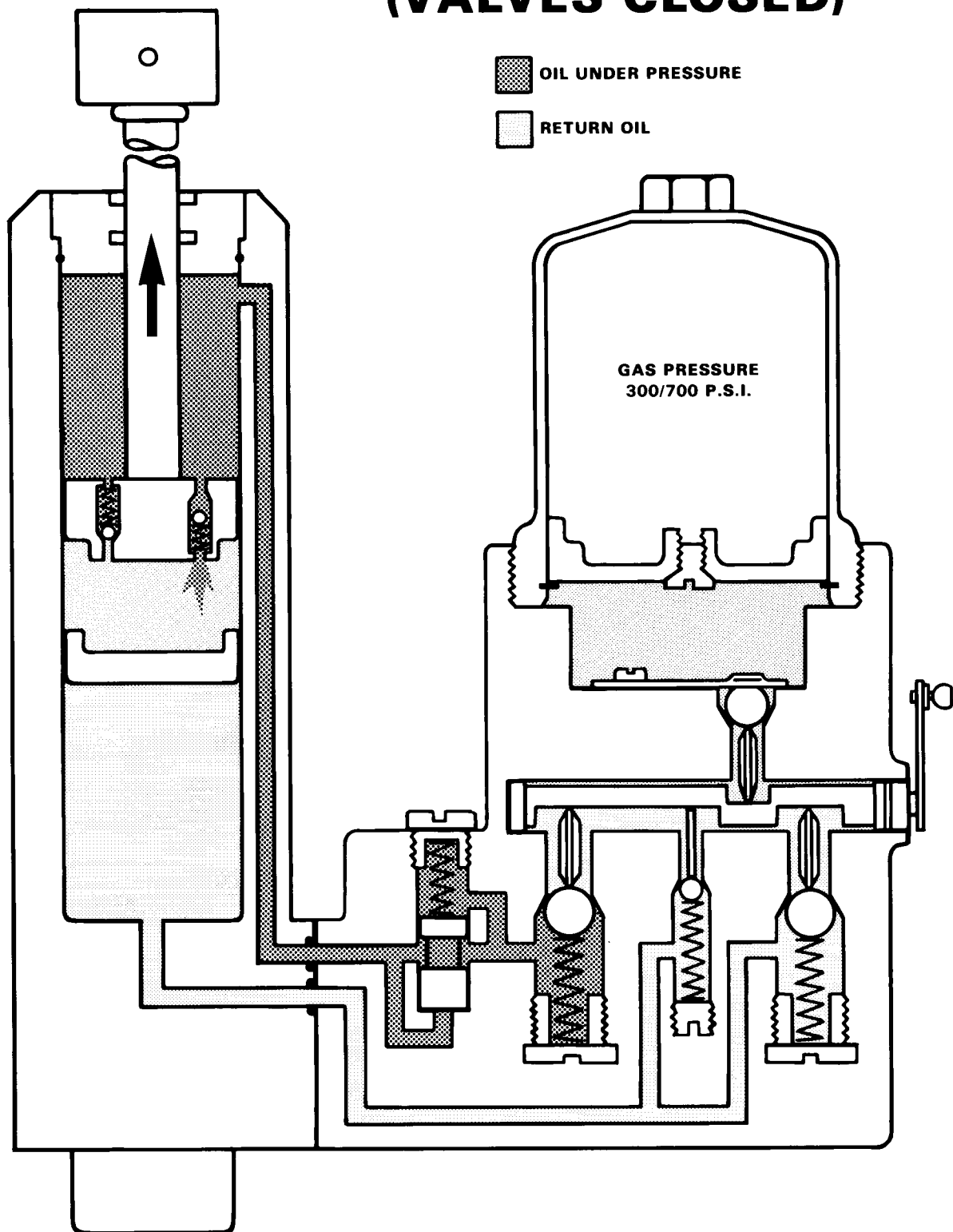


51659



## Design 2

### SHOCK FUNCTION (VALVES CLOSED)



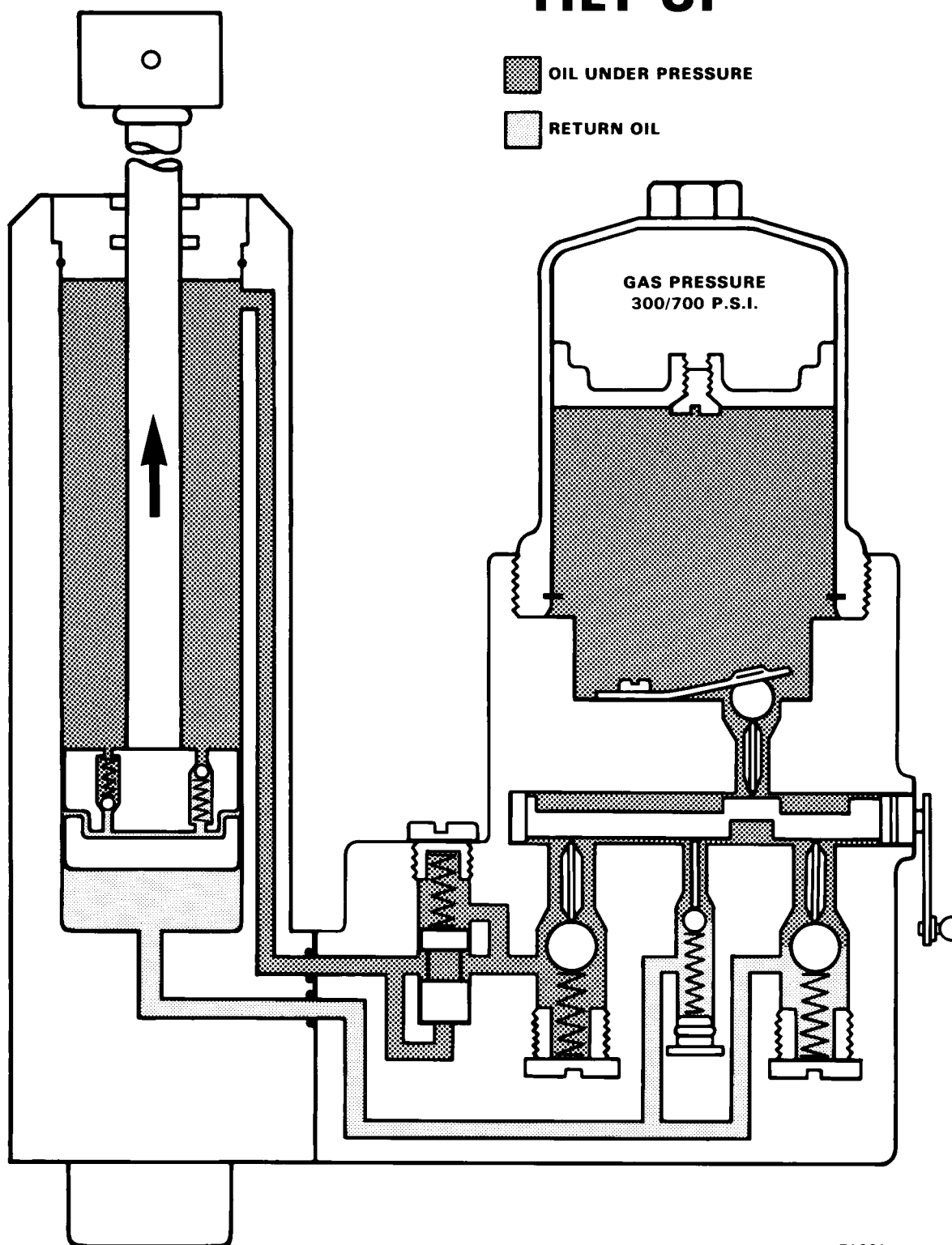
51660



# Manual Tilt Flow Diagrams

## Design 3

### TILT UP

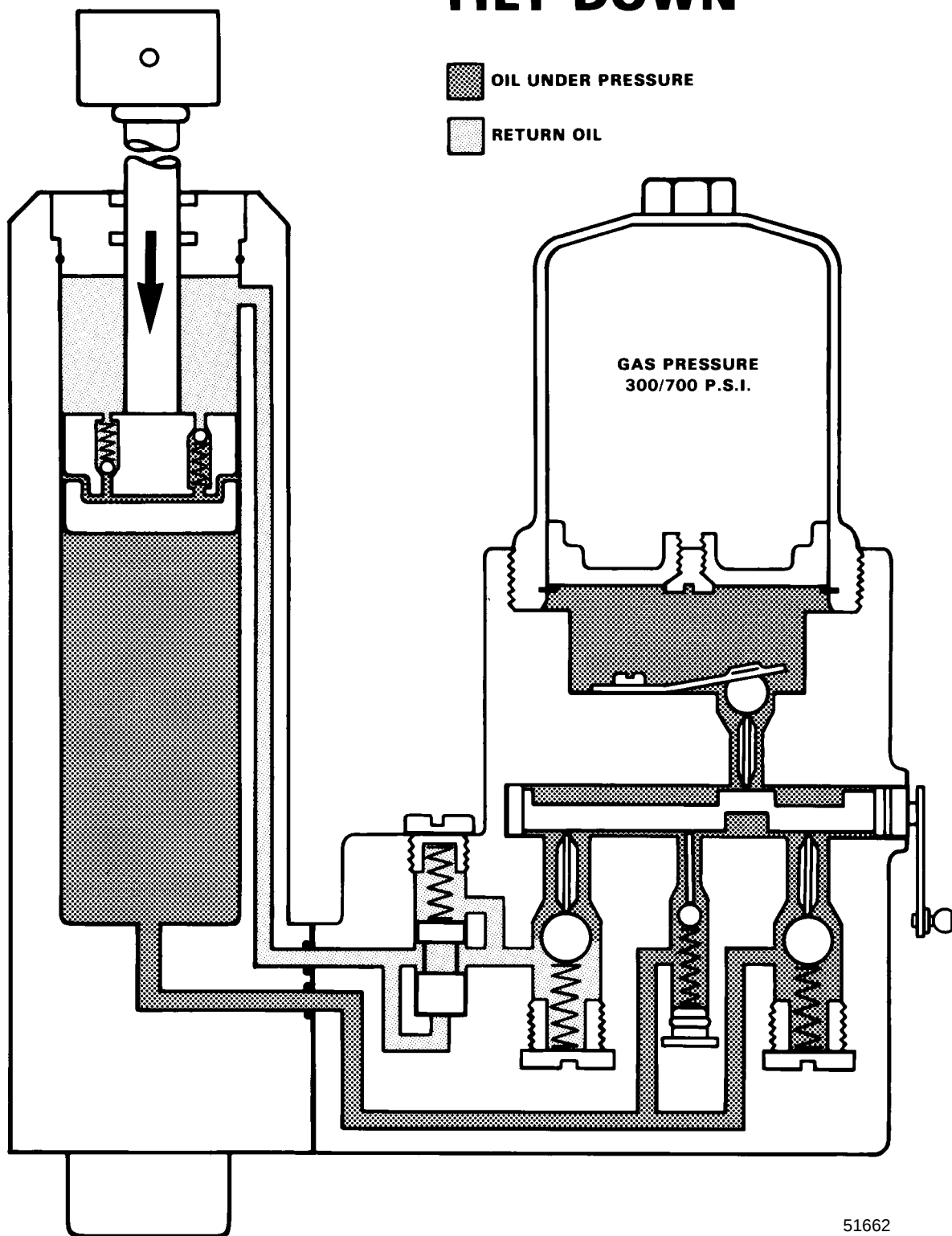


51661



## Design 3

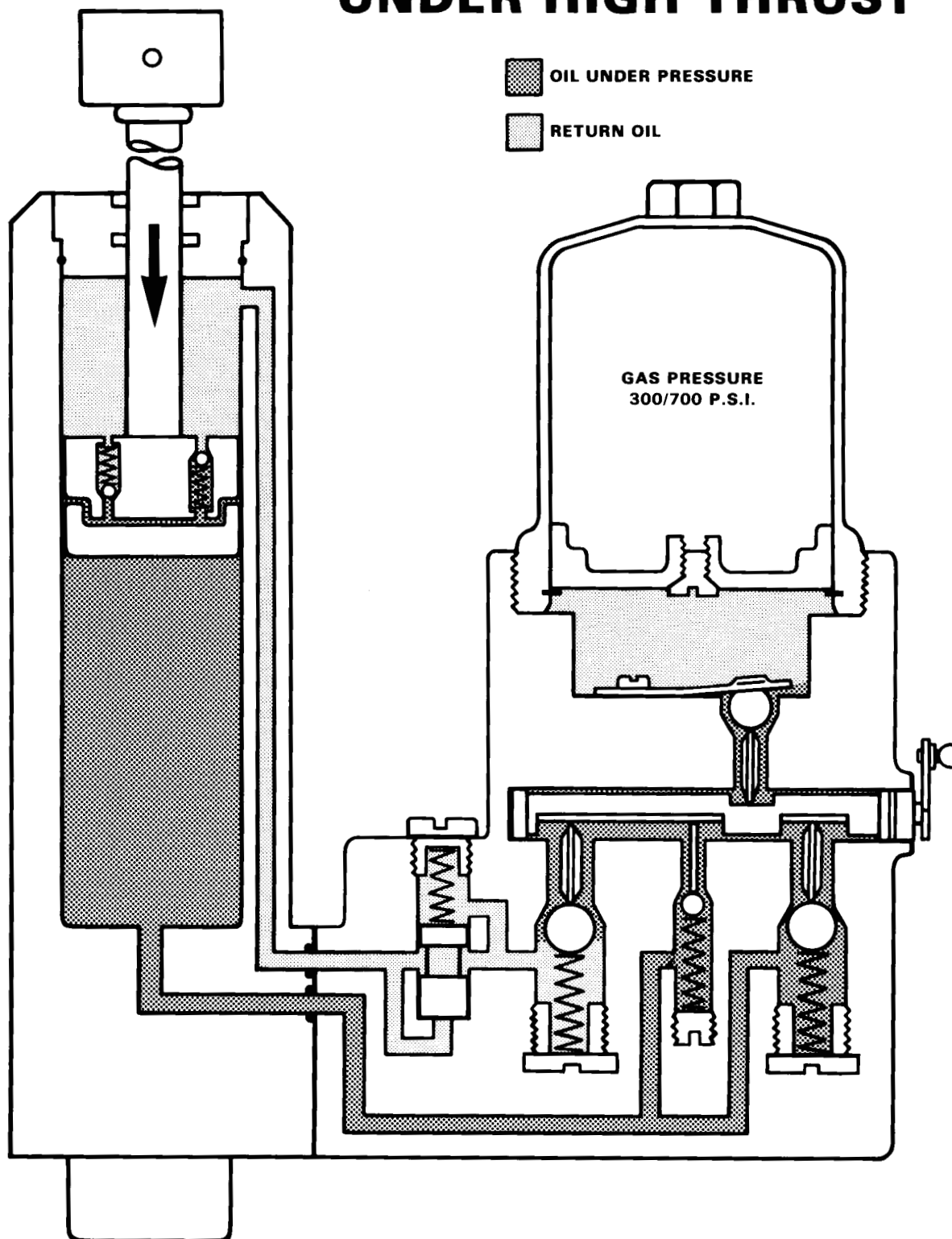
### TILT DOWN





## Design 3

# SLOW TILT DOWN UNDER HIGH THRUST

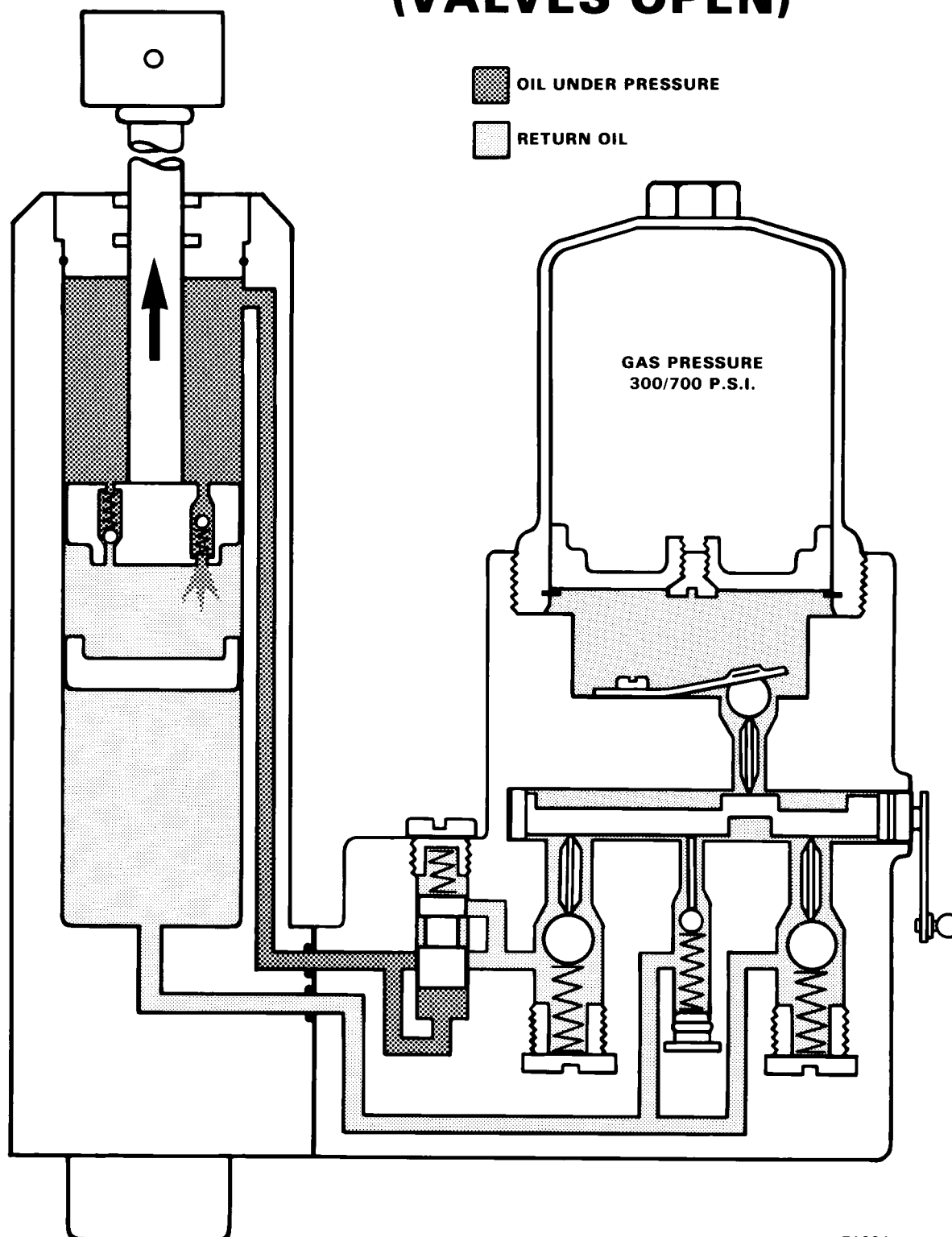


51663



## Design 3

### UNDER WATER STRIKE (VALVES OPEN)

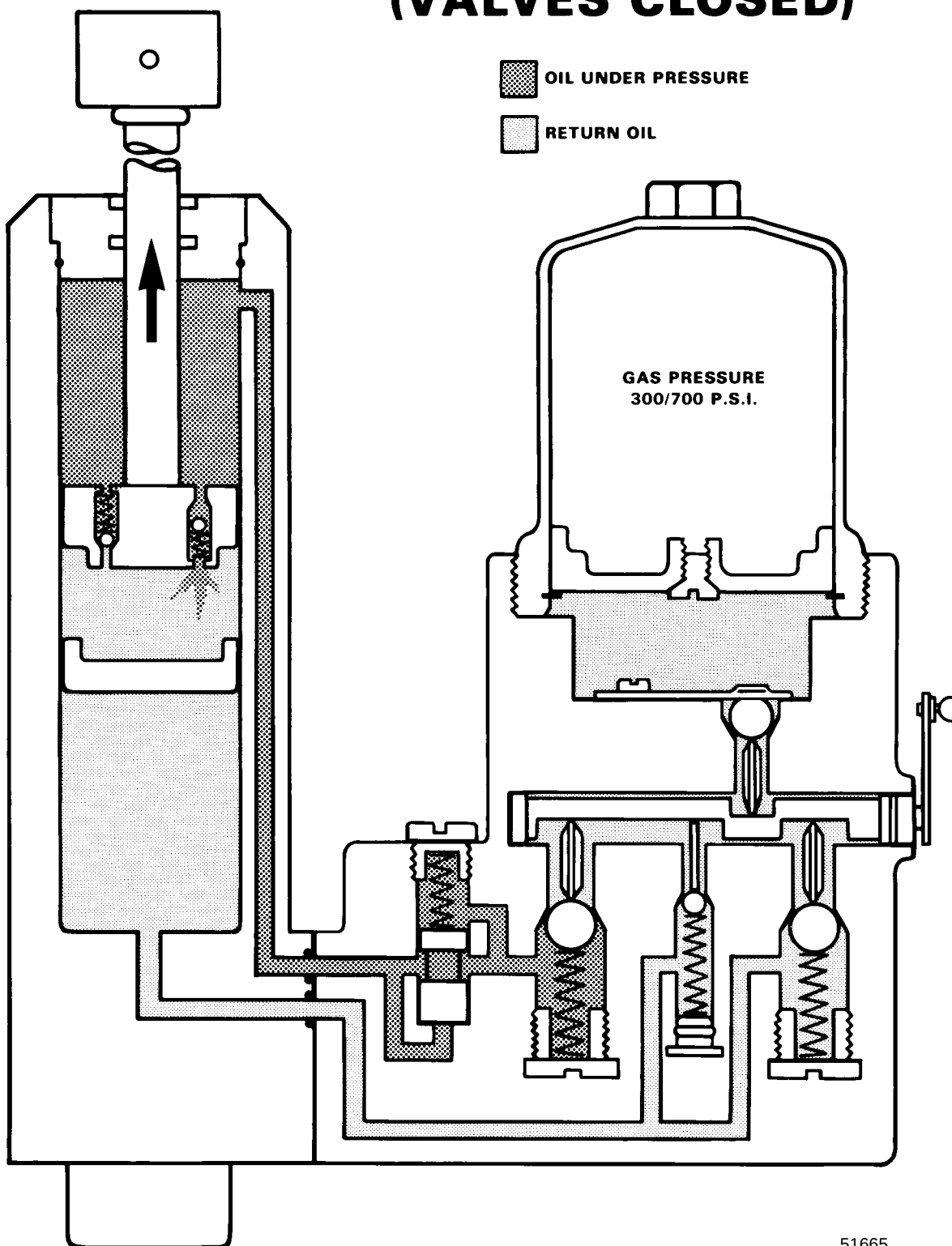


51664



## Design 3

### SHOCK FUNCTION (VALVES CLOSED)



51665



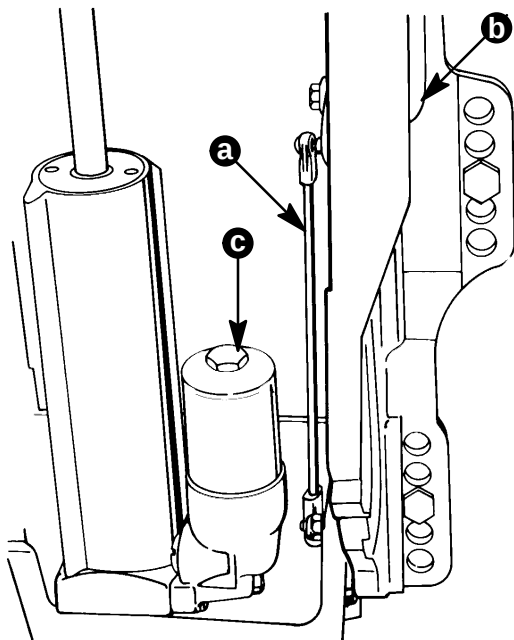
# Hydraulic System Troubleshooting

Refer to disassembly/reassembly instructions (following) if disassembly is required when servicing.

**IMPORTANT:** After debris or failed components have been found (during troubleshooting procedure) it is recommended that unit be disassembled completely and ALL O-rings be replaced. Check ball components and castings must be cleaned using engine cleaner and compressed air or replaced prior to reassembly.

Support outboard with tilt lock lever when servicing manual tilt system.

1. Check manual release cam adjustment. Cam must open and close freely. Adjust cam link rod as necessary.



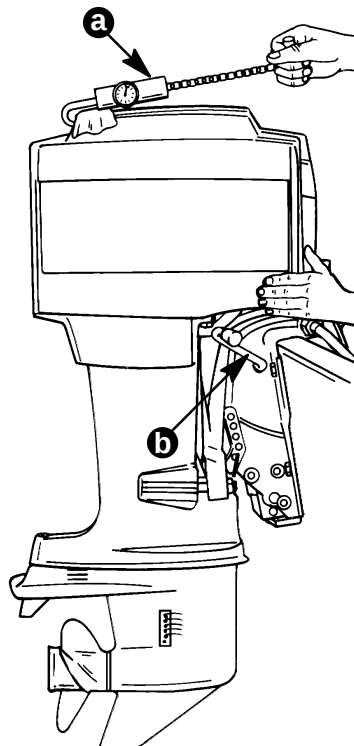
51143

- a - Link Rod
- b - Manual Release Lever
- c - Accumulator

2. Check for external leaks in the manual tilt system. Replace defective part(s) if leak is found.

**IMPORTANT:** If cut or damaged O-rings are found, inspect machined surfaces for scoring, burrs or debris.

3. Check for discharged accumulator. 35 to 50 lb. ft. (47-68 N·m) of pulling force must be attained when tilting outboard from full "down" to full "up" position. If more than 50 lb. ft. (68 N·m) of force is required, replace accumulator.

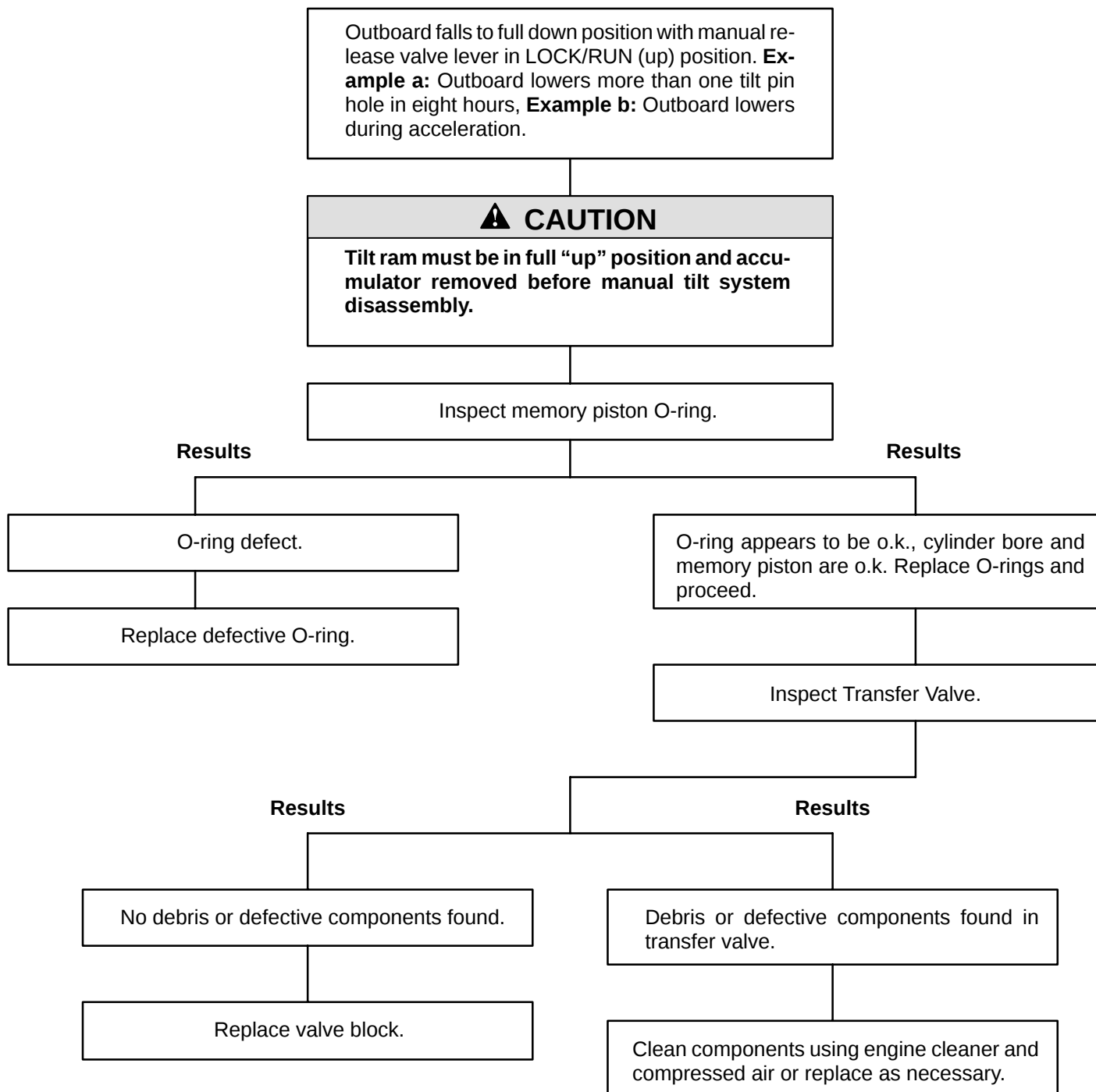


50431

- a - Weight Scale
- b - Valve Lever (open position)

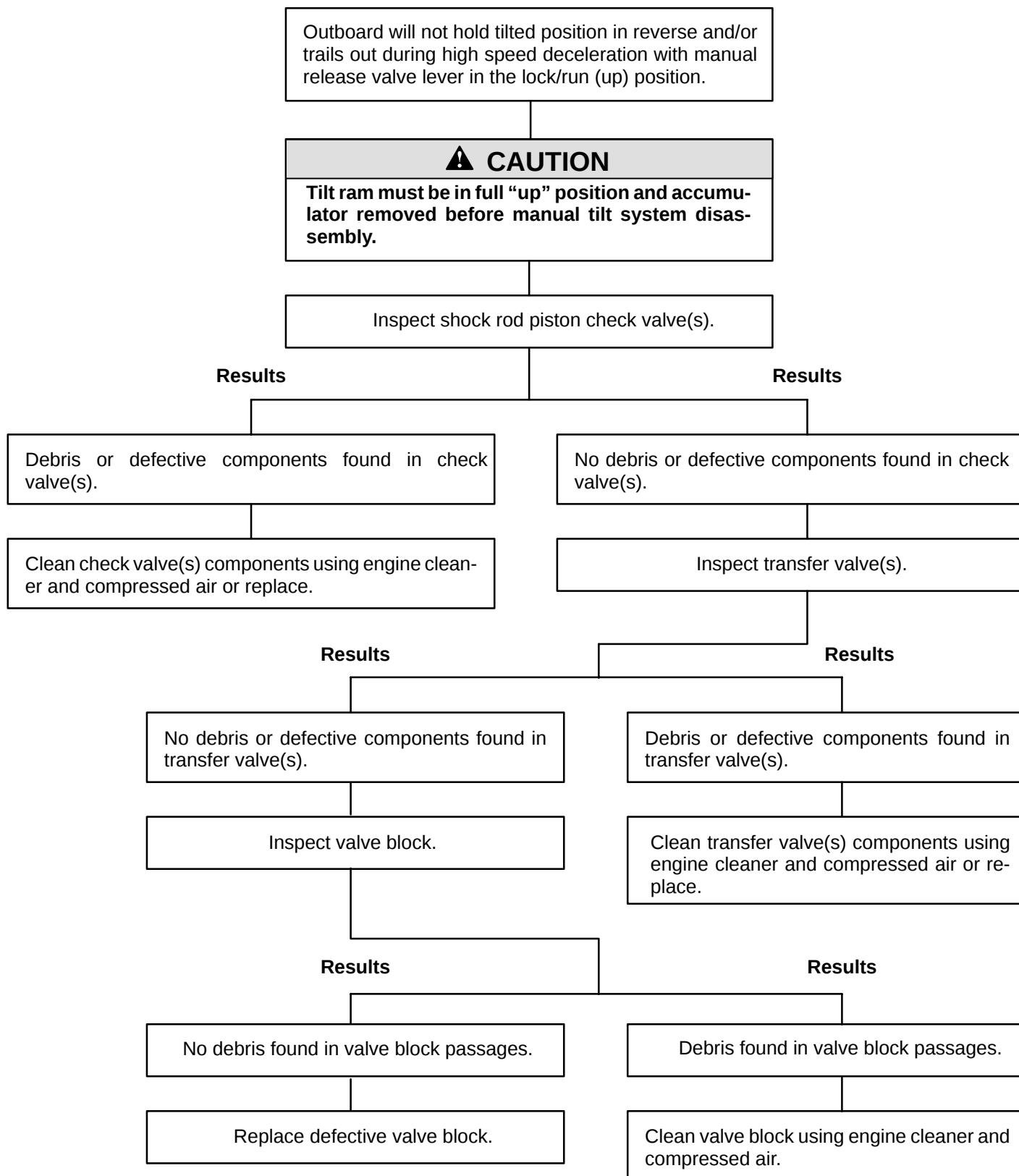


# Troubleshooting Flow Chart





# Troubleshooting Flow Chart (Continued)





## Manual Tilt System Removal

### ⚠ CAUTION

Remove cowling and remove all spark plug leads from spark plugs to prevent accidental starting while servicing outboard.

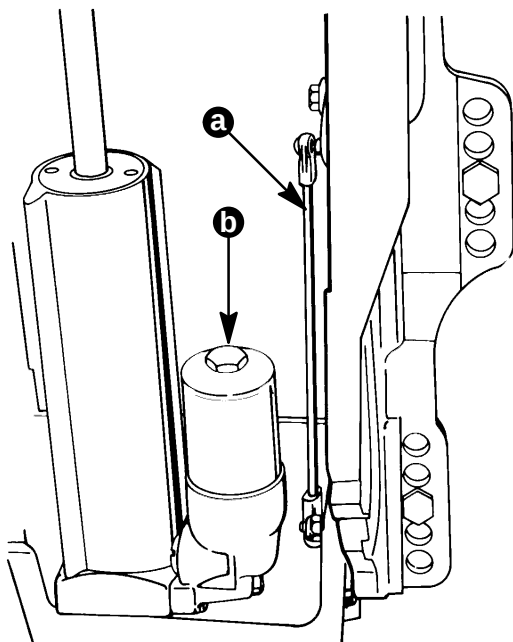
### ⚠ WARNING

Service or installation of the tilt system may result in loss of pressure in the shock cylinder. If the outboard is not in the full down position, such loss of pressure will cause the engine to fall to the full down position with a potential for damaging engine or causing personal injury. To avoid such injury support outboard in the up position using tilt lock lever.

### ⚠ WARNING

Manual tilt system is pressurized. Accumulator must be removed when shock rod is in the full up position, prior to servicing, otherwise oil spray-back may occur.

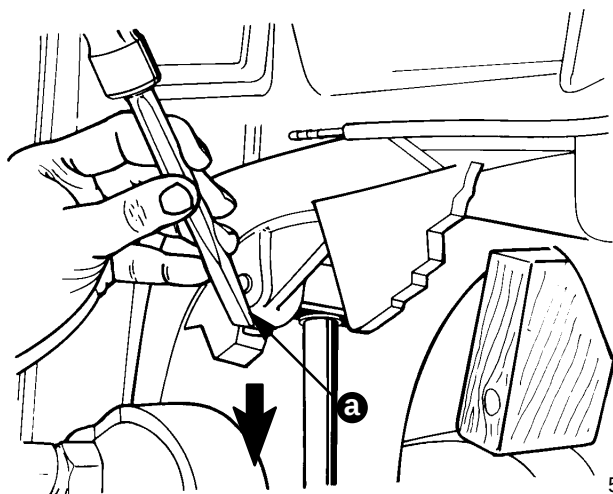
1. Support outboard in the up position using tilt lock lever.
2. Remove link rod.



51143

- a - Link Rod  
b - Accumulator

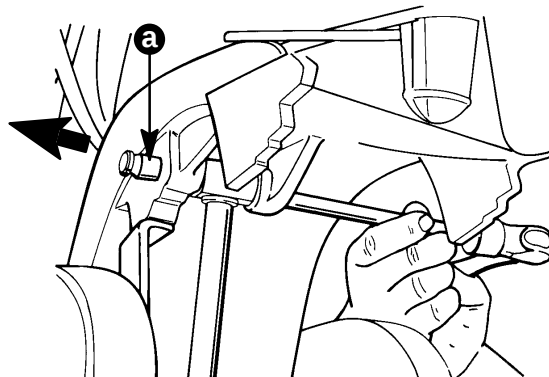
3. Use suitable punch to remove (DRIVE DOWN) upper dowel pin. Retain dowel pin.



51144

- a - Dowel Pin

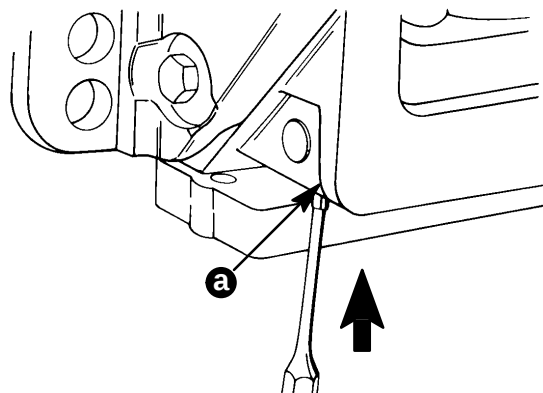
4. Use suitable punch to drive out upper pivot pin.



51144

- a - Pivot Pin

5. Use punch to remove (DRIVE UP) lower dowel pin. Retain dowel pin.

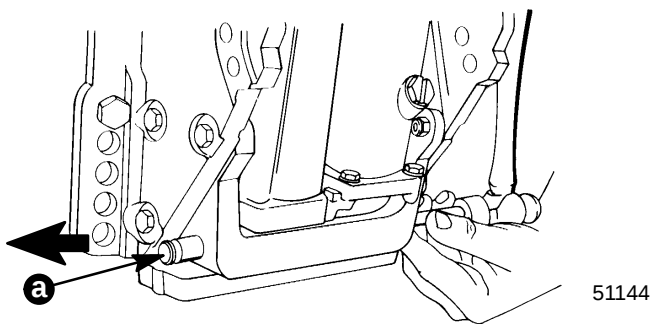


51144

- a - Dowel Pin

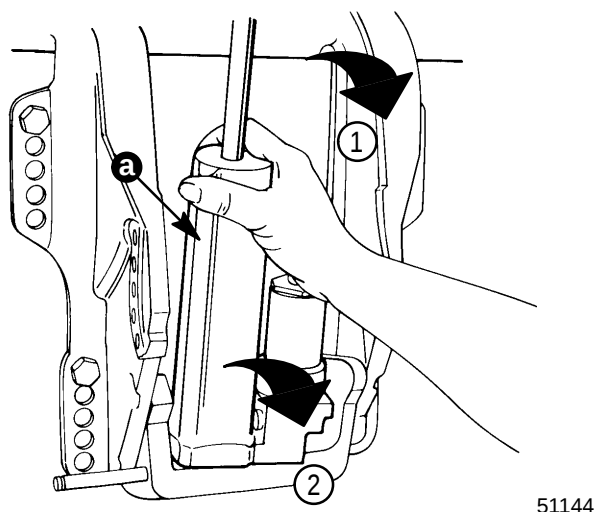


6. Use suitable punch to drive out lower pivot pin.



a - Pivot Pin

7. Tilt shock absorber assembly (TOP FIRST) out from clamp bracket and remove assembly.



a - Manual Tilt System

## Manual Tilt System Disassembly

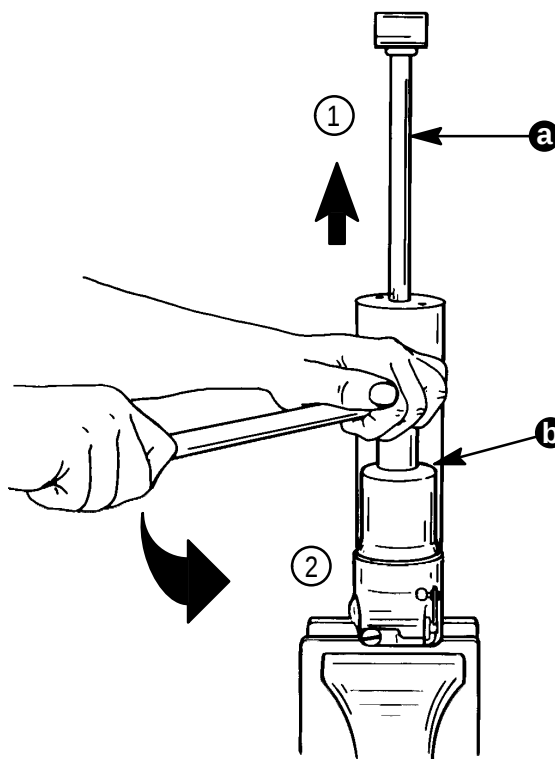
**NOTE:** Accumulator contains a high pressure nitrogen charge and is NOT SERVICEABLE. Replace if necessary.

### ⚠ WARNING

This tilt system is pressurized. Remove accumulator only when shock rod is in full up position.

## Accumulator Removal

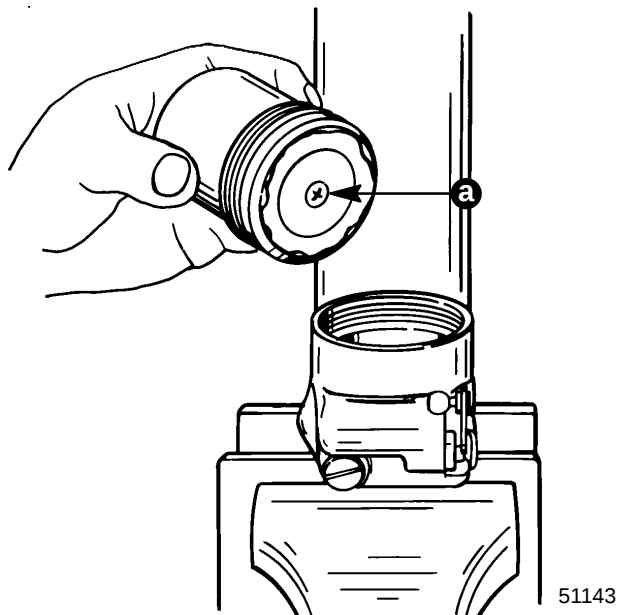
1. Place manual tilt system in soft jawed vise.
2. Position shock rod to full up position.
3. Remove accumulator.



a - Shock Rod  
b - Accumulator

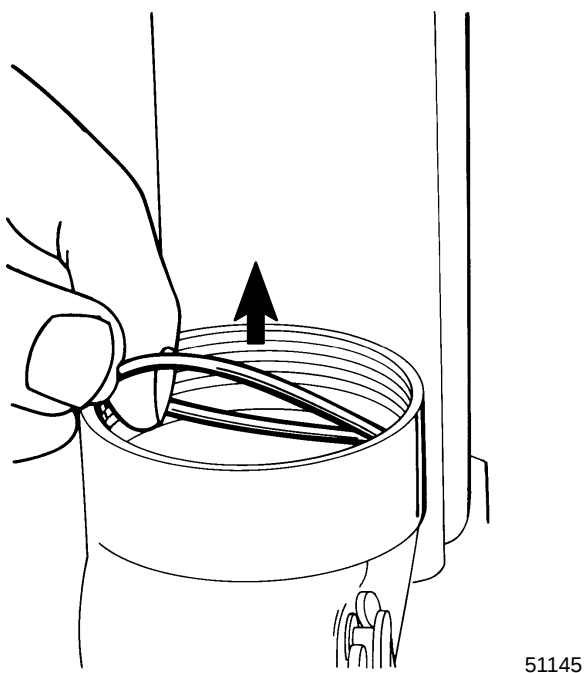


4. If plunger can be compressed into accumulator by hand, accumulator is defective. Replace accumulator.



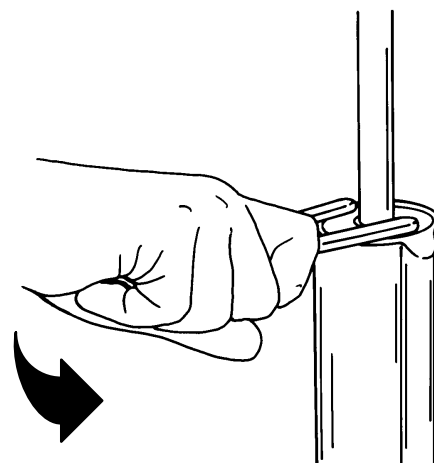
a - Plunger

5. Remove O-ring.

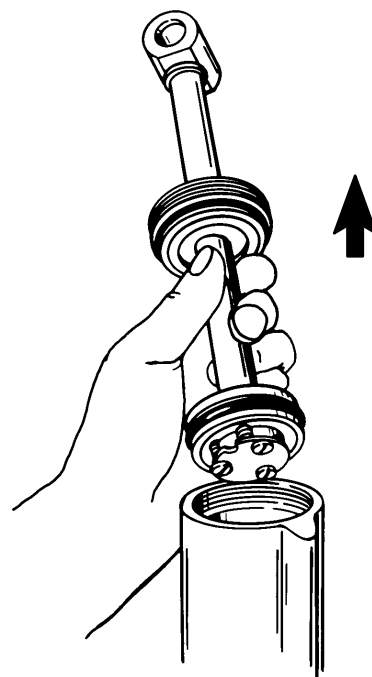


## Shock Rod Removal

1. Remove cylinder end cap assembly using spanner wrench [1/4 in. x 5/16 in. long pegs].

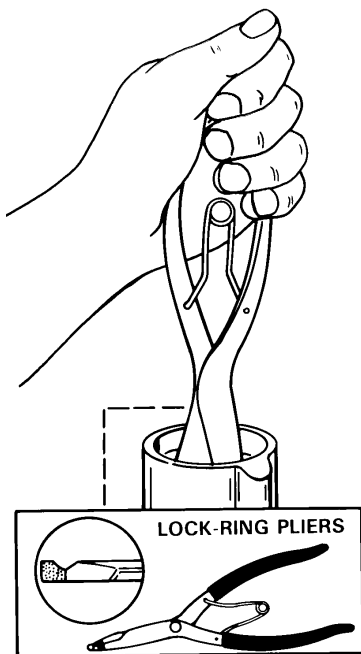


2. Remove shock rod assembly.

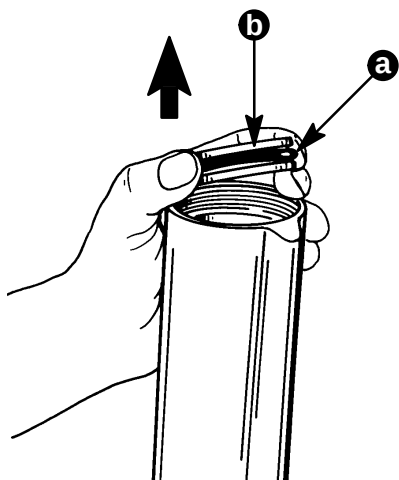




3. Remove memory piston from cylinder using lock ring pliers (Craftsman P/N 4735) or suitable tool.



4. Remove O-ring from memory piston.

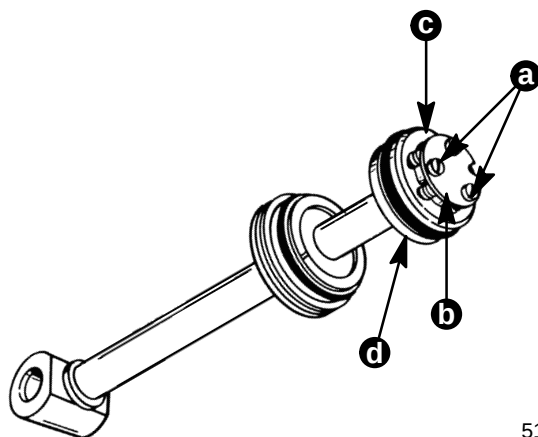


- a - O-ring
- b - Memory Piston

5. Remove tilt system from vise and empty fluid into appropriate container.

## Shock Rod Disassembly

1. Place shock rod assembly on clean work surface.
2. Remove plate and O-ring.
3. Remove check ball components from shock rod piston.



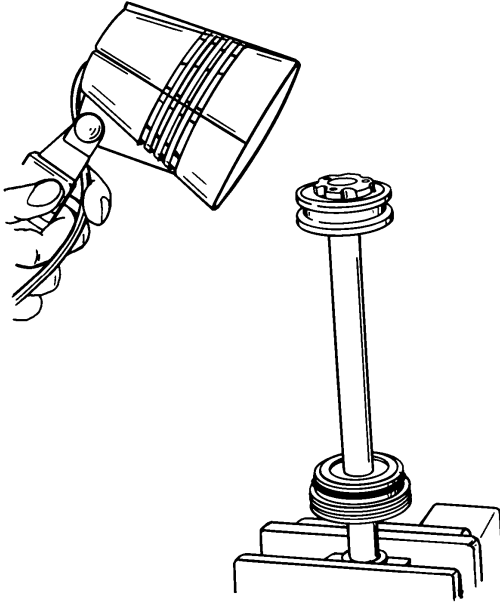
- a - Screw (3)
- b - Plate
- c - O-ring
- d - Shock Rod Piston

### **CAUTION**

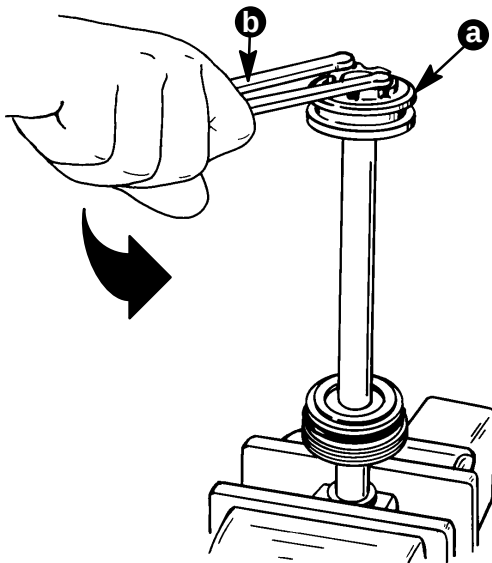
When removing shock piston, spanner wrench must have 1/4 in. x 5/16 in. long pegs to avoid damage to shock piston.



4. Place shock rod into soft jawed vise and apply heat to loosen piston using torch lamp (P/N 91-63209).
5. Loosen shock rod piston using spanner wrench [1/4 in. x 5/16 in. (6.4mm x 8mm) long pegs].
6. Allow shock rod piston to cool. Remove from shock rod.



51146



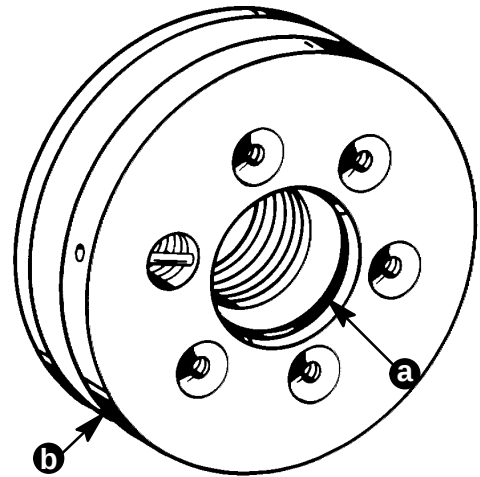
51146

a - Shock Rod Piston  
b - Spanner Wrench

## ⚠ CAUTION

**Do not remove check ball components from shock rod piston. Removal and reinstallation of check valve could result in improper operating pressure and possible manual tilt system damage.**

7. Inspect check valve for debris; clean debris from check valve if found. If debris cannot be cleaned from check valve, replace shock piston as an assembly.
8. Clean shock and components with compressed air.
9. Remove inner O-ring.



51199

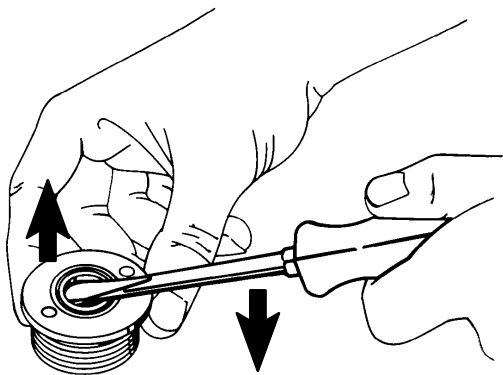
a - O-ring  
b - Shock Piston

10. Remove cylinder end cap assembly from shock rod.
11. Inspect shock. If wiper (located in cap) has failed to keep rod clean, replace wiper.

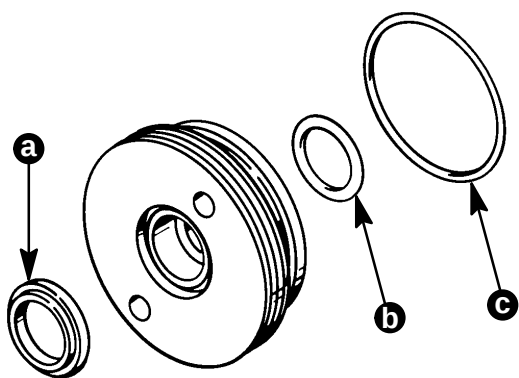


12. Place end cap on clean work surface.

13. Remove rod wiper, inner O-ring, and outer O-ring.



51147

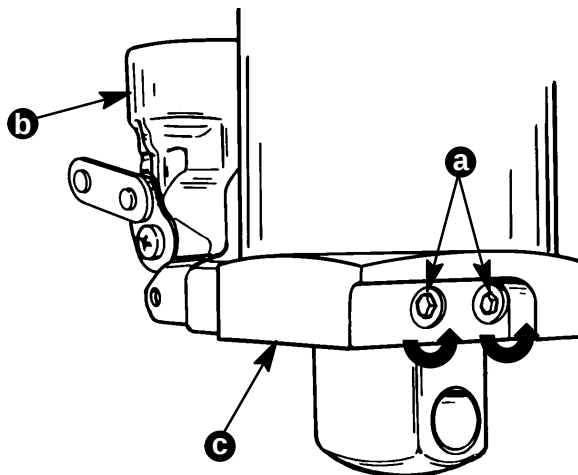


51145

- a - Rod Wiper
- b - Inner O-ring
- c - Outer O-ring

## Valve Block Removal

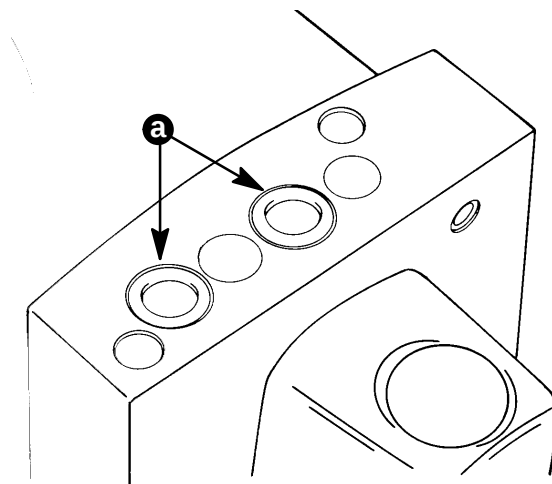
1. Remove valve block from shock rod cylinder.



51146

- a - Screws (2)
- b - Valve Block
- c - Shock Rod Cylinder

2. Remove O-rings.



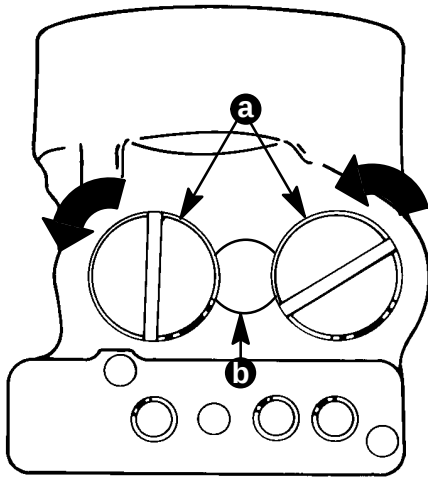
51148

- a - O-rings (2)



## Valve Block Disassembly

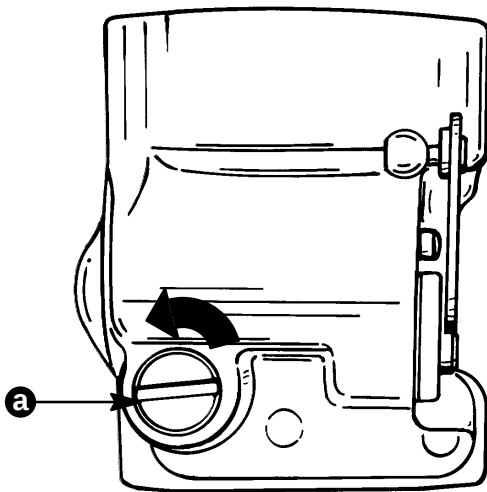
1. Remove slow trim valve assembly.
2. Remove hydraulic oil transfer valve components.



51143

- a - Transfer Valves (2)
- b - Slow trim Valve Assembly (Plug or Screw Plug)

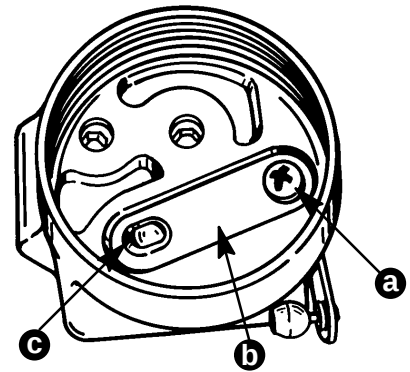
3. Remove surge valve assembly.



51145

- a - Surge Valve

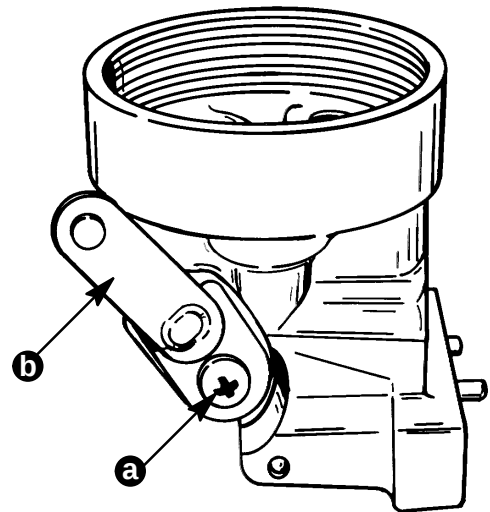
4. Remove reservoir assembly.



51142

- a - Screw
- b - Flat Spring
- c - Ball

5. Remove cam assembly.



51145

- a - Screw
- b - Cam Assembly



## Manual Tilt System Cleaning and Inspection

1. It is recommended that all O-rings exposed during disassembly be replaced.
2. Clean components, filter, and check valve seats using engine cleaner and compressed air. Do not use cloth rags.
3. Inspect all machined surfaces for burrs or scoring to assure O-ring longevity.
4. Inspect shock rod. If wiper (located in cap) has failed to keep rod clean, replace wiper.

## Manual Tilt System Reassembly

**IMPORTANT:** Components must be dirt and lint free. Slightest amount of debris in tilt system could cause system to malfunction.

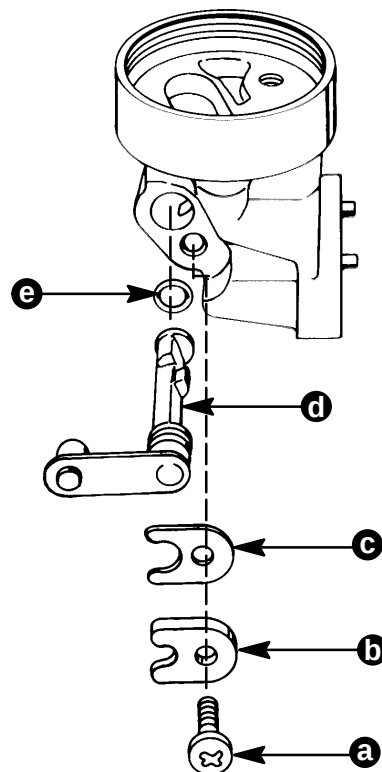
Apply Quicksilver Power Trim and Steering Fluid or, (ATF) Type F, FA or Dexron II on all O-rings during reassembly.

**NOTE:** Refer to "Manual Tilt System Components" for proper O-ring sizes.

## Valve Block Reassembly

**IMPORTANT:** Cam shaft O-ring must be lubricated using Special Lubricant 101 prior to installation.

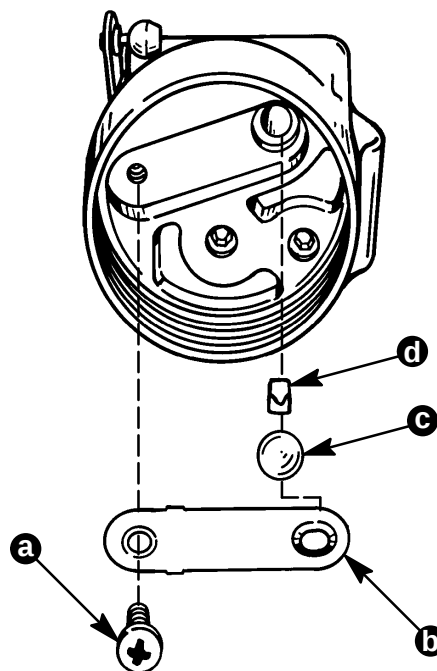
1. Install lubricated O-ring to cam shaft.
2. Install cam shaft in valve block.
3. Secure cam shaft in place using insulator, retain-er plate, and screw. Tighten screw securely.



51142

- a - Screw
- b - Retainer Plate
- c - Insulator
- d - Cam Shaft
- e - O-ring

4. Install push rod, ball, flat spring and screw in valve block.
5. Torque screw to 27 lb. in. (3.0 N·m).

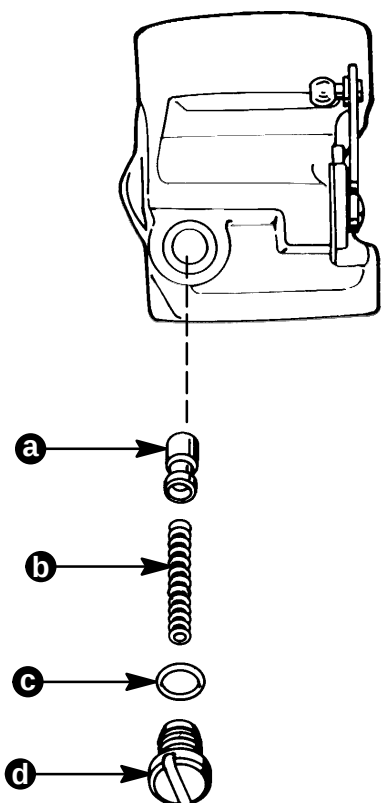


51145

- a - Screw
- b - Flat Spring
- c - Ball
- d - Push Rod



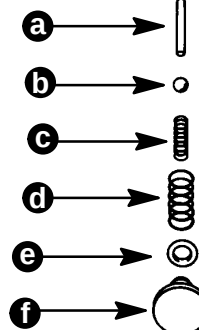
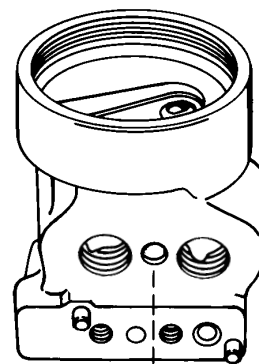
6. Install spool, spring, lubricated O-ring and screw plug (surge valve assembly) into valve block.
7. Torque screw plug to 75 lb. in. (8.5 N·m).



- a - Spool
- b - Spring
- c - O-ring
- d - Screw Plug

8. Install push rod, ball, spring, lubricated O-rings and screw plug (transfer valve components) in valve block.
9. Install plunger, ball, spring (small), spring (large) in valve block (Slow Trim Valve Assembly).
10. Apply Loctite Pipe Sealant with Teflon 592 to threads of pipe plug (design one and two style valve block).
11. Install pipe plug or plug into valve block. Tighten pipe plug (if equipped) securely.

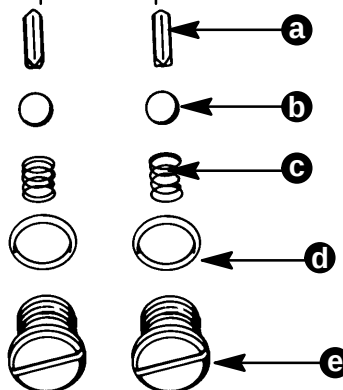
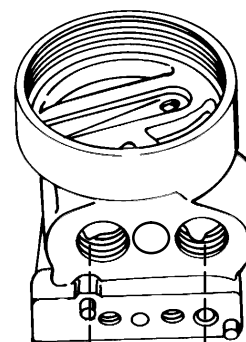
51142



- a - Plunger
- b - Ball
- c - Spring (Small)
- d - Spring (Large)
- e - O-ring
- f - Plug (Design 3)

51142

12. Torque screw plug to 75 lb. in. (8.5 N·m).



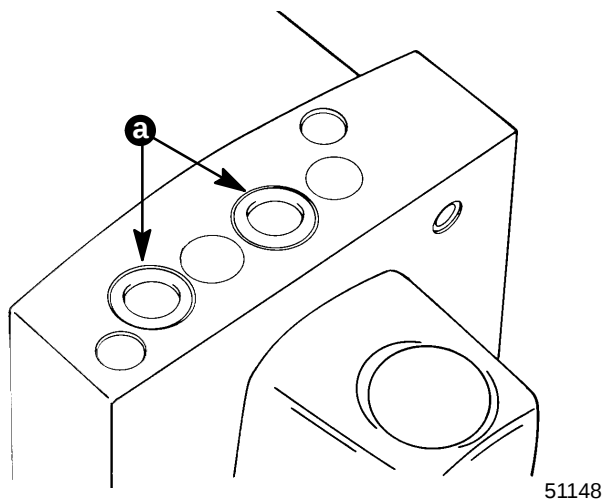
- a - Push Rod (2)
- b - Ball (2)
- c - Spring (2)
- d - O-ring (2)
- e - screw Plug (2)

51142



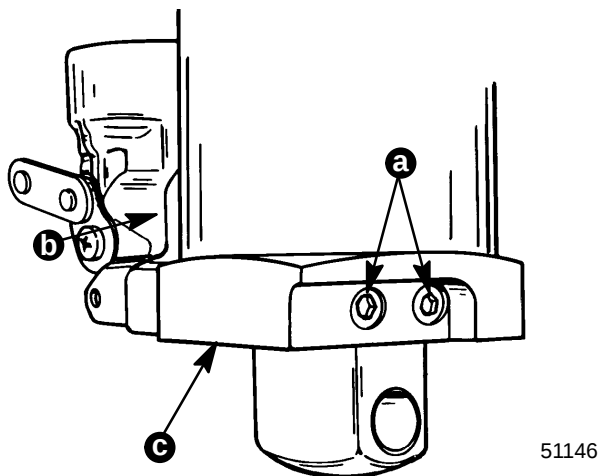
## Valve Block Installation

1. Install lubricated O-rings.



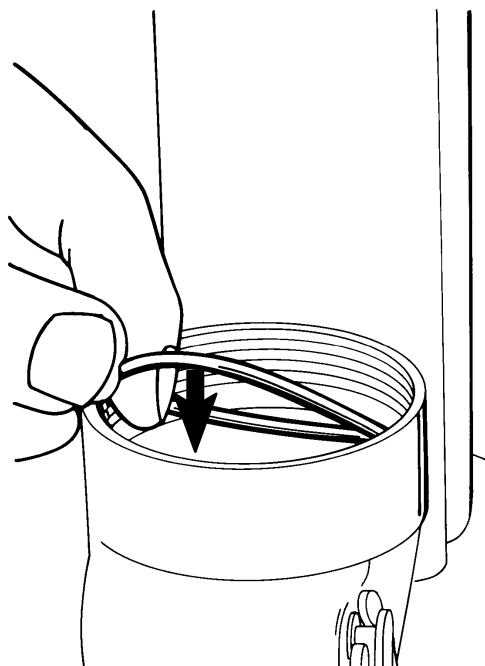
a - O-rings (2)

2. Install valve block to shock rod cylinder. Torque screws to 100 lb. in. (11.2 N·m).



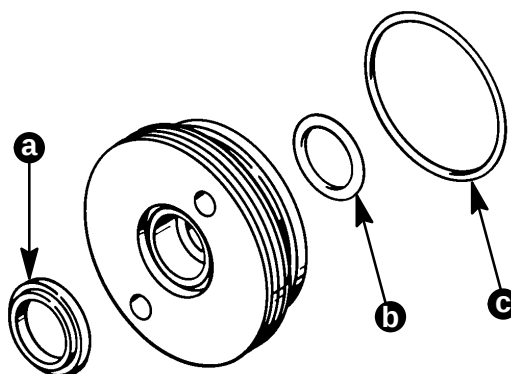
a - Screw (2)  
b - Valve Block  
c - Shock Rod Cylinder

3. Install lubricated O-ring.



## Shock Rod Reassembly

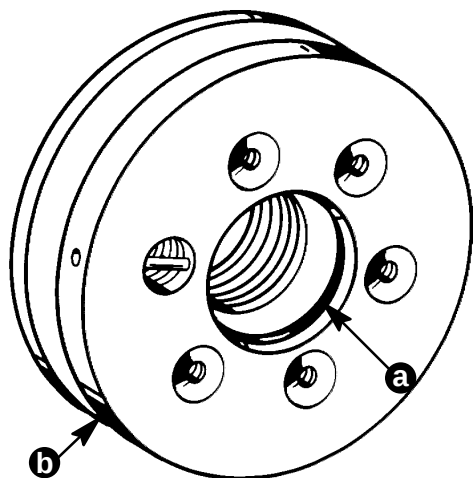
1. Install lubricated O-rings.
2. Install rod wiper.



a - Rod Wiper  
b - Inner O-ring  
c - Outer O-ring



3. Install lubricated O-ring.



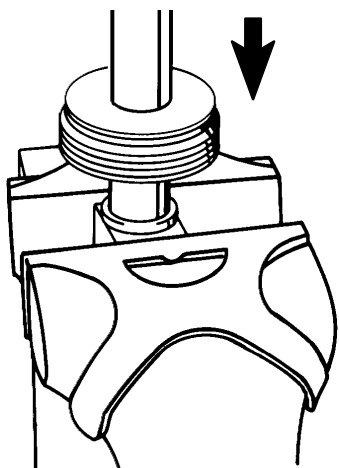
51199

a - O-ring

b - Shock Piston

4. Clamp shock rod in soft jawed vise.

5. Position cylinder end cap onto rod as shown.



51146

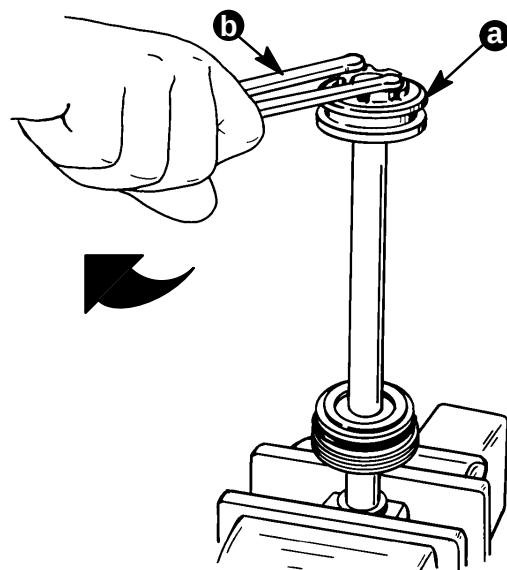
### CAUTION

When installing shock rod piston, spanner wrench must have 1/4 in. x 5/16 in. (6.4mm x 8mm) long pegs to avoid damage to shock rod piston.

6. Apply Loctite Grade "A" (271) to threads on shock rod.

7. Install shock rod piston.

8. Tighten shock rod piston securely using spanner wrench (1/4 in. x 5/16 in. long pegs).



51146

a - Shock Rod Piston

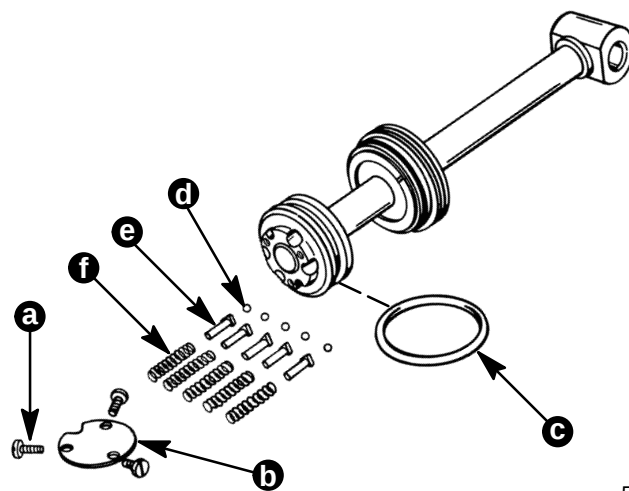
b - Spanner Wrench

9. Remove shock rod assembly from vise.

10. Install lubricated O-ring to shock rod piston.

11. Install ball, seat, and spring (five sets) to shock rod piston.

12. Secure components with plate. Torque screws to 35 lb. in. (4.0 N·m).



51147

a - Screw (3)

b - Plate

c - O-ring

d - Ball (5)

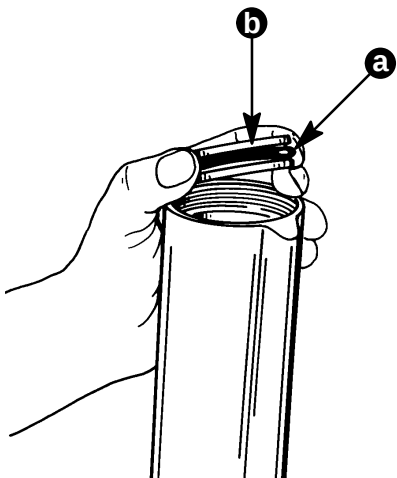
e - Seat (5)

f - Spring (5)



## Shock Rod Installation

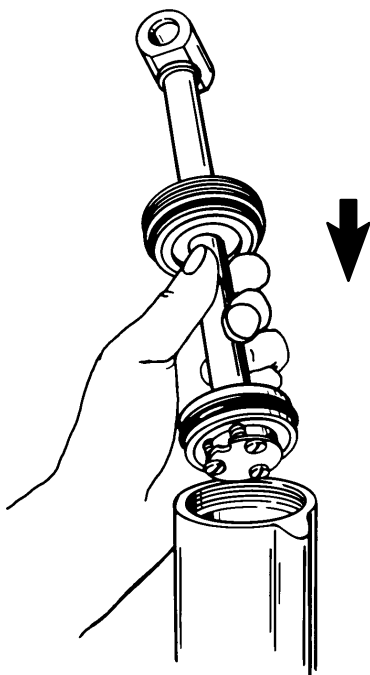
1. Place cylinder/manifold assembly into soft jawed vise.
2. Fill cylinder to top using Quicksilver Power Trim and Steering Fluid or; (ATF) Type F, FA of Dexron II.
3. Place cam shaft lever in the open position (lever facing down).
4. Install lubricated O-ring to memory piston and install piston into cylinder three inches (76mm) from top.



51144

- a - O-ring  
b - Memory Piston

5. Refill cylinder to top and install shock rod assembly into cylinder.



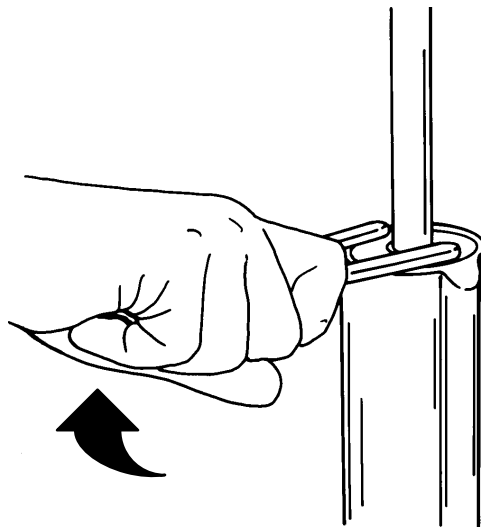
51143

6. Refill cylinder to top.

### CAUTION

**End cap must not make contact with shock rod piston when tightening. Shock rod piston must be positioned in cylinder deep enough to avoid contact.**

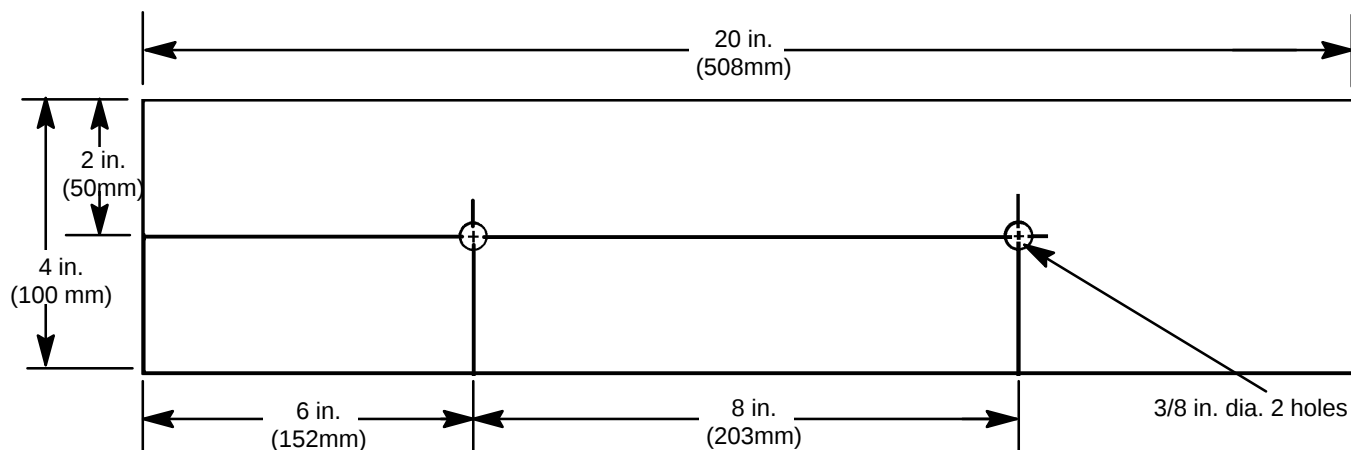
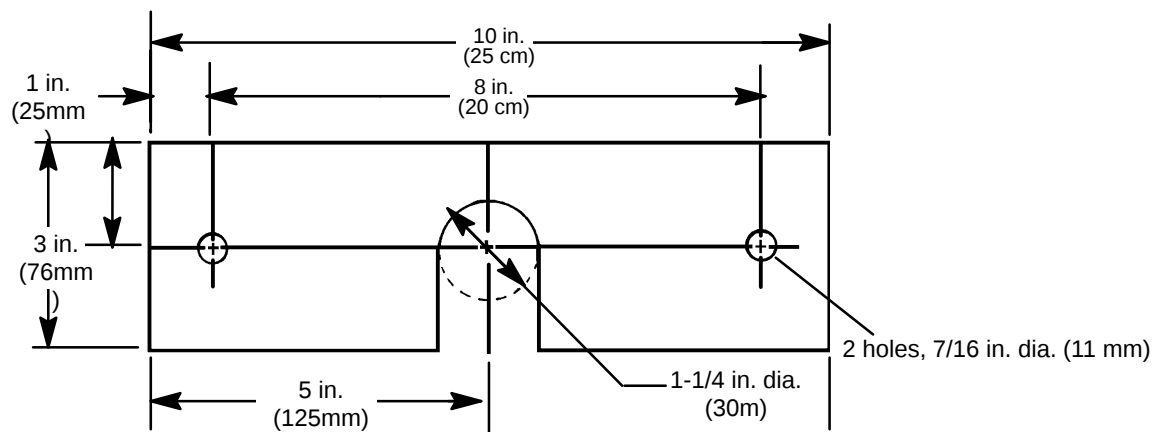
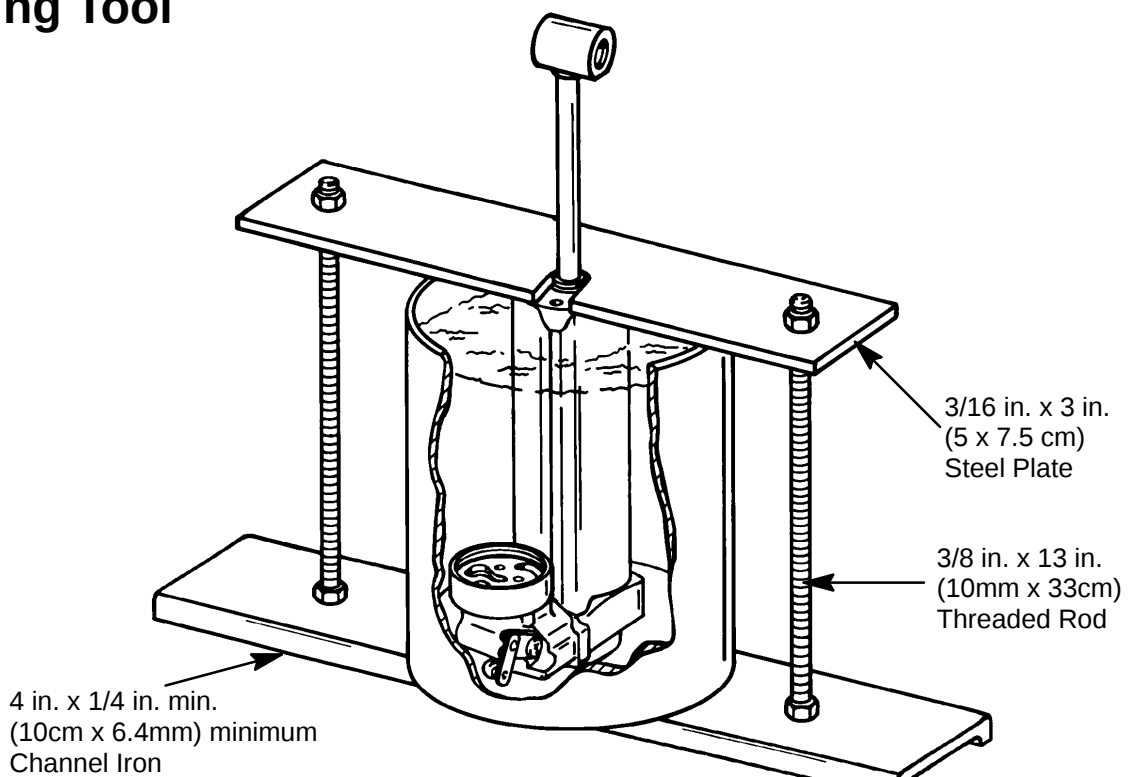
7. Tighten end cap securely using spanner wrench [1/4 in. x 5/16 in. (6.4mm x 8mm) long pegs].



51145



# Instructions for Making Retaining Tool



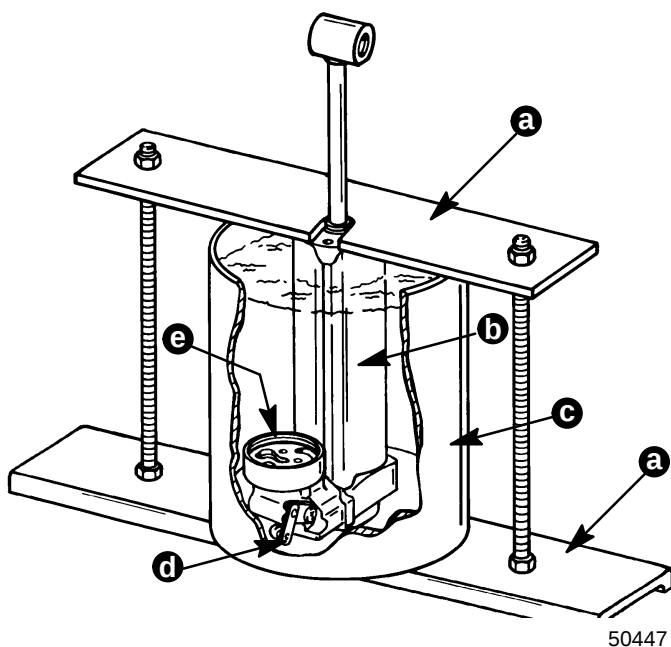


## Bleeding Manual Tilt System

**IMPORTANT:** While bleeding tilt system, time must be allowed between each stroke to allow air bubbles to dissipate.

1. With shock rod in the full up position and manifold cam lever open (facing down), secure tilt system to retaining tool and container. (A No. 10 can or 3 lb. coffee can can be used).
2. Fill container to near full level using Quicksilver Power Trim and Steering Fluid or; (ATF) Type F, FA or Dexron II.

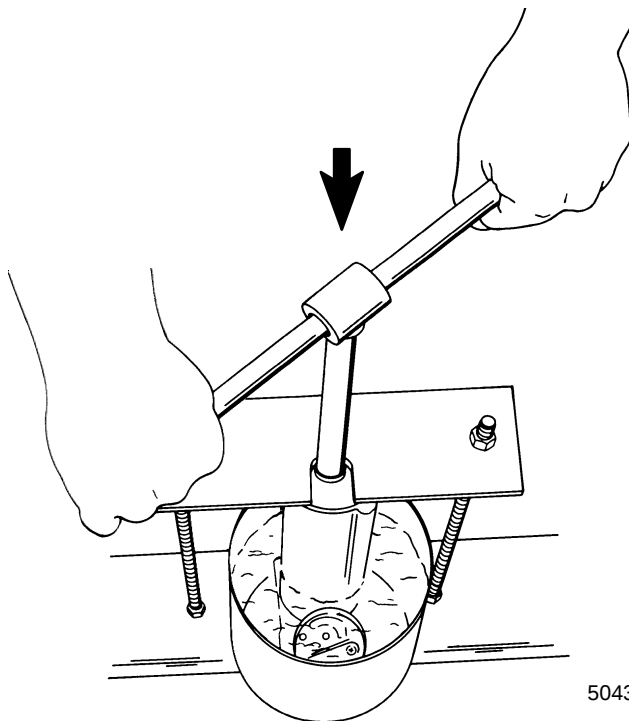
**IMPORTANT:** Fluid level must remain above accumulator opening during bleeding process.



- a - Retaining Tool
- b - Tilt System
- c - Container
- d - Cam Lever
- e - Accumulator Opening

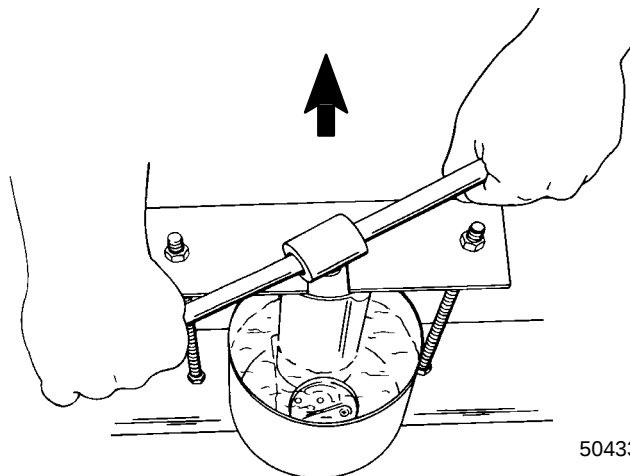
50447

3. Bleed unit by pushing rod down slowly (18-20 seconds per stroke) until stopped at base. Wait until all air bubbles exit accumulator base.



50432

4. During up stroke, pull up on rod slowly 3 in. (76mm) from base.
5. Wait until all air bubbles exit accumulator base.

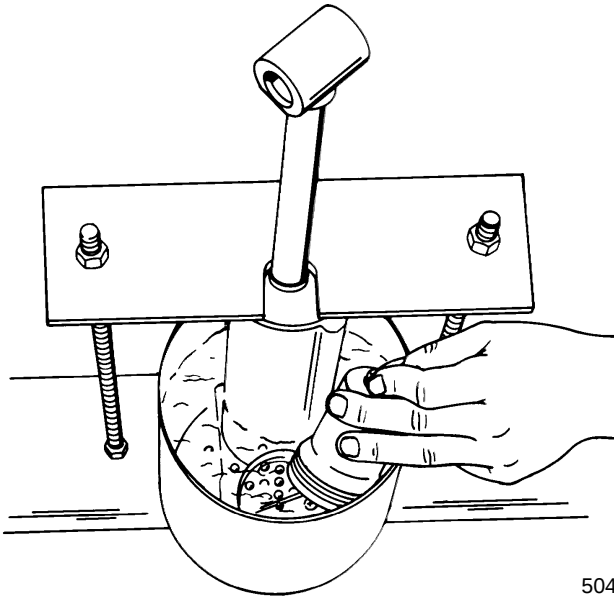


50433

6. Slowly cycle unit 5-8 times (round trip per cycle) using short strokes 3 in. (76mm) from base allowing bubbles to disappear during each stroke.

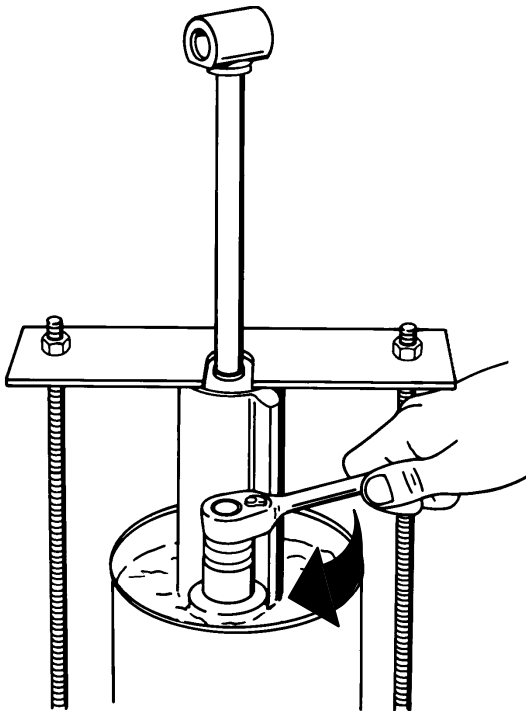


7. Allow unit to stand five minutes then proceed to cycle unit 2-3 more times using short strokes. No air bubbles should appear from accumulator port at this time.
8. With oil level well above accumulator port, slowly pull rod to full up position.
9. Install accumulator making sure air bubbles do not enter system.



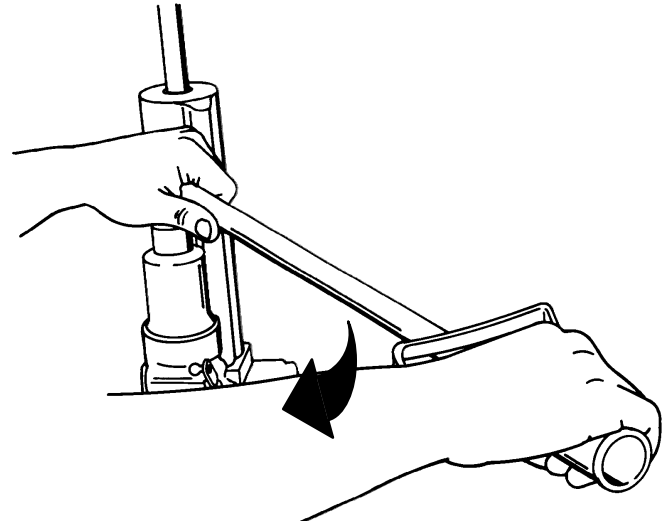
50432

10. Tighten accumulator snugly at this time.



50432

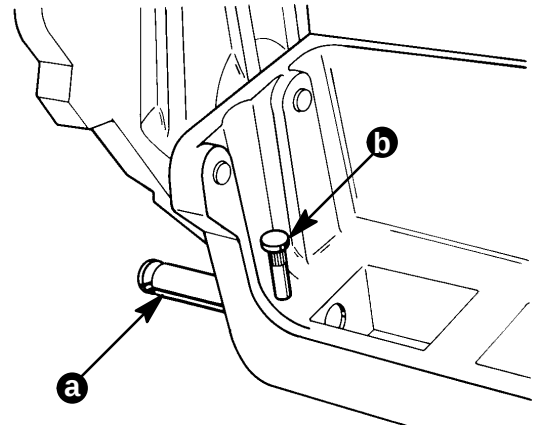
11. With cam lever remaining open (facing down), remove tilt assembly from oil and secure in soft jawed vise. Torque accumulator to 35 lb. ft. (47 N·m).



50433

## Manual Tilt System Installation

1. Apply Special Lubricant 101 to lower pivot pin hole and pivot pin surface.
2. Start lower pivot pin into pivot pin hole and position lower dowel pin (retained) in its hole.

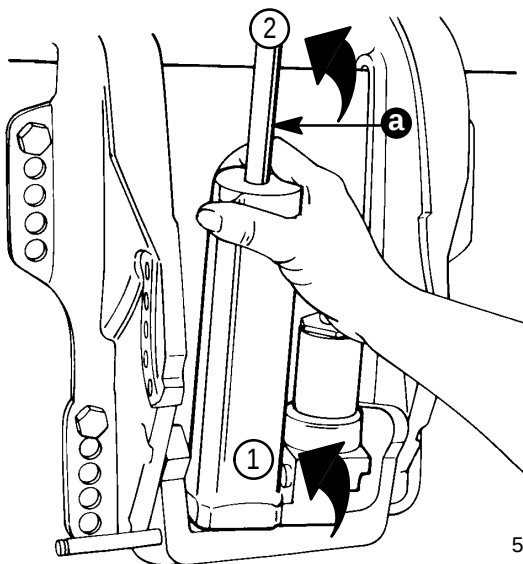


51148

- a - Lower Pivot Pin  
b - Lower Dowel Pin



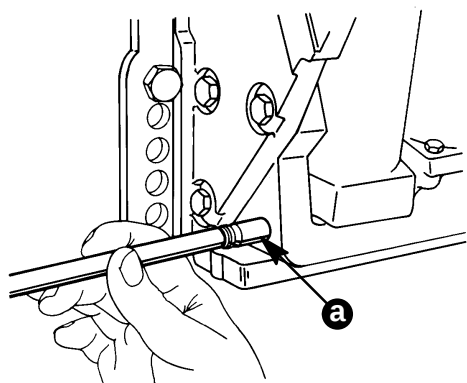
3. Reinstall manual tilt system. Reconnect release valve link rod.



51144

a - Manual Tilt System

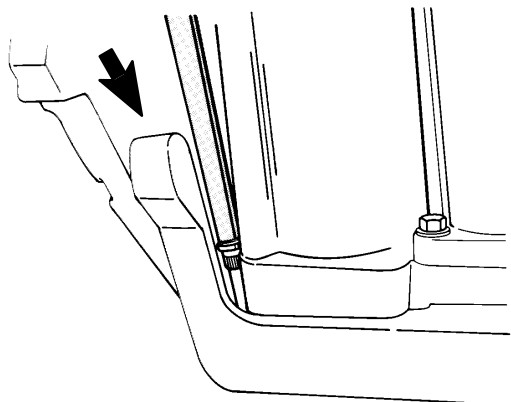
4. Using a suitable punch, drive lower pivot pin into clamp bracket and trim cylinder assembly until pivot pin is flush with outside surface.



51147

a - Lower Pivot Pin

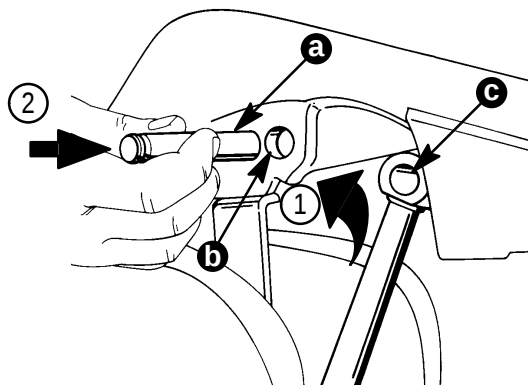
5. Using a punch, drive lower dowel pin in until seated.



51148

a - Lower Dowel Pin

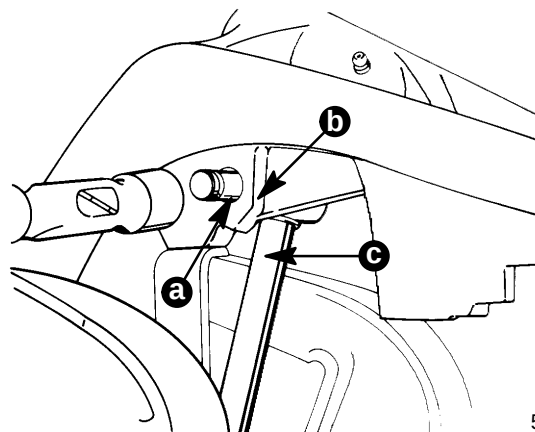
6. Apply 2-4-C Marine Lubricant (92-90018A12) to surface of upper pivot pin, pivot pin hole and shock rod hole.



51148

- a - Pivot Pin  
b - Pivot Pin Bore  
c - Shock Rod Bore

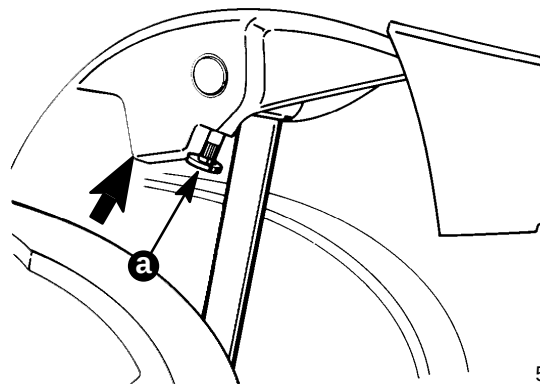
7. Using a mallet, drive upper pivot pin into swivel bracket and through shock rod until pivot pin is flush with swivel bracket.



51148

- a - Pivot Pin  
b - Swivel Bracket  
c - Shock Rod

8. Drive upper dowel pin (a) into its hole until seated.



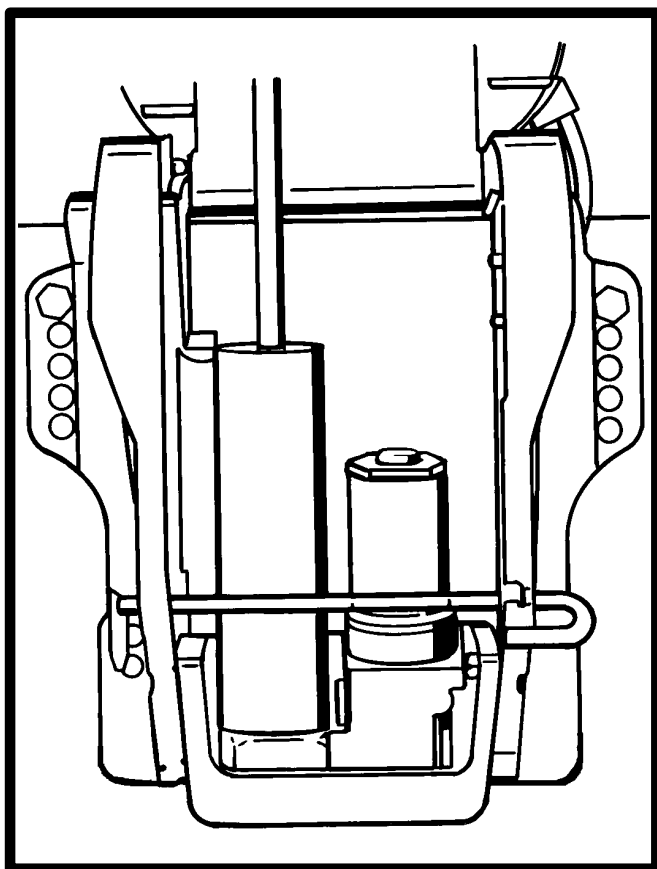
51147

a - Dowel Pin

9. Check manual release cam adjustment. Cam must open and close freely. Adjust link rod as necessary.



# MID-SECTION



5

G

**MANUAL TILT SYSTEM  
(DESIGN 4)**



# Table of Contents

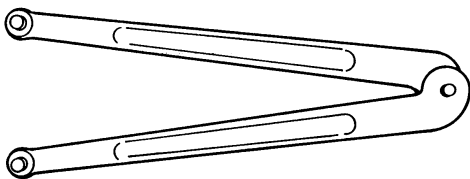
|                                          | Page  |
|------------------------------------------|-------|
| Special Tools .....                      | 5G-1  |
| Tilt Up .....                            | 5G-5  |
| Tilt Down .....                          | 5G-7  |
| Slow Tilt Down Under High Thrust .....   | 5G-9  |
| Under Water Strike with Valves Open .... | 5G-11 |
| Shock Function with Valves Closed ....   | 5G-13 |
| Shock Function Return .....              | 5G-15 |
| Hydraulic System Troubleshooting .....   | 5G-16 |
| Manual Tilt System Removal .....         | 5G-17 |
| Manual Tilt System Disassembly .....     | 5G-18 |
| Accumulator Removal .....                | 5G-18 |
| Shock Rod Removal .....                  | 5G-19 |
| Shock Rod Disassembly .....              | 5G-20 |
| Valve Block Removal .....                | 5G-22 |
| Memory Piston Removal .....              | 5G-22 |
| Valve Block Disassembly .....            | 5G-23 |
| Actual O-ring Sizes .....                | 5G-25 |
| O-ring Description and Sizes .....       | 5G-26 |
| Manual Tilt System                       |       |
| Cleaning and Inspection .....            | 5G-27 |

|                                             | Page  |
|---------------------------------------------|-------|
| Manual Tilt System Reassembly .....         | 5G-27 |
| Cam Shaft Reassembly .....                  | 5G-27 |
| Valve Body Check Reassembly .....           | 5G-27 |
| Velocity Valve Reassembly .....             | 5G-27 |
| Check Retainer Reassembly .....             | 5G-28 |
| Valve Plug Reassembly .....                 | 5G-28 |
| Valve Block Installation .....              | 5G-28 |
| Shock Rod Reassembly .....                  | 5G-29 |
| Shock Rod Installation and                  |       |
| Fluid Filling Procedure .....               | 5G-30 |
| Instructions for Making Retaining Tool .... | 5G-31 |
| Bleeding Manual Tilt System .....           | 5G-32 |
| Manual Tilt System Installation .....       | 5G-34 |
| Manual Release Valve Adjustment .....       | 5G-35 |

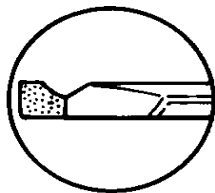


## Special Tools

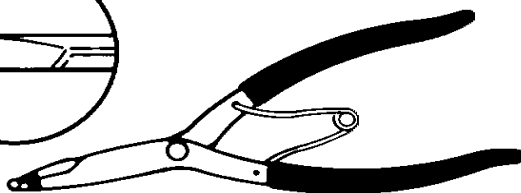
1. Spanner Wrench P/N 91-74951



2. Lock-Ring Pliers P/N 91-822778A3

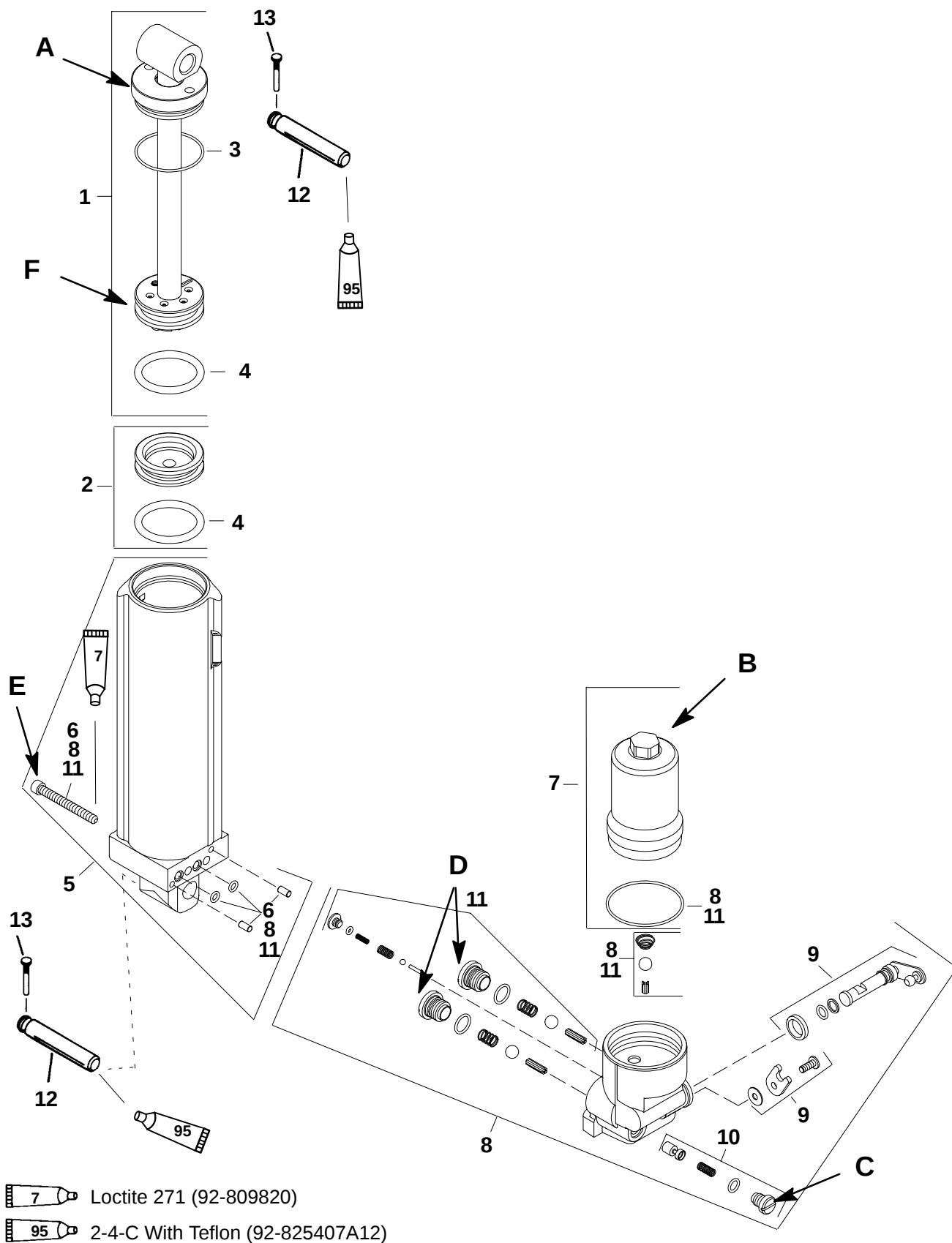


**LOCK-RING PLIERS**





# MANUAL TILT COMPONENTS



**NOTE:** Lubricate all O-rings using Quicksilver Power Trim and Steering Fluid. If not available, use automotive (ATF) automatic transmission fluid.

**NOTE:** It is recommended that all O-rings be replaced when servicing tilt system.



## MANUAL TILT COMPONENTS

| REF. NO. | QTY. | DESCRIPTION                            | TORQUE  |         |     |
|----------|------|----------------------------------------|---------|---------|-----|
|          |      |                                        | lb. in. | lb. ft. | N·m |
| –        | 1    | MANUAL TRIM ASSEMBLY                   |         |         |     |
| –        | 1    | MANUAL TRIM <b>BEACHING</b> ASSEMBLY   |         |         |     |
| 1        | 1    | SHOCK ROD ASSEMBLY                     |         | 45      | 61  |
|          | 1    | SHOCK ROD ASSEMBLY ( <b>BEACHING</b> ) |         |         |     |
| 2        | 1    | MEMORY PISTON ASSEMBLY                 |         |         |     |
| 3        | 1    | O RING REBUILD KIT-Cylinder            |         |         |     |
| 4        | 2    | O RING                                 |         |         |     |
| 5        | 1    | CYLINDER ASSEMBLY                      |         |         |     |
| 6        | 1    | SCREW AND SEAL KIT                     |         |         |     |
| 7        | 1    | ACCUMULATOR ASSEMBLY                   |         | 35      | 47  |
| 8        | 1    | VALVE BODY ASSEMBLY                    |         |         |     |
| 9        | 1    | CAM KIT                                |         |         |     |
| 10       | 1    | VELOCITY VALVE KIT                     | 75      |         | 8.5 |
| 11       | 1    | CHECK SYSTEM REPAIR KIT                | 75      |         | 8.5 |
| –        | 1    | O RING KIT                             |         |         |     |
| 12       | 2    | PIN                                    |         |         |     |
| 13       | 2    | GROOVE PIN                             |         |         |     |

**A** – Torque cylinder cap to 45 lb. ft. (61 N·m)

**B** – Torque Accumulator to 35 lb. ft. (47 N·m)

**C** – Torque Velocity Valve to 75 lb. in. (8.5 N·m)

**D** – Torque Transfer Valve Plug to 75 lb. in. (8.5 N·m)

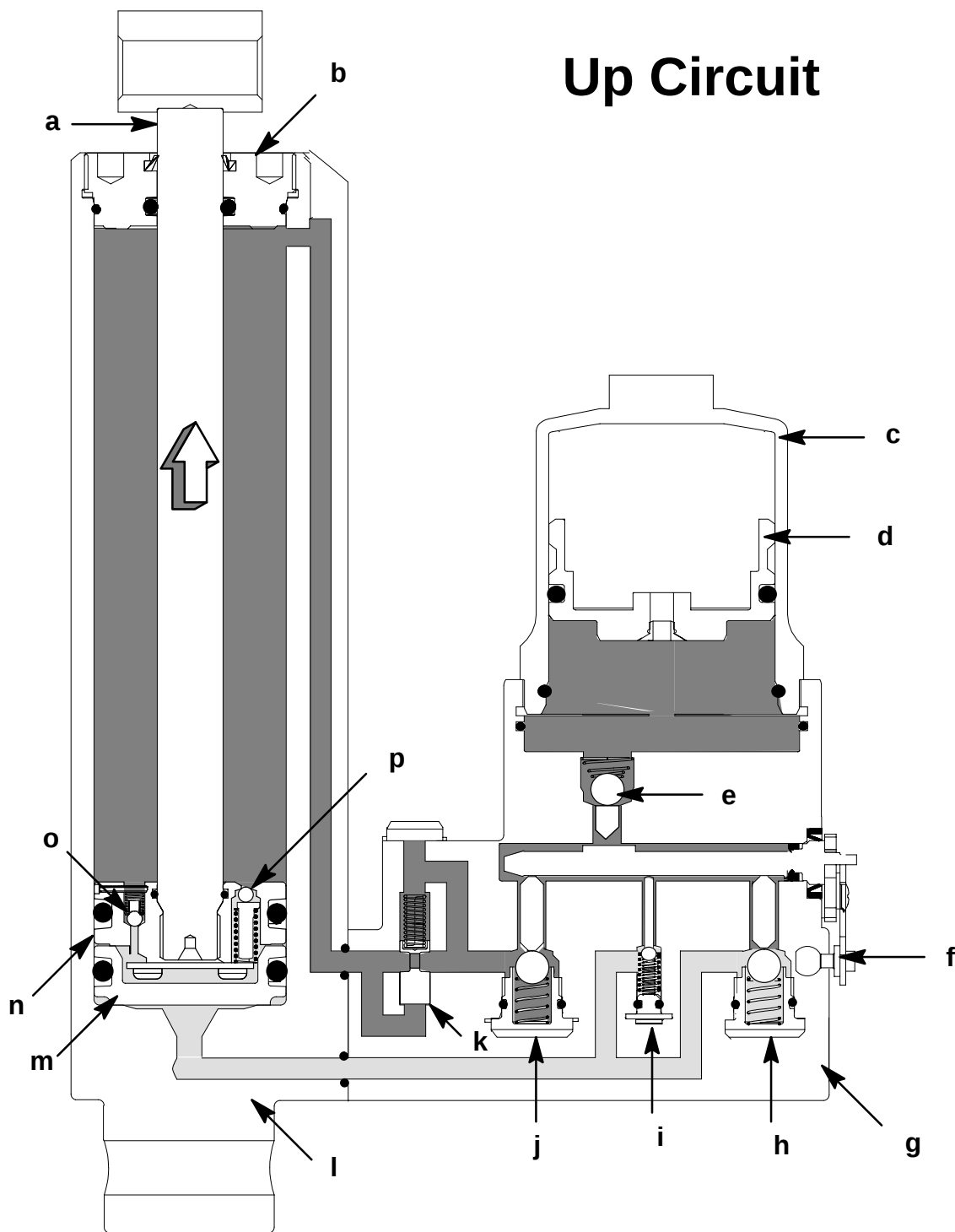
**E** – Torque Screw to 100 lb. in. (11 N·m)

**F** – Torque Shock Piston to 90 lb. ft. (122 N·m)



# MANUAL TRIM FLOW DIAGRAMS

## Up Circuit



a - Shock Rod  
b - End Cap  
c - Accumulator  
d - Accumulator Piston  
e - Accumulator Check Valve  
f - Camshaft Lever  
g - Manifold  
h - Down Fast Transfer Valve

i - Down Slow Transfer Valve  
j - Up Fast Transfer Valve  
k - Surge Valve  
l - Cylinder  
m - Memory Piston  
n - Shock Piston  
o - Shock Return Valve  
p - Impact Relief Valve

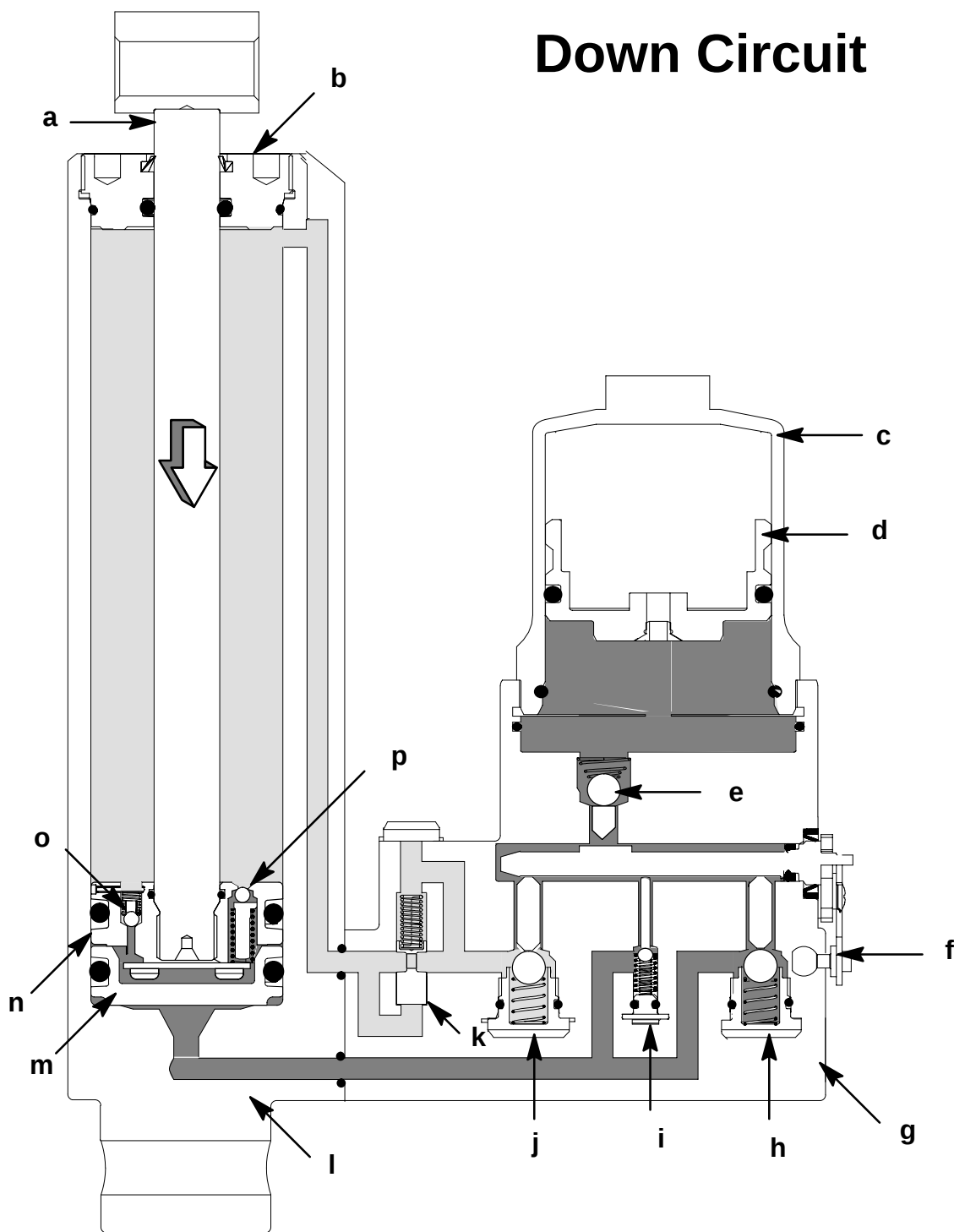


## Tilt Up

With the engine in the down position, the accumulator piston (d) will be at the top of the accumulator (c) with the gas at maximum pressure. To raise the engine, the camshaft lever (f) is rotated all the way down. The internal shaft connected to the camshaft lever will move the push rods, opening the accumulator check valve (e), both fast transfer valves (h & j) and the down slow transfer valve (i). As the operator lifts the engine; oil, under pressure inside the accumulator, will flow around both the slow transfer valve (i) and the down circuit fast transfer valve (h). Oil flows into the bottom of the tilt cylinder forcing the memory piston (m) into the shock piston (n) and then forcing the shock rod (a) up and out. Oil above the shock piston exits the cylinder (l) through an interconnecting passage along side of the cylinder and returns into the manifold (g). Inside the manifold the oil flows past the groove in the surge valve (k), through the transfer valve (j) and mixes with the oil flowing from the accumulator into the up cavity. With the engine in the correct position, the camshaft lever (f) is rotated up and the push rods allow the check valves (e, h, i, & j) to close. The closed check valves prevent the oil from traveling between cavities and locks the engine into position.



## Down Circuit



a - Shock Rod  
b - End Cap  
c - Accumulator  
d - Accumulator Piston  
e - Accumulator Check Valve  
f - Camshaft Lever  
g - Manifold  
h - Down Fast Transfer Valve

i - Down Slow Transfer Valve  
j - Up Fast Transfer Valve  
k - Surge Valve  
l - Cylinder  
m - Memory Piston  
n - Shock Piston  
o - Shock Return Valve  
p - Impact Relief Valve

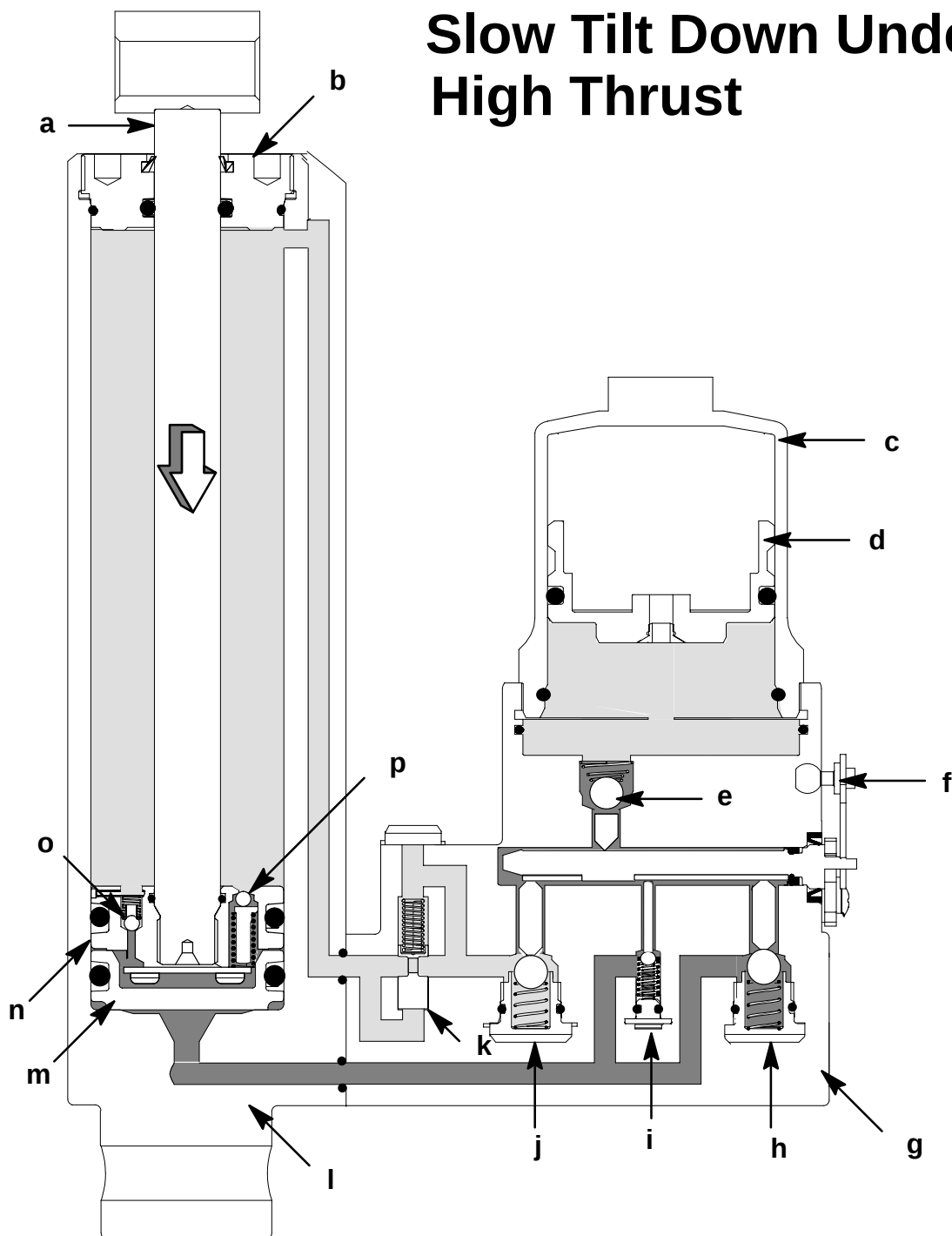


## Tilt Down

With the engine tilted up, the piston inside the accumulator piston (d) will be at the bottom of the accumulator (c) and the gas pressure is low. To lower the engine, the camshaft lever (f) is rotated down, the internal cam will cause the push rods to open the accumulator check valve (e), both fast transfer valves (h & j) and the down slow transfer valve (i). The operator will have to press down on the engine cowl to overcome the pressure inside cylinder. Fluid will flow out of the bottom of the cylinder, past both the down fast transfer valve (h) and down slow transfer valve (i). Fluid will flow past the up fast transfer valve (j), surge valve (k) and through the interconnecting passage into the top of the cylinder (l). Due to the shock rod (a), the tilt cylinder cavities differ in volume, the extra fluid from the up cavity [forced into the accumulator (c)] will cause the internal accumulator piston (d) to compress the gas. With the engine in the correct position, the camshaft lever is rotated up and the push rods allow the check valves (e, h, i, & j) to close.



## Slow Tilt Down Under High Thrust



a - Shock Rod  
b - End Cap  
c - Accumulator  
d - Accumulator Piston  
e - Accumulator Check Valve  
f - Camshaft Lever  
g - Manifold  
h - Down Fast Transfer Valve

i - Down Slow Transfer Valve  
j - Up Fast Transfer Valve  
k - Surge Valve  
l - Cylinder  
m - Memory Piston  
n - Shock Piston  
o - Shock Return Valve  
p - Impact Relief Valve

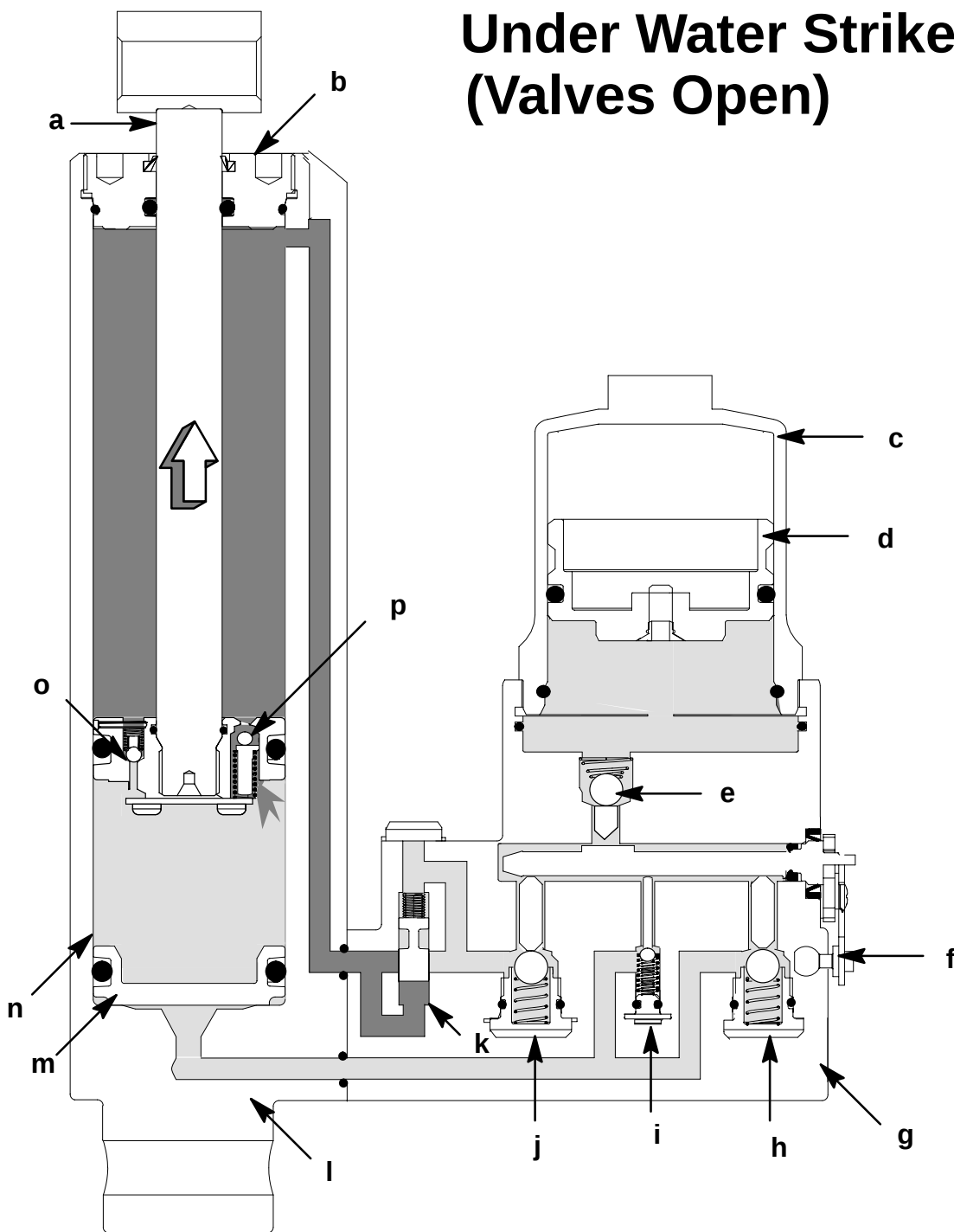


## Slow Tilt Down Under High Thrust

To tilt the engine down under high thrust conditions [where the propeller thrust forces the shock rod down, creating higher pressure below the memory piston (m)] the camshaft lever (f) is rotated slightly downward. The internal shaft connected to the lever will open the down slow transfer valve (i) allowing oil under pressure into the cavity around the shaft. The higher oil pressure will open the up fast transfer valve (j) allowing oil from the bottom of the cylinder to flow above the shock piston (n) while lowering the engine. Additional oil will flow into the accumulator (c) as the internal pressure forces the accumulator check valve (e) to open. Oil flowing into the accumulator moves the accumulator piston (d) and compresses the gas.



## Under Water Strike (Valves Open)



a - Shock Rod  
b - End Cap  
c - Accumulator  
d - Accumulator Piston  
e - Accumulator Check Valve  
f - Camshaft Lever  
g - Manifold  
h - Down Fast Transfer Valve

i - Down Slow Transfer Valve  
j - Up Fast Transfer Valve  
k - Surge Valve  
l - Cylinder  
m - Memory Piston  
n - Shock Piston  
o - Shock Return Valve  
p - Impact Relief Valve

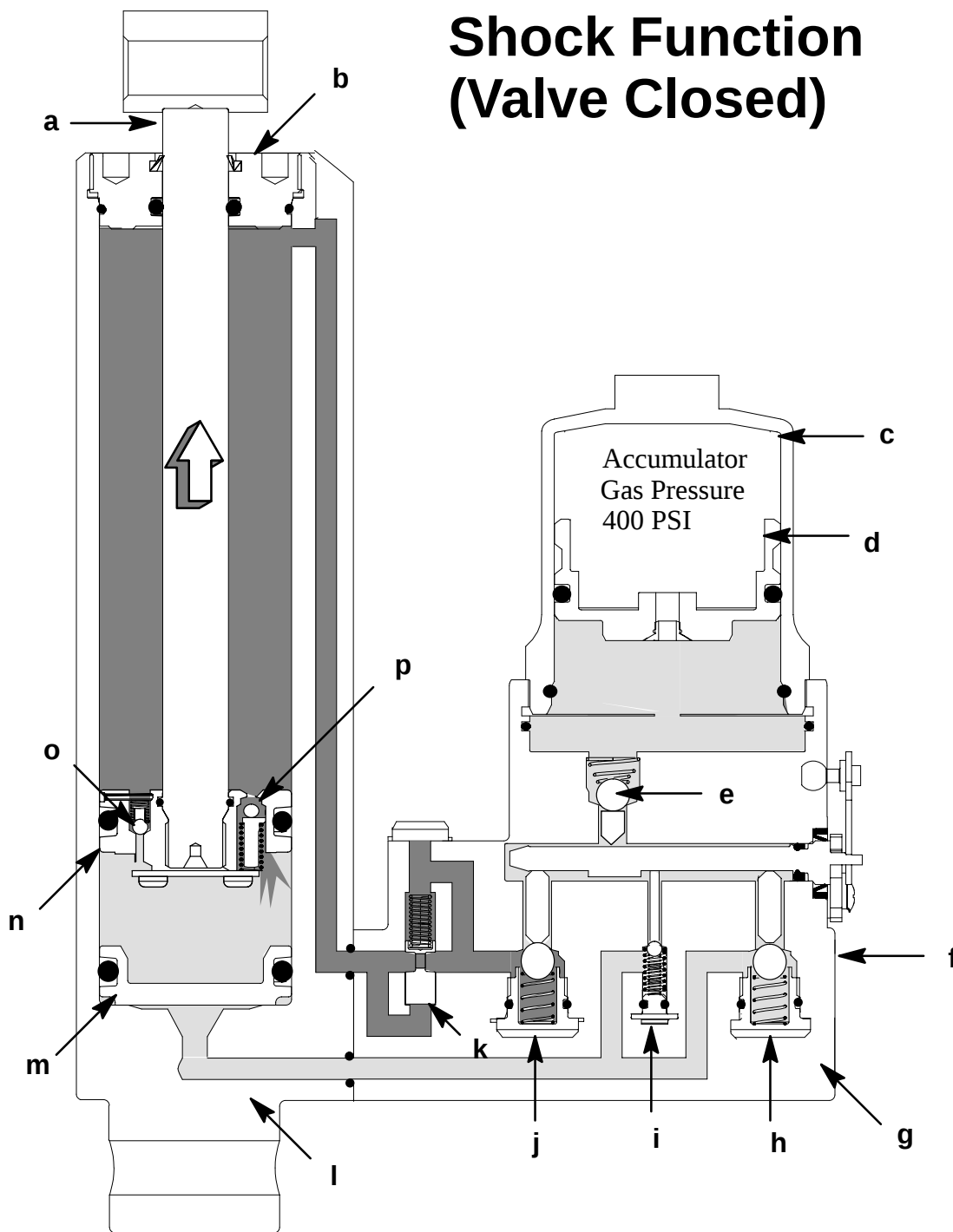


## Under Water Strike With Valves Open

Should the drive unit strike a submerged object while in forward motion, the shock rod (a) will extend from the tilt cylinder (l). Fluid will attempt to exit the cylinder through the interconnecting passage. The rapid fluid flow will increase the pressure below the surge valve (k), causing the valve to move, closing the oil return passage back into the accumulator (c). Oil inside the up cavity is locked in a static position by the closed up fast transfer valve (j), the closed down slow transfer valve (i) and down fast transfer valve (h). As the shock rod extends outward, the pressure inside the up cavity will reach sufficient pressure to open the shock valve (p) which opens at 880-1110 psi. Oil will flow into the cavity created as the shock rod & shock piston (a & n) moves away from the memory piston (m).



## Shock Function (Valve Closed)



- a - Shock Rod
- b - End Cap
- c - Accumulator
- d - Accumulator Piston
- e - Accumulator Check Valve
- f - Camshaft Lever
- g - Manifold
- h - Down Fast Transfer Valve

- i - Down Slow Transfer Valve
- j - Up Fast Transfer Valve
- k - Surge Valve
- l - Cylinder
- m - Memory Piston
- n - Shock Piston
- o - Shock Return Valve
- p - Impact Relief Valve

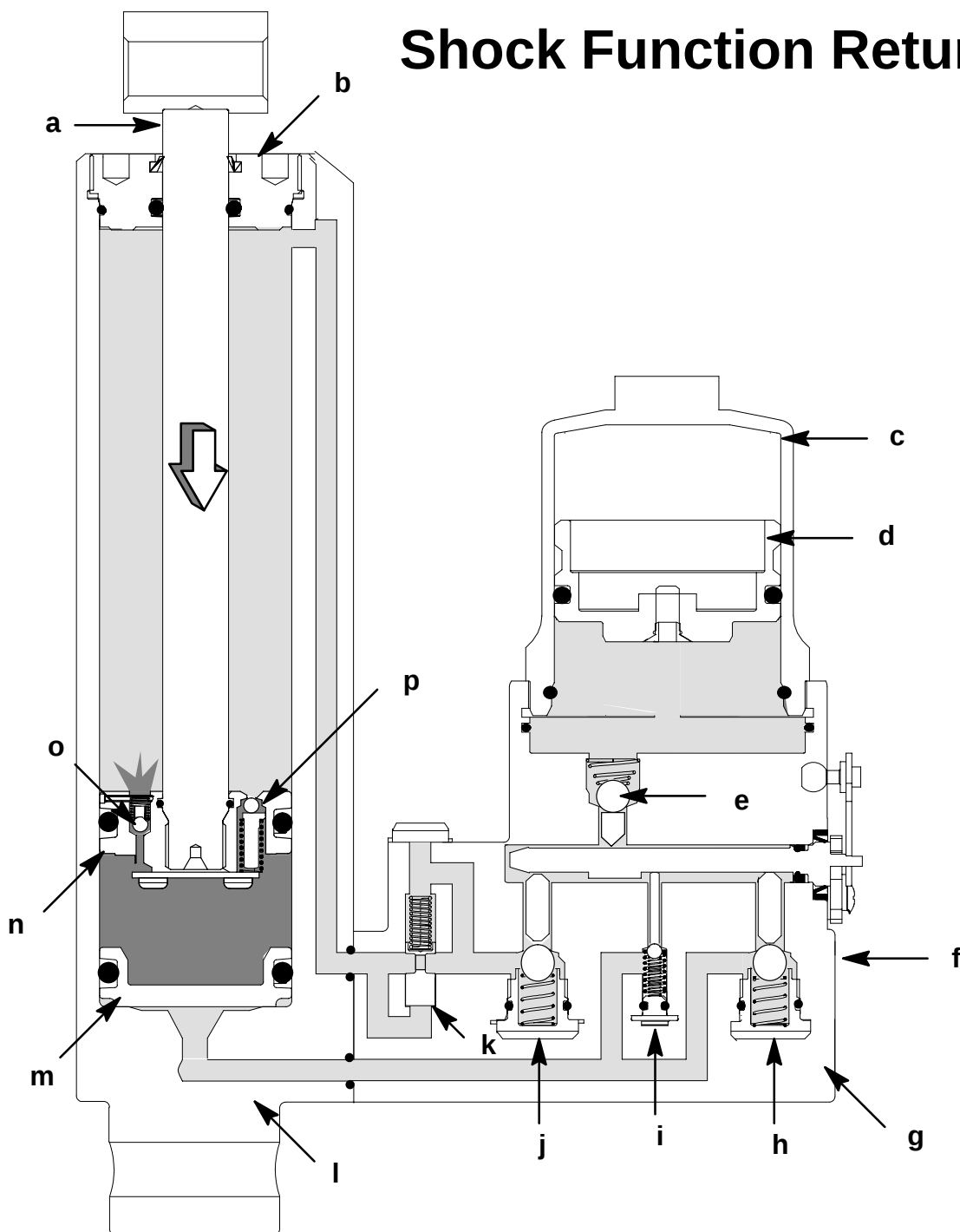


## Shock Function With Valves Closed

Should the drive unit strike a submerged object while in forward motion, the shock rod (a) will extend from the cylinder (l). Oil inside the up cavity is locked in a static position by the closed up fast transfer valve (j), the closed down slow transfer valve (i) and closed down fast transfer valve (h). Fluid will attempt to exit the cylinder through the interconnecting passage back into the accumulator (c). The closed up fast transfer valve (j) will prevent the fluid return. As the shock rod extends outward, the pressure inside the up cavity will reach sufficient pressure to open the shock valve (p) which opens at 880-1110 psi. Oil will flow into the cavity created as the shock rod & shock piston (a & n) moves away from the memory piston (m).



# Shock Function Return



a - Shock Rod  
b - End Cap  
c - Accumulator  
d - Accumulator Piston  
e - Accumulator Check Valve  
f - Camshaft Lever  
g - Manifold  
h - Down Fast Transfer Valve

i - Down Slow Transfer Valve  
j - Up Fast Transfer Valve  
k - Surge Valve  
l - Cylinder  
m - Memory Piston  
n - Shock Piston  
o - Shock Return Valve  
p - Impact Relief Valve



## Shock Function Return

After the drive clears the object, the shock return valve (o) will allow the oil to flow from between the shock piston (n) and memory piston (m) onto the down cavity as the drive returns to its original running position.



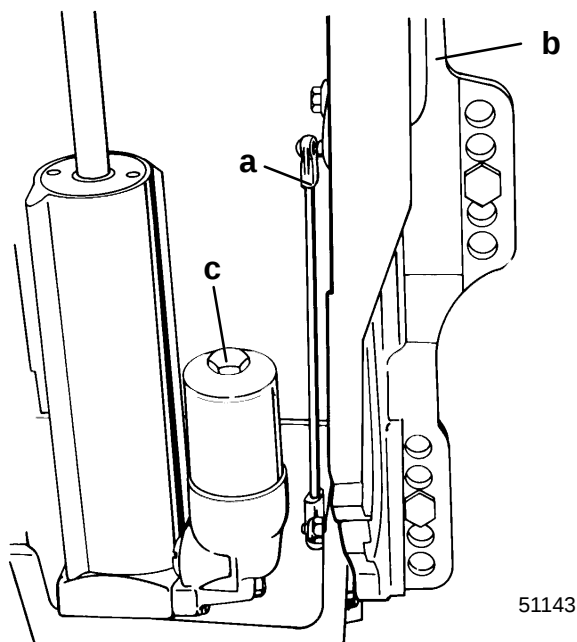
# Hydraulic System Troubleshooting

Refer to disassembly/reassembly instructions (following) if disassembly is required when servicing.

**IMPORTANT:** After debris or failed components have been found (during troubleshooting procedure), it is recommended that unit be disassembled completely and ALL O-rings be replaced. Check ball components and castings must be cleaned using engine cleaner and compressed air or replaced prior to reassembly.

Support outboard with tilt lock lever when servicing manual tilt system.

1. Check manual release cam adjustment. Cam must open and close freely. Adjust cam link rod as necessary.

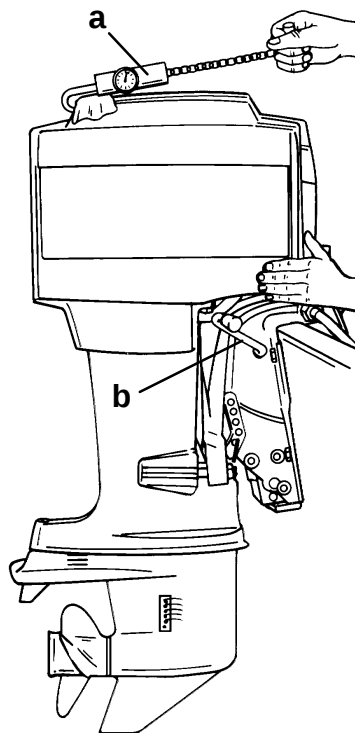


- a - Link Rod  
b - Manual Release Lever  
c - Accumulator

2. Check for external leaks in the manual tilt system. Replace defective part(s) if leak is found.

**IMPORTANT:** If cut or damaged O-rings are found, inspect machined surfaces for scoring, burrs or debris.

3. Check for discharged accumulator. 35 to 50 lb. ft. (47-68 N·m) of pulling force must be attained when tilting outboard from full "down" to full "up" position. If more than 50 lb. ft. (68 N·m) of force is required, replace accumulator.



50431

- a - Weight Scale  
b - Valve Lever (open position)



# Manual Tilt System Removal

## ⚠ CAUTION

Remove cowling and remove all spark plug leads from spark plugs to prevent accidental starting while servicing outboard.

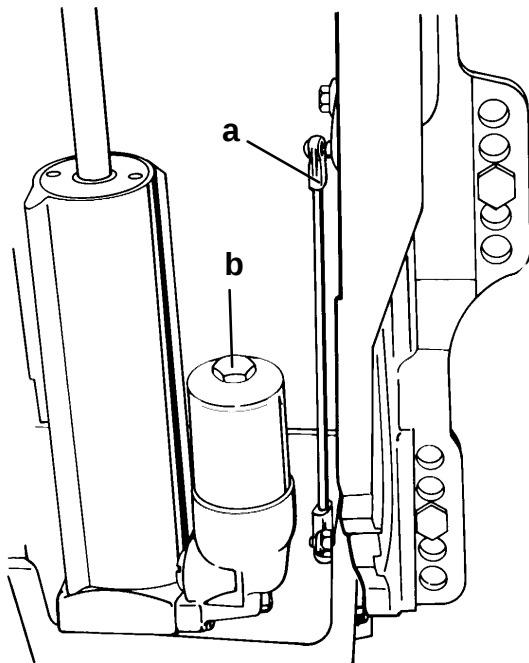
## ⚠ WARNING

Service or installation of the tilt system may result in loss of pressure in the shock cylinder. If the outboard is not in the full down position, such loss of pressure will cause the engine to fall to the full down position with a potential for damaging engine or causing personal injury. To avoid such injury support outboard in the up position using tilt lock lever.

## ⚠ WARNING

Manual tilt system is pressurized. Accumulator must be removed when shock rod is in the full up position, prior to servicing, otherwise oil spray-back may occur.

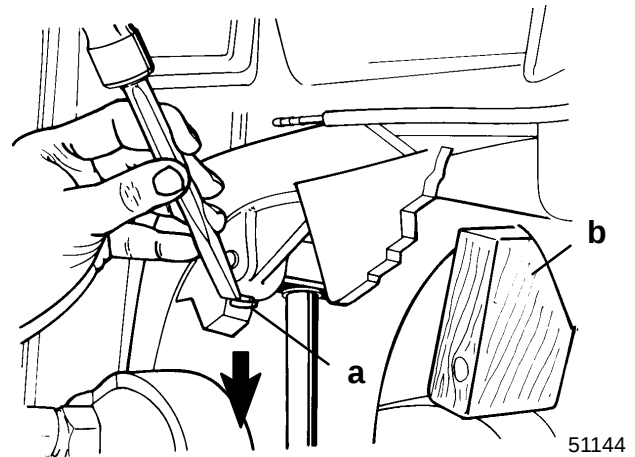
1. Support outboard in the up position using tilt lock lever.
2. Remove link rod.



51143

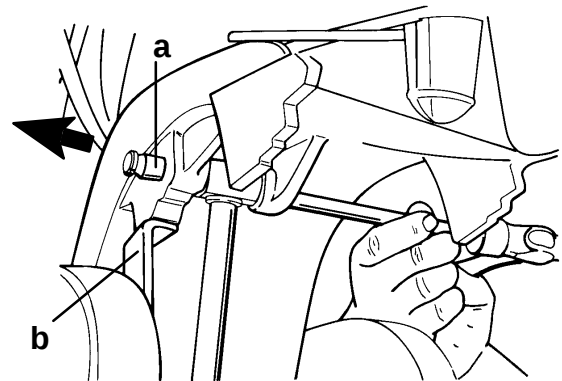
a - Link Rod  
b - Accumulator

3. Position piece of wood under transom bracket instead of tilt lock for access of removing pin. Use suitable punch to remove (DRIVE DOWN) upper dowel pin. Retain dowel pin.



a - Dowel Pin  
b - Wood

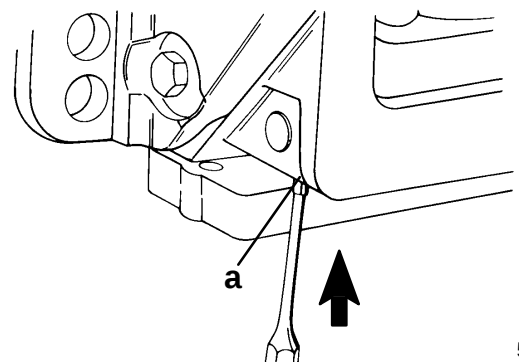
4. Position tilt lock and remove piece of wood. Use suitable punch to drive out upper pivot pin.



51144

a - Pivot Pin  
b - Tilt Lock

5. Use punch to remove (DRIVE UP) lower dowel pin. Retain dowel pin.

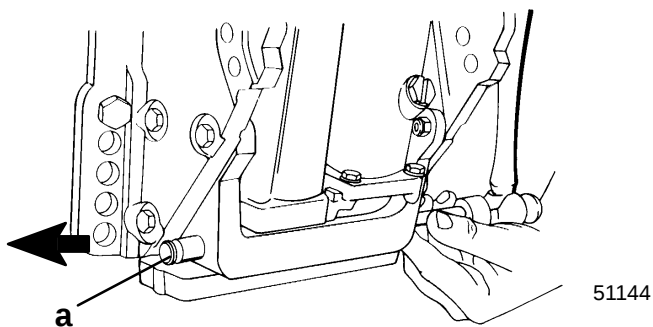


51144

a - Dowel Pin

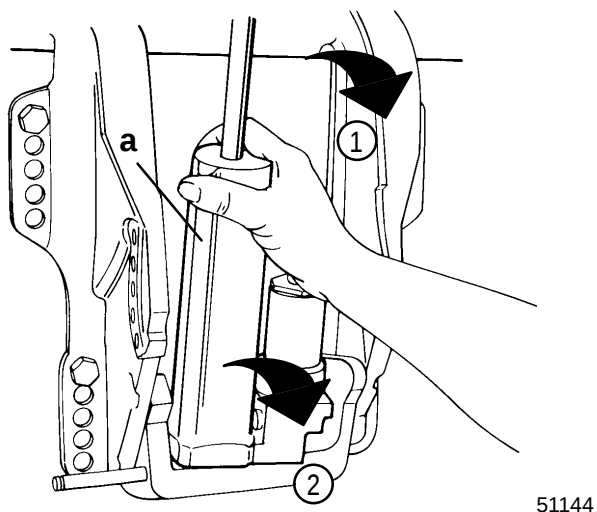


6. Use suitable punch to drive out lower pivot pin.



a - Pivot Pin

7. Tilt shock absorber assembly (TOP FIRST) out from clamp bracket and remove assembly.



a - Manual Tilt System

## Manual Tilt System Disassembly

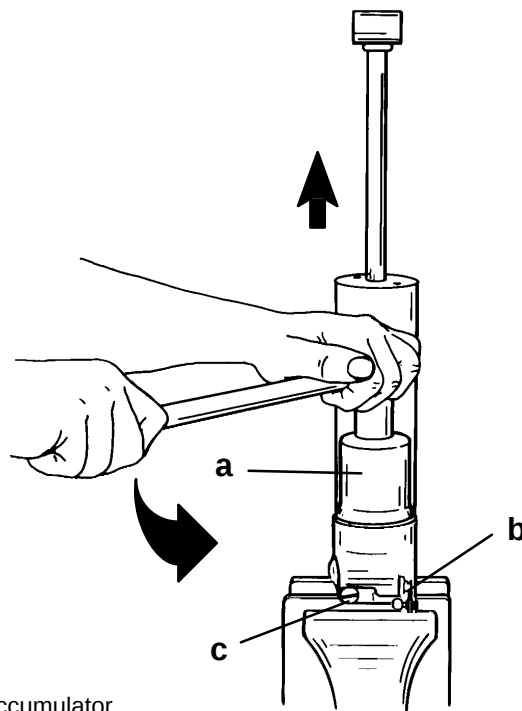
**NOTE:** Accumulator contains a high pressure nitrogen charge and is NOT SERVICEABLE. Replace if necessary.

### ⚠ WARNING

This tilt system is pressurized. Remove accumulator only when shock rod is in full up position.

### Accumulator Removal

1. Place manual tilt system in soft jawed vise.
2. Position shock rod to full up position.
3. Open cam shaft valve (Down Position).
4. Loosen surge valve enough to drip, wait until dripping stops.
5. When fluid stops dripping, loosen and remove accumulator.

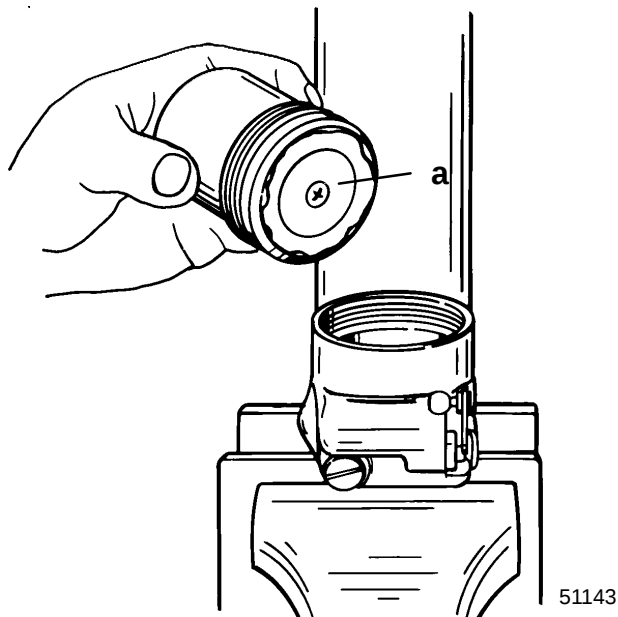


a - Accumulator  
b - Cam Lever  
c - Velocity Plug

51143

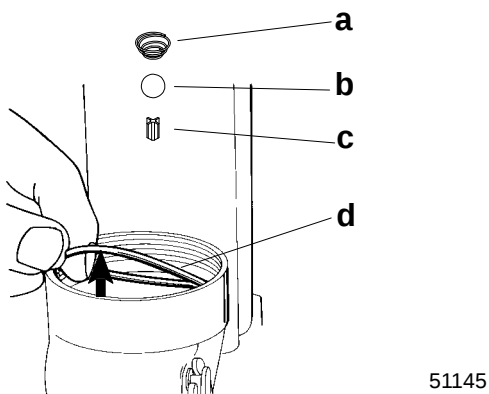


6. If plunger can be compressed into accumulator by hand, accumulator is defective. Replace accumulator.



a - Plunger

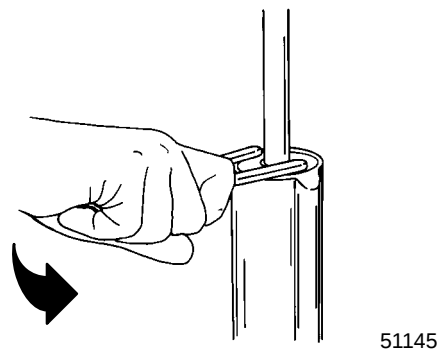
7. Once accumulator is removed, remove O-ring, conical spring, steel ball and plunger.



a - Conical Spring  
b - Steel Ball  
c - Plunger  
d - O-ring

## Shock Rod Removal

1. Unscrew cylinder end cap assembly using spanner wrench [1/4 in. x 5/16 in. long pegs].



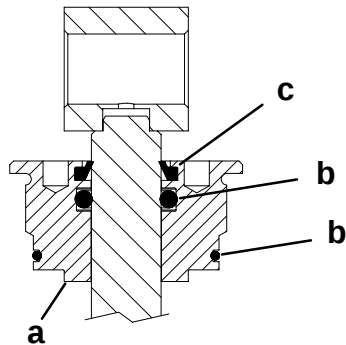
2. Remove shock rod assembly from cylinder.





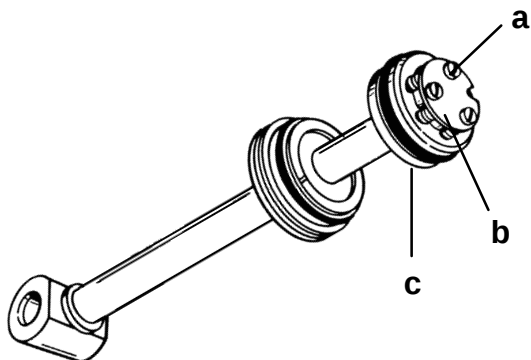
# Shock Rod Disassembly

**NOTE:** The only serviceable items on the shock rod assembly are the O-rings and wiper ring. If shock rod requires any other repair, replace shock rod assembly.



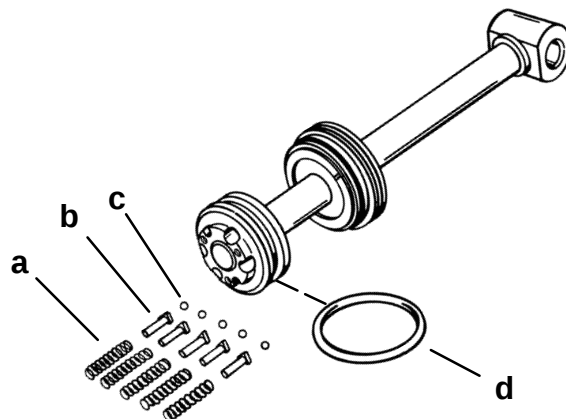
- a - End Cap
- b - O-rings (2)
- c - Wiper Ring

1. Place shock rod assembly on clean work surface.
2. Remove three (3) screws and remove plate from shock rod piston.



- a - Screw (3)
- b - Plate
- c - Shock Rod Piston

3. Remove check ball components from shock rod piston.
4. Remove O-ring.



51147

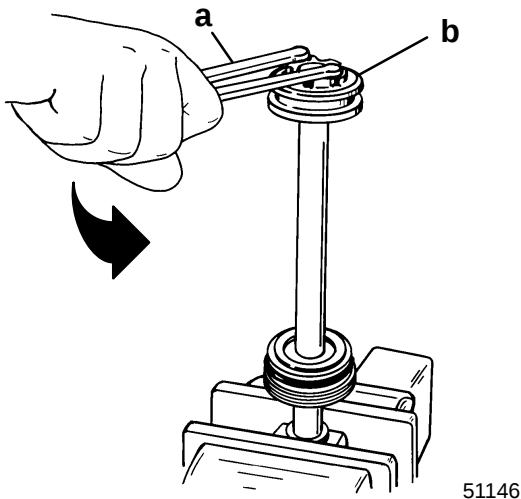
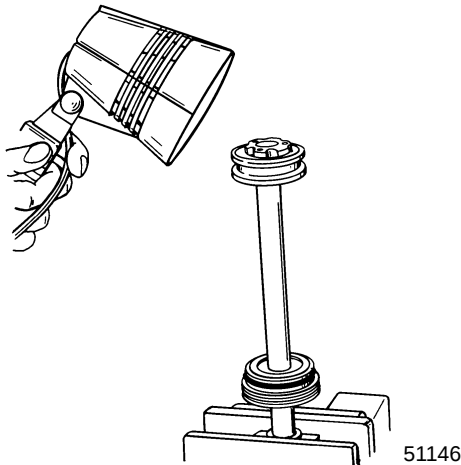
- a - Springs (5)
- b - Seats (5)
- c - Balls (5)
- d - O-ring



## ⚠ CAUTION

When removing shock piston, spanner wrench must have 1/4 in. x 5/16 in. long pegs to avoid damage to shock piston.

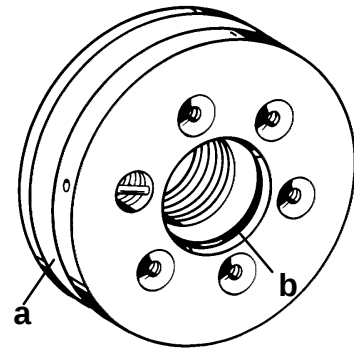
5. Place shock rod in soft jawed vise and apply heat to loosen piston using torch lamp (P/N 91-63209).
6. Loosen shock rod piston using spanner wrench [1/4 in. x 5/16 in. (6.4mm x 8mm) long pegs].
7. Allow shock rod piston to cool. Remove from shock rod.



a - Spanner Wrench  
b - Shock Rod Piston

8. Inspect check valve for debris; clean debris from check valve if found. If debris cannot be cleaned from check valve, replace shock piston as an assembly.
9. Clean shock and components with compressed air.

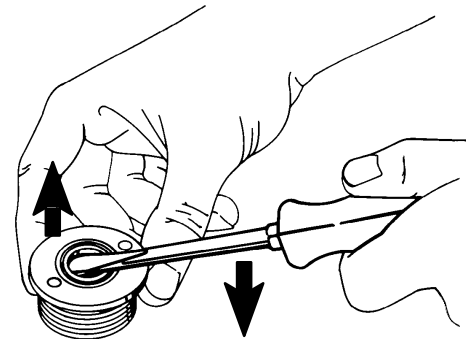
10. Remove inner O-ring.



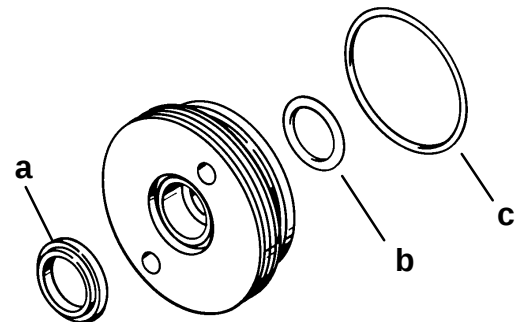
51199

a - Shock Piston  
b - O-ring

11. Remove cylinder end cap assembly from shock rod.
12. Inspect shock. If wiper (located in cap) has failed to keep rod clean, replace wiper.
13. Place end cap on clean work surface.
14. Remove rod wiper, inner O-ring, and outer O-ring.



51147



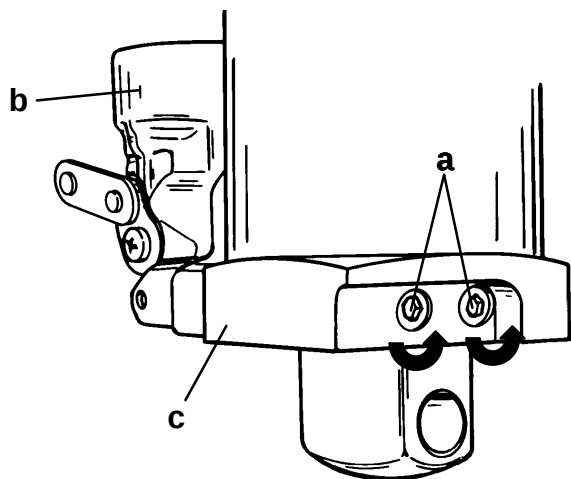
51145

a - Rod Wiper  
b - Inner O-ring  
c - Outer O-ring



## Valve Block Removal

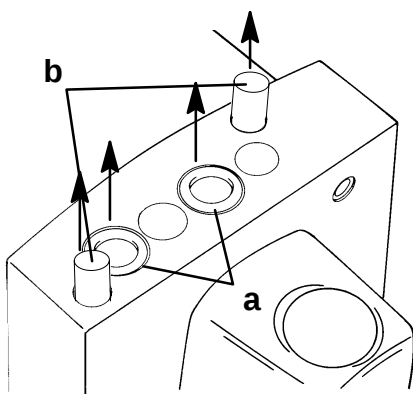
1. Remove two screws from the shock rod cylinder to separate the valve block.



51146

- a - Screws (2)  
b - Valve Block  
c - Shock Rod Cylinder

2. Remove O-rings and dowel pins.

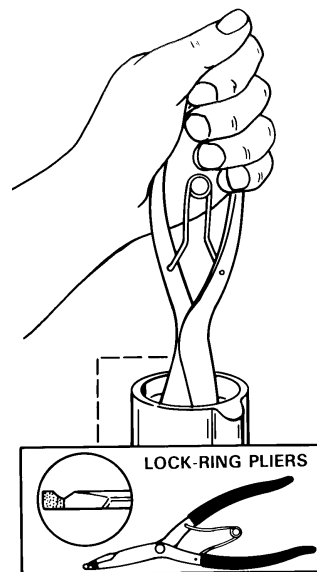


51148

- a - O-ring (2)  
b - Dowel Pin (2)

## Memory Piston Removal

1. Remove memory piston from cylinder using one of two methods:
  - a. Using lock ring pliers (Craftsman P/N 4735) or (Snap-on P/N SRP4).



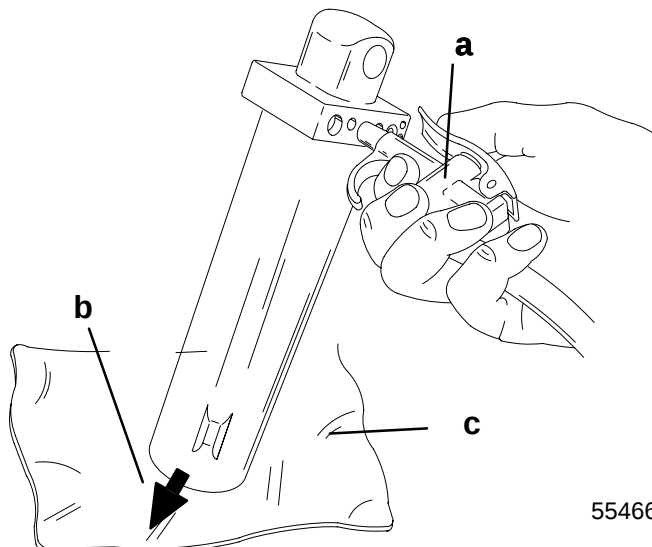
51144

- b. Blowing compressed air into center O-ring hole.

### ⚠ WARNING

Memory piston cup may be expelled at a high velocity when air pressure is applied. Failure to place cylinder as shown below could result in personal injury.

**NOTE:** Point cylinder opening down and away. Use a shop rag or towel to avoid damage to the memory piston. Fluid will blow out also.

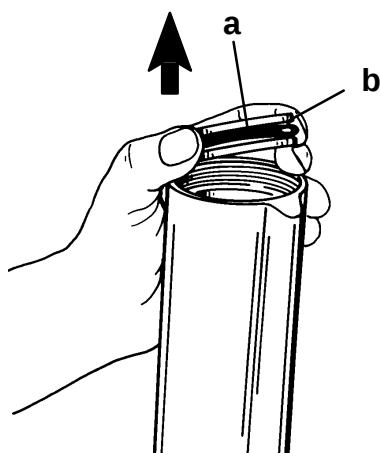


55466

- a - Adaptor/Air Hose  
b - Memory Piston Exit  
c - Shop Rag



2. Remove O-ring from memory piston.

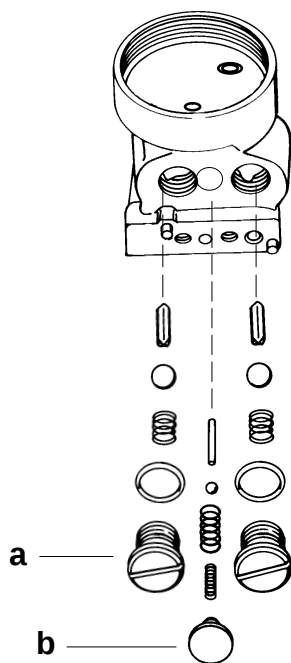


51144

a - O-Ring  
b - Memory Piston

## Valve Block Disassembly

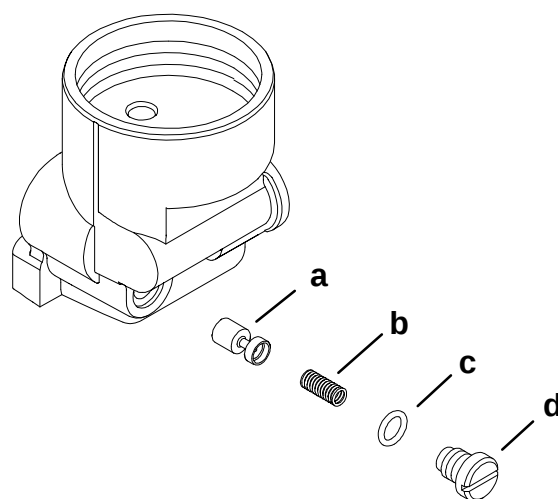
1. Remove check retainer plug and components.
2. Remove hydraulic oil transfer valve plugs and components.



51142

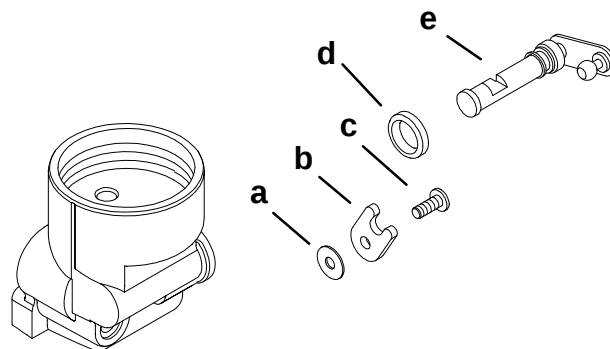
a - Transfer Valve Plug Assembly (2)  
b - Check Retainer Plug or Screw Assembly

3. Remove surge valve assembly.



a - Spool  
b - Spring  
c - O-ring  
d - Screw Plug

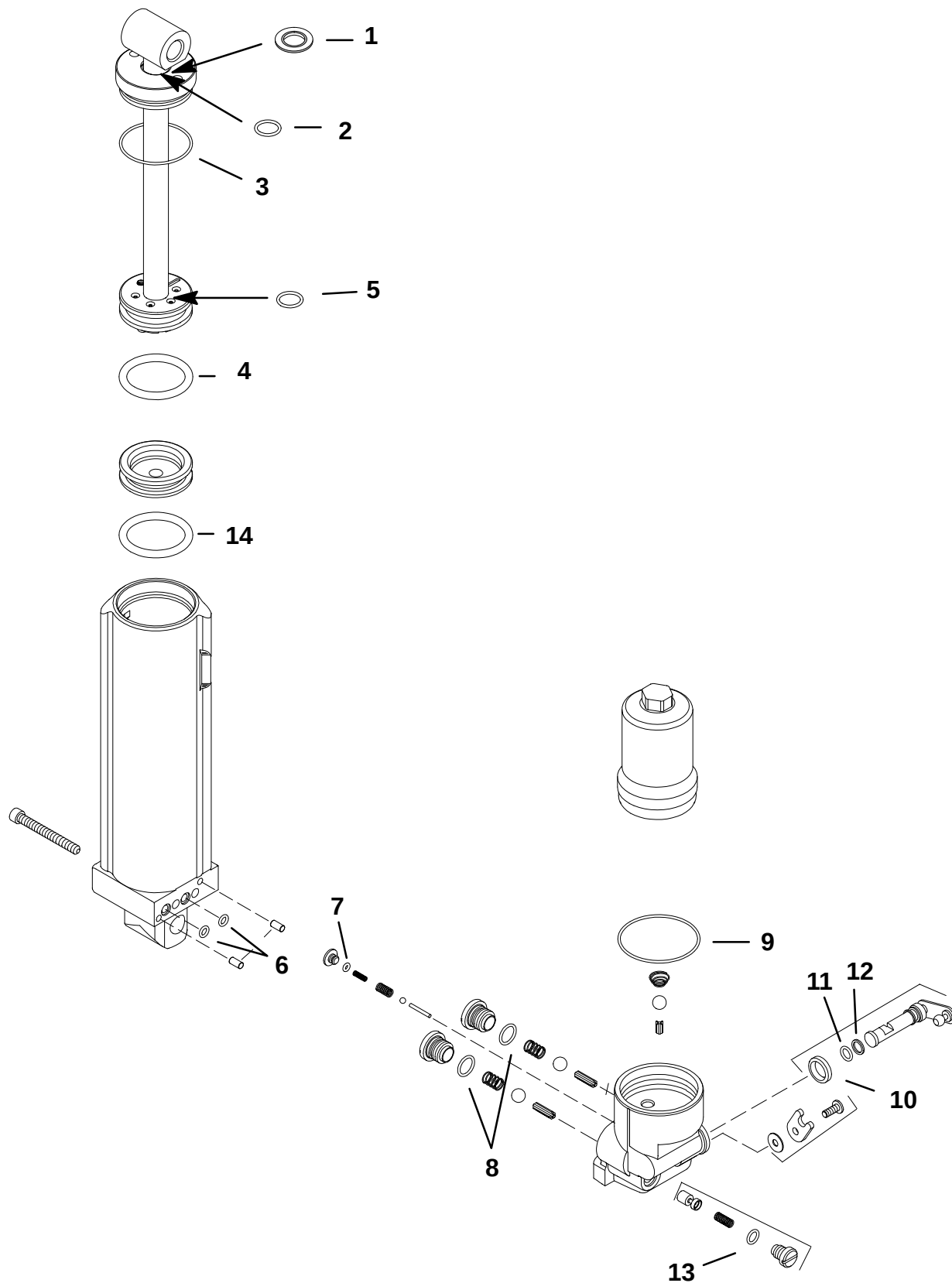
4. Remove screw and remove cam assembly.



a - Spacer Retainer Clip  
b - Retainer Clip  
c - Screw  
d - Shaft Seal  
e - Cam



## REASSEMBLY - O-RING AND SEAL PLACEMENT

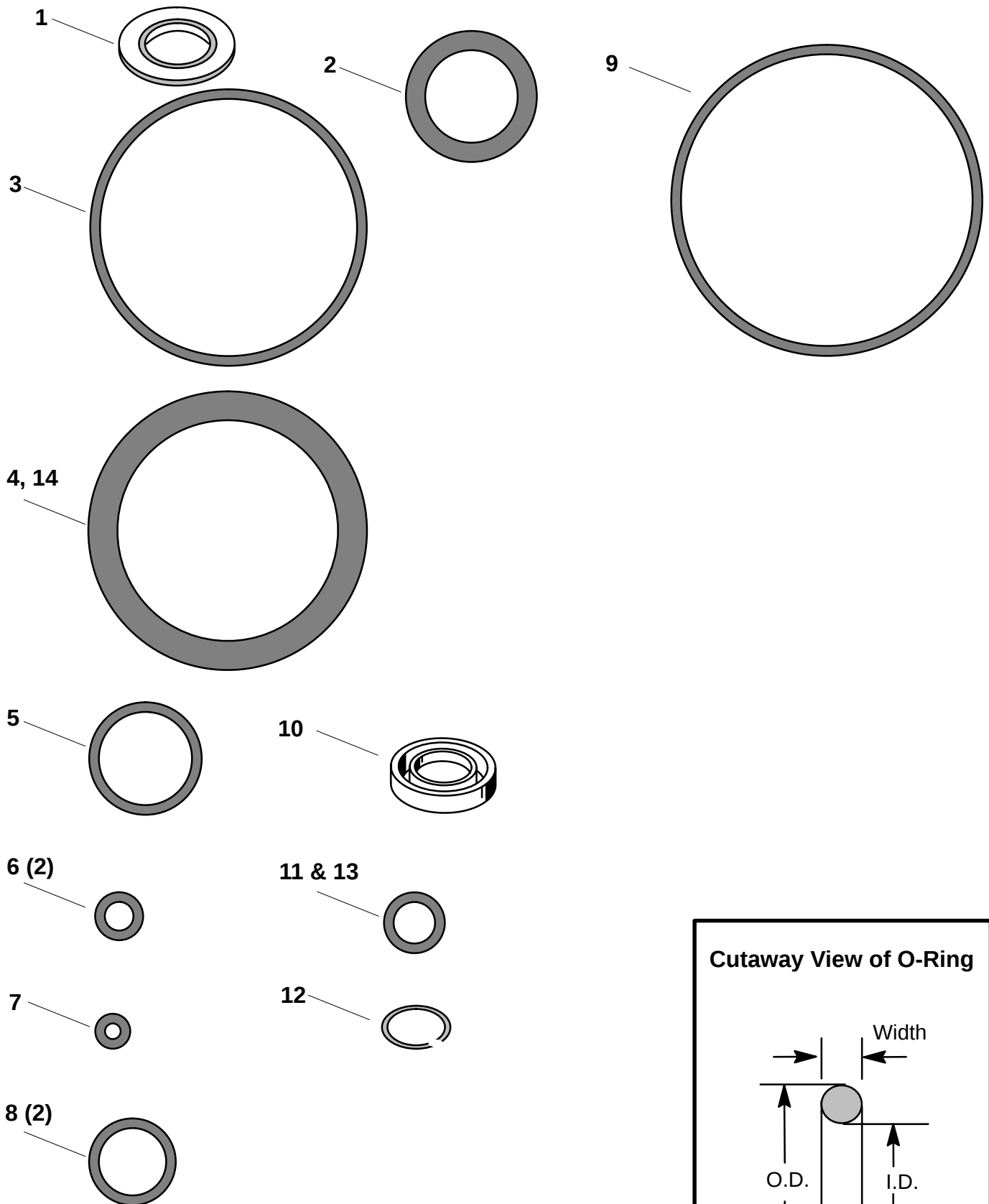


**NOTE:** Lubricate all O-rings using Quicksilver Power Trim and Steering Fluid. If not available, use automotive (ATF) automatic transmission fluid.

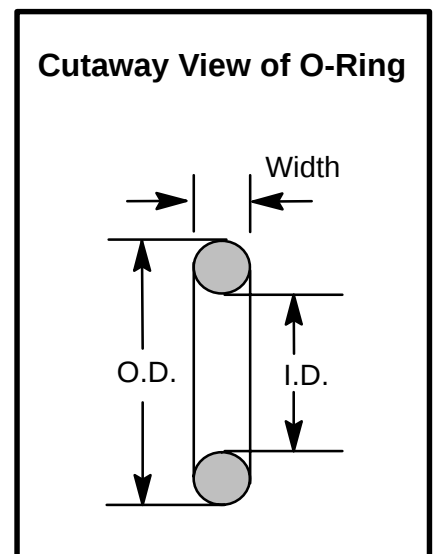
**NOTE:** It is recommended that all O-rings be replaced when servicing tilt system.



# Actual O-ring Sizes



O-RINGS SHOWN ARE ACTUAL SIZE





## O-ring Description and Sizes

| O-Ring       | Description         | O-Ring I.D.          | O-Ring O.D.          | O-Ring Width        |
|--------------|---------------------|----------------------|----------------------|---------------------|
| <b>1</b>     | Wiper Ring          |                      |                      |                     |
| <b>2</b>     | Cyl. Cap, Inner     | 0.671 in. (17.04 mm) | 0.949 in. (24.10 mm) | 0.139 in. (3.53 mm) |
| <b>3</b>     | Cyl. Cap            | 1.864 in. (47.34 mm) | 2.004 in. (50.90 mm) | 0.07 in. (1.78 mm)  |
| <b>4</b>     | Shock Piston        | 1.6 in. (40.64 mm)   | 2.02 in. (53.086 mm) | 0.21 in. (5.334 mm) |
| <b>5</b>     | Piston Bolt         | 0.676 in. (17.17 mm) | .816 in. (20.726 mm) | 0.07 in. (1.78 mm)  |
| <b>6 (2)</b> | Manifold Split Line | 0.208 in. (5.283 mm) | 0.348 in. (8.839 mm) | 0.07 in. (1.78 mm)  |
| <b>7</b>     | Slow Valve          | 0.114 in. (2.90 mm)  | 0.254 in. (6.451 mm) | 0.07 in. (1.78 mm)  |
| <b>8 (2)</b> | Plug                | 0.489 in. (12.42 mm) | 0.629 in. (15.97 mm) | 0.07 in. (1.78 mm)  |
| <b>9</b>     | Accumulator         | 2.114 in. (53.69 mm) | 2.254 in. (57.25 mm) | 0.07 in. (1.78 mm)  |
| <b>10</b>    | Lip Seal            |                      |                      |                     |
| <b>11</b>    | Cam Shaft           | 0.301 in. (7.645 mm) | 0.441 in. (11.20 mm) | 0.07 in. (1.78 mm)  |
| <b>12</b>    | Back Up Ring        |                      |                      |                     |
| <b>13</b>    | Surge Valve         | 0.301 in. (7.645 mm) | 0.441 in. (11.20 mm) | 0.07 in. (1.78 mm)  |
| <b>14</b>    | Memory Piston       | 1.6 in. (40.64 mm)   | 2.02 in. (53.086 mm) | 0.21 in. (5.334 mm) |



## Manual Tilt System Cleaning and Inspection

1. It is recommended that all O-rings exposed during disassembly be replaced.
2. Clean components, filter, and check valve seats using engine cleaner and compressed air. Do not use cloth rags.
3. Inspect all machined surfaces for burrs or scoring to assure O-ring longevity.
4. Inspect shock rod. If wiper (located in cap) has failed to keep rod clean, replace wiper.

## Manual Tilt System Reassembly

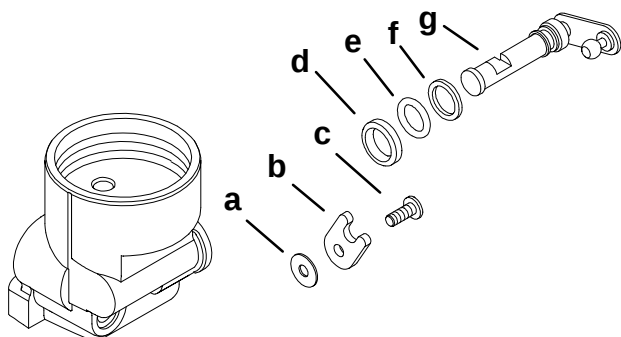
**IMPORTANT:** Components must be dirt and lint free. Slightest amount of debris in tilt system could cause system to malfunction.

Apply Quicksilver Power Trim and Steering Fluid to all O-rings during reassembly. If not available, use automotive (ATF) automatic transmission fluid.

### CAM SHAFT REASSEMBLY

**IMPORTANT:** Cam shaft O-ring must be lubricated using 2-4-C with Teflon (92-825407A12).

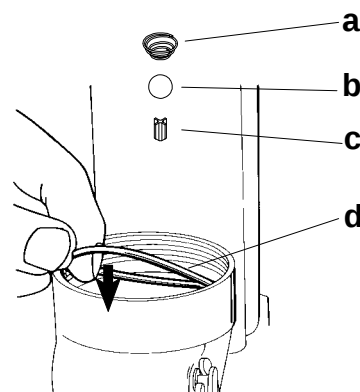
1. Install lubricated O-ring and back up seal to cam.
2. Install shaft seal in valve block with lips facing out.
3. Install cam shaft assembly in valve block.
4. Secure cam shaft in place using insulator, retain-er plate, and screw. Tighten screw securely.



- a - Spacer Retainer Clip
- b - Retainer Clip
- c - Screw
- d - Shaft Seal
- e - O-ring
- f - Back up Seal
- g - Cam

### VALVE BODY CHECK REASSEMBLY

1. Install lubricated O-ring, plunger, steel ball and conical spring to valve block.

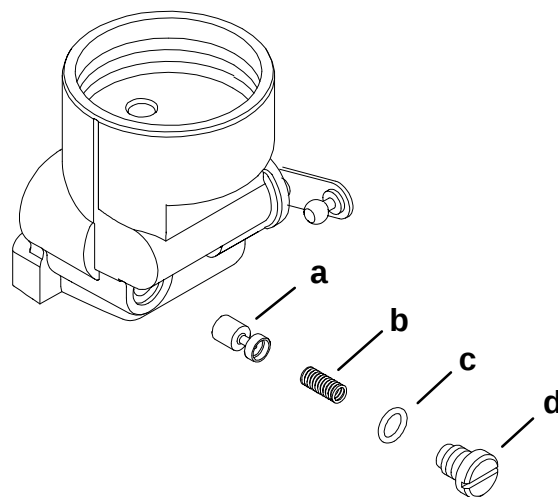


51145

- a - Conical Spring
- b - Steel Ball
- c - Plunger
- d - O-ring

### VELOCITY VALVE REASSEMBLY

1. Install spool, spring, lubricated O-ring and screw plug (surge valve assembly) into valve block.
2. Torque screw plug to 75 lb. in. (8.5 N·m).

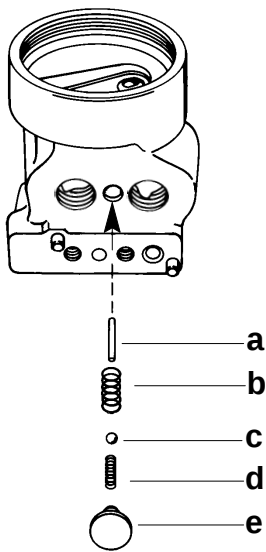


- a - Spool
- b - Spring
- c - O-ring
- d - Screw Plug - Torque to 75 lb. in. (8.5 N·m)



## CHECK RETAINER REASSEMBLY

1. Install plunger, spring (large), ball, spring (small), and plug into valve block.

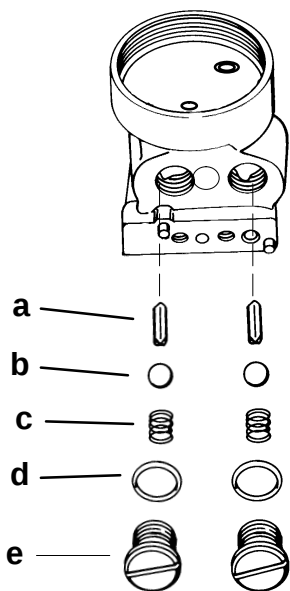


51142

- a - Plunger
- b - Spring (Large)
- c - Ball
- d - Spring (Small)
- e - Plug

## VALVE PLUG REASSEMBLY

1. Install plunger, steel ball, spring, lubricated O-ring and screw plug. Torque screw plugs to 75 lb. in. (8.5 N·m).

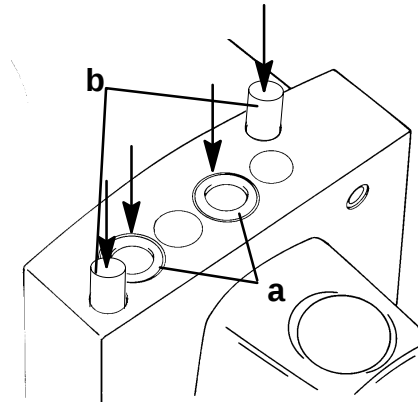


51142

- a - Plungers (2)
- b - Steel Balls (2)
- c - Springs (2)
- d - O-rings (2)
- e - Screw Plugs (2) Torque to 75 lb. in. (8.5 N·m)

## Valve Block Installation

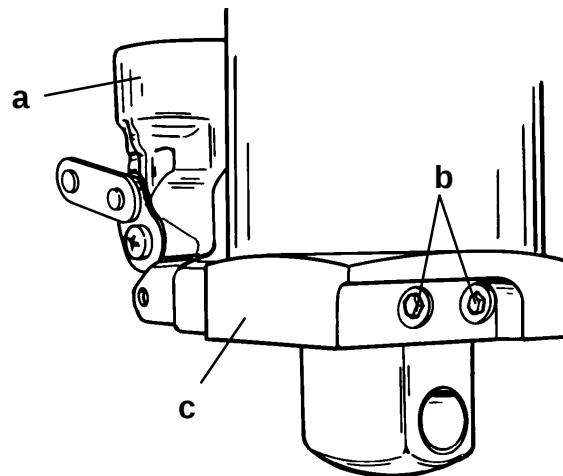
1. Install lubricated O-rings and dowel pins.



51148

- a - O-rings (2)
- b - Dowel Pins (2)

2. Install valve block to shock rod cylinder. Insert screws to shock rod cylinder and torque to 100 lb. in. (11 N·m).



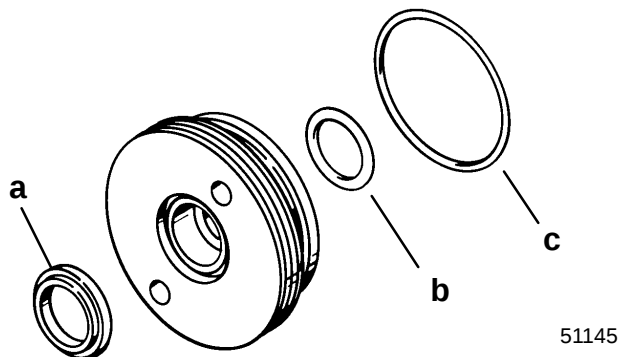
51146

- a - Valve Block
- b - Screws (2) Torque to 100 lb. in. (11 N·m)
- c - Shock Rod Cylinder



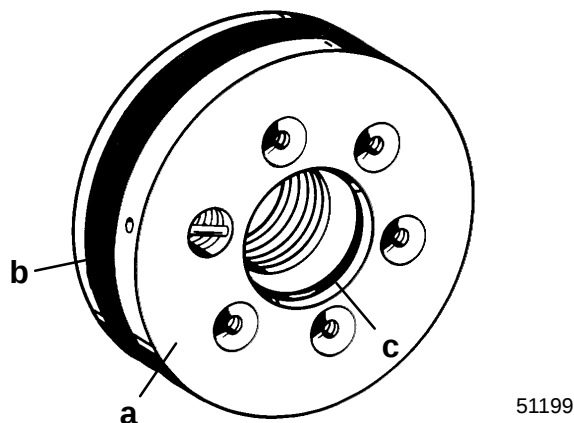
## Shock Rod Reassembly

1. Install lubricated O-rings to end cap.
2. Install rod wiper.



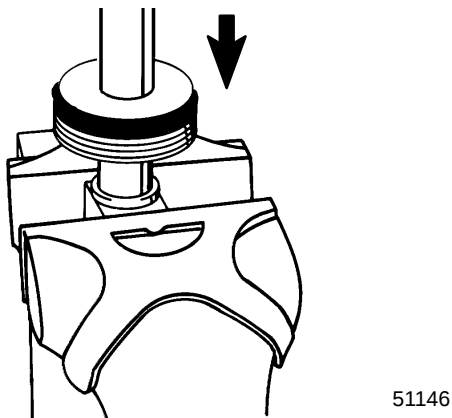
- a - Rod Wiper  
b - Inner O-ring  
c - Outer O-ring

3. Install lubricated O-rings to shock piston.



- a - Shock Piston  
b - O-ring  
c - O-ring

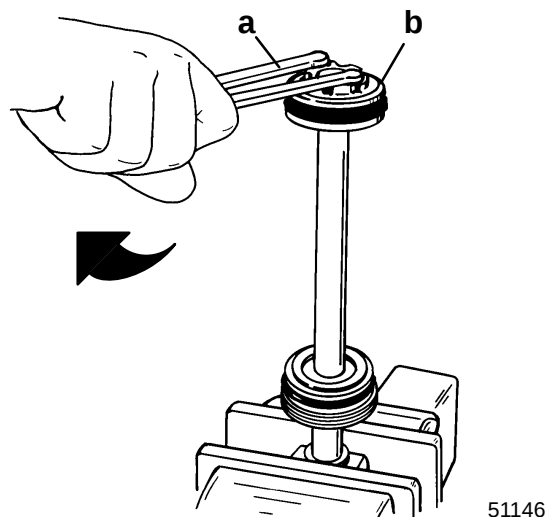
4. Clamp shock rod in soft jawed vise.
5. Position cylinder end cap onto rod as shown.



## ⚠ CAUTION

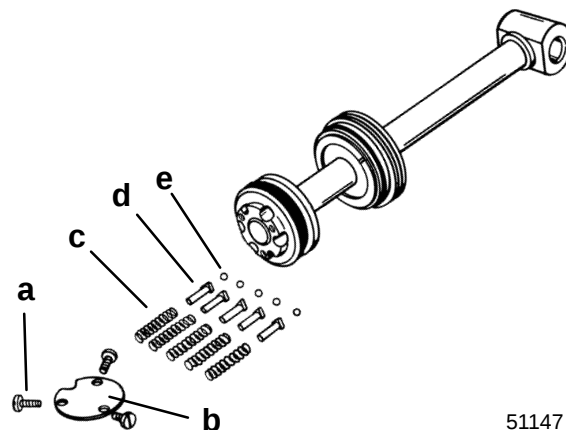
**When installing shock rod piston, spanner wrench must have 1/4 in. x 5/16 in. (6.4mm x 8mm) long pegs to avoid damage to shock rod piston.**

6. Apply Loctite Grade "A" (271) to threads on shock rod.
7. Install shock rod piston.
8. Tighten shock rod piston securely using spanner wrench [1/4 in. x 5/16 in. (6.4mm x 8mm) long pegs]. If a torquing type spanner tool is used to tighten shock piston, then torque to 90 lb. ft. (122 N-m).



- a - Spanner Wrench  
b - Shock Rod Piston - Torque to 90 lb. ft. (122 N-m)

9. Install ball, seat, and spring (five sets) to shock rod piston.
10. Secure components with plate. Torque screws to 35 lb.in. (3.9 N-m).
11. Remove shock rod assembly from vise.



- a - Screw (3) Torque to 35 lb. in. (3.9 N-m)  
b - Plate  
c - Spring (5)  
d - Seat (5)  
e - Ball (5)

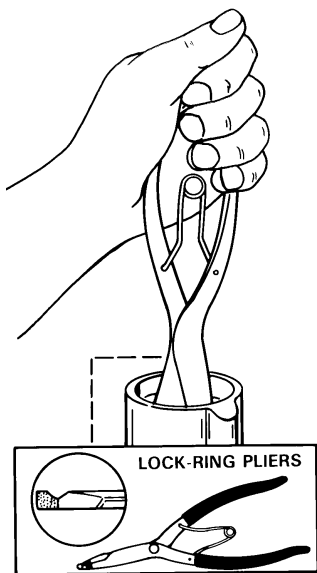


## Shock Rod Installation and Fluid Filling Procedure

**NOTE:** There are two ways for the filling procedure. The first is the easiest and less time consuming.

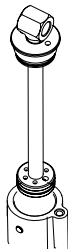
### Filling Procedure Option One

1. Place trim cylinder in soft jawed vice.
2. With manifold cam lever closed (Up Position), fill cylinder and manifold to top with Quicksilver Power trim and steering fluid, or (ATF) automatic transmission fluid. Let bubbles disperse.
3. Install lubricated O-ring to memory piston.
4. Using lock ring pliers (Craftsman P/N 4735) or (Snap-on P/N SRP4) set memory piston in top of cylinder then open cam lever (Down Position) and push memory piston down just below cylinder treads. Close cam lever (Up Position).

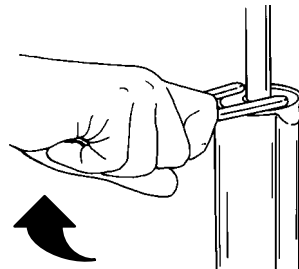


51144

5. Fill top of cylinder again with fluid to top and install shock rod assembly on top memory piston. Open cam lever (Down Position) and push shock rod assembly down to 1/8" below cylinder threads. Close cam lever (Up Position).

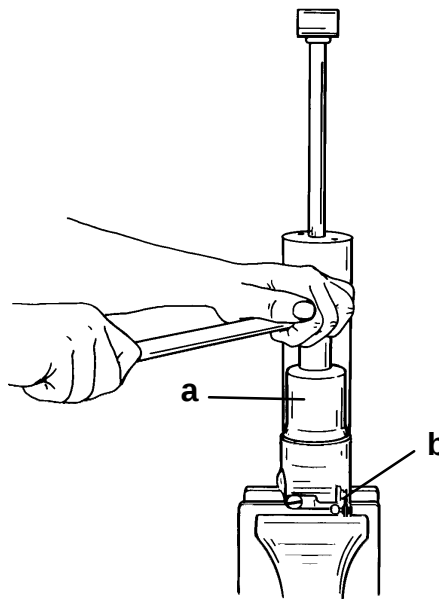


6. Fill top of shock rod assembly with fluid to top of cylinder. Open cam lever (Down Position) and screw cylinder cap down.
7. Tighten end cap securely using spanner wrench [1/4 in. x 5/16 in. (6.4mm x 8mm) long pegs]. If a torquing type spanner tool is used to tighten end cap, then torque the end cap to 45 lb. ft. (61.0 N·m). Close cam lever (up Position).



51145

8. Open and close cam lever watching for bubbles coming from accumulator check ball hole. When bubbles stop, fill accumulator opening to top with fluid. Grease threads on accumulator and opening with 2-4-C with Teflon. Start accumulator in threads and open cam lever (Down Position). Torque accumulator to 35 lb. ft. (47 N·m).



51143

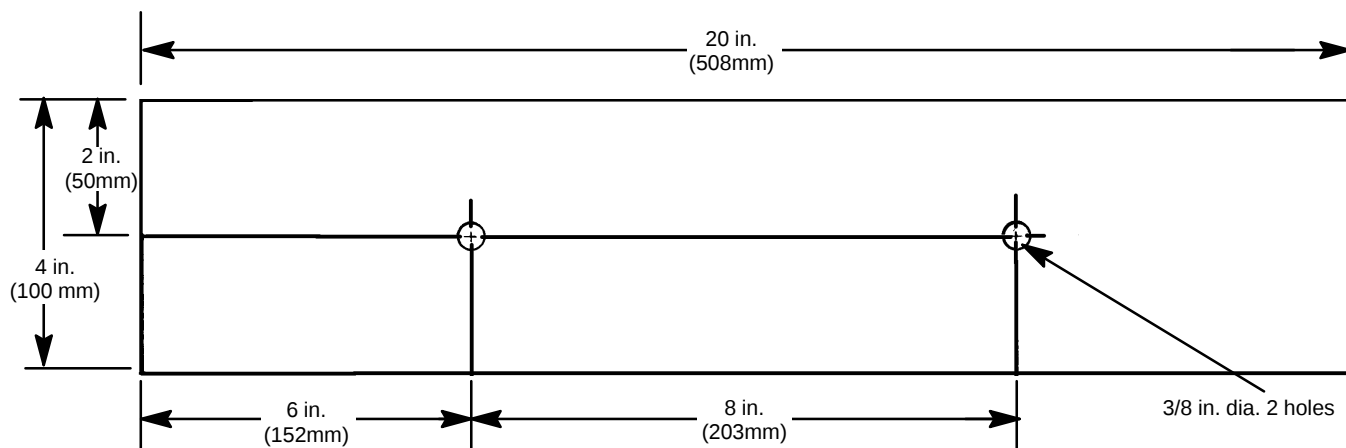
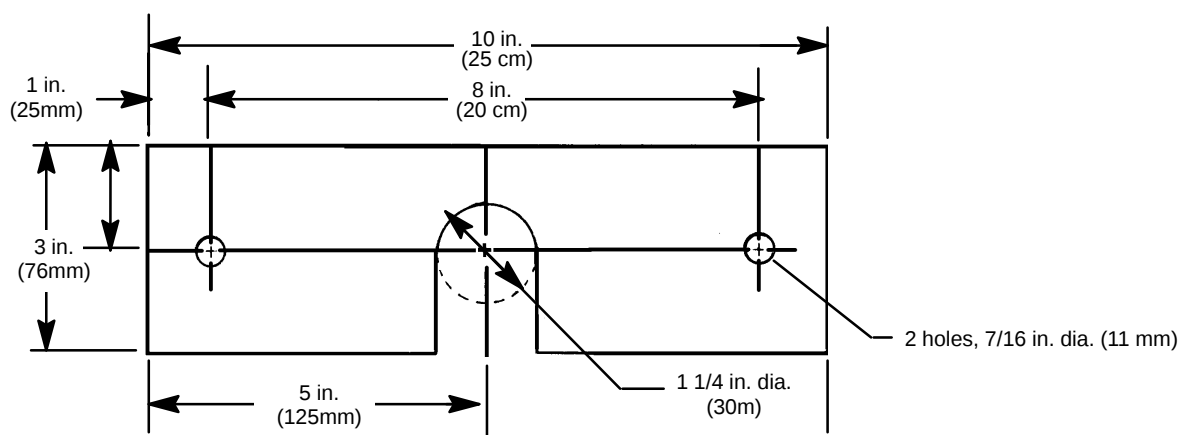
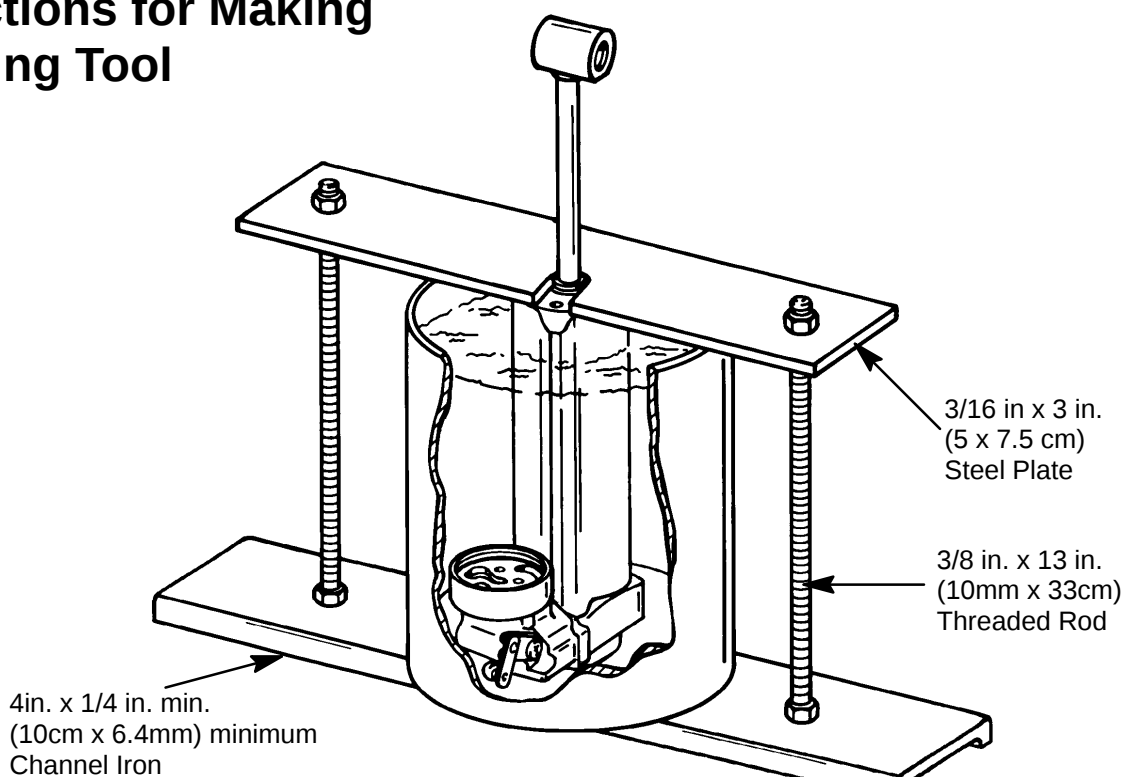
- a - Accumulator  
b - Cam Lever (Down Position)

**NOTE:** If filling procedure is done correctly, it should be hard to turn cylinder rod assembly by hand.



# Filling Procedure Option Two

## Instructions for Making Retaining Tool



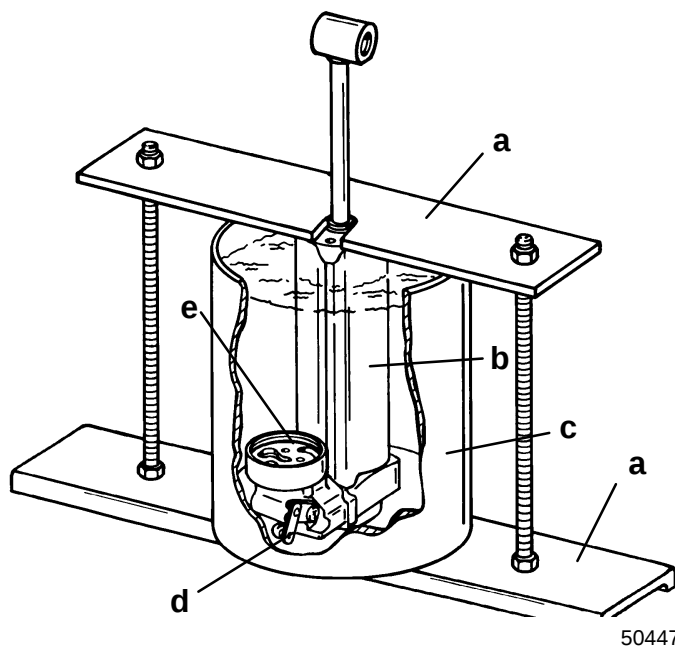


## Bleeding Manual Tilt System

**IMPORTANT:** While bleeding tilt system, time must be allowed between each stroke to allow air bubbles to dissipate.

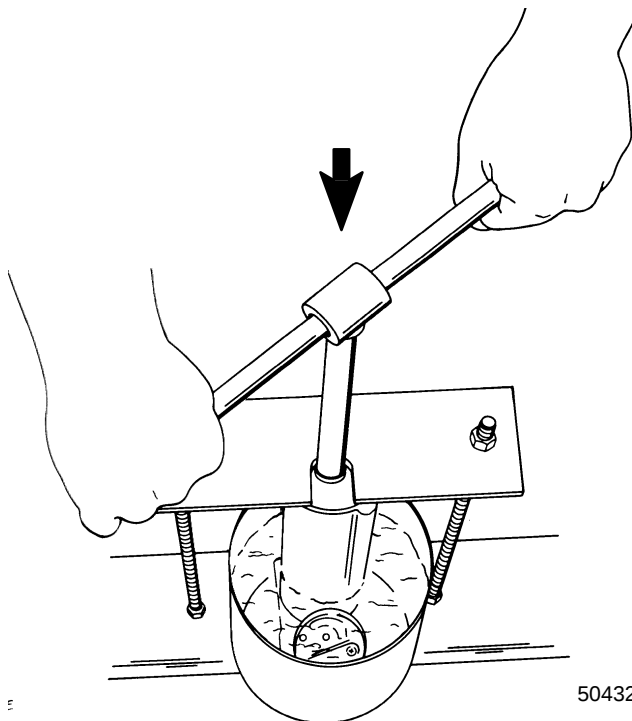
1. With shock rod in the full up position and manifold cam lever open (facing down), secure tilt system to retaining tool and container. (A No. 10 can or 3 lb. coffee can could be used).
2. Fill container to near full level using Quicksilver Power Trim and Steering Fluid. If not available, use automotive (ATF) automatic transmission fluid.

**IMPORTANT:** Fluid level must remain above accumulator opening during bleeding process.

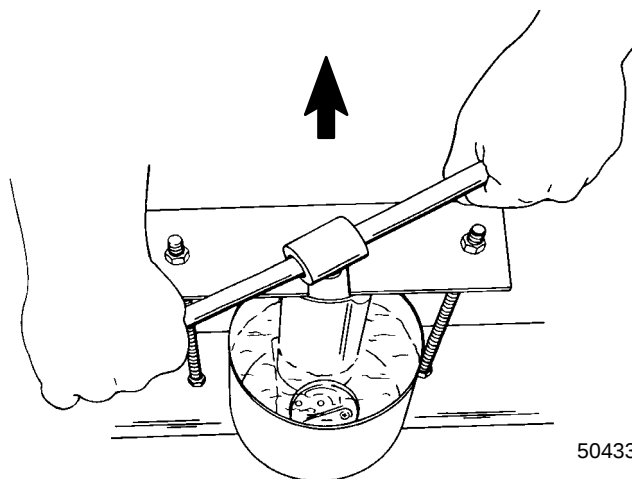


- a - Retaining Tool
- b - Tilt System
- c - Container
- d - Cam Lever
- e - Accumulator Opening

3. Bleed unit by pushing rod down slowly (18-20 seconds per stroke) until stopped at base. Wait until all air bubbles exit accumulator base.



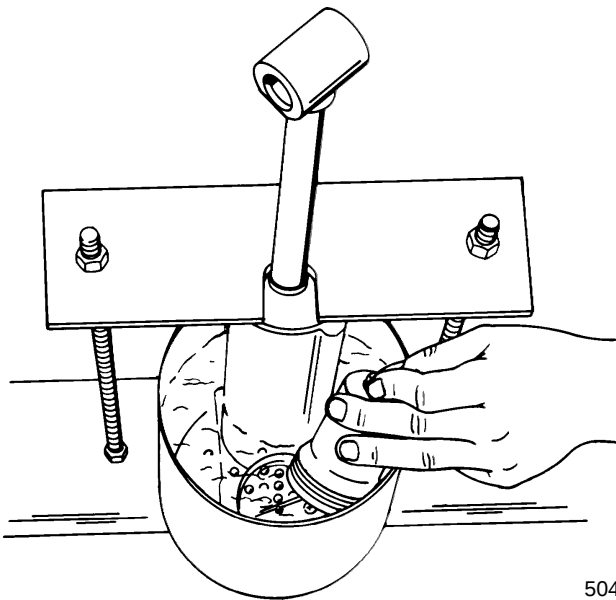
4. During up stroke, pull up on rod slowly 3 in. (76mm) from base.
5. Wait until all air bubbles exit accumulator base.



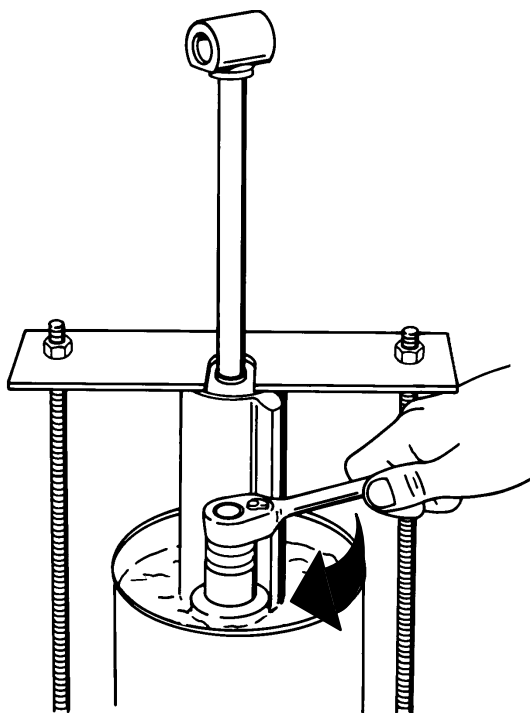
6. Slowly cycle unit 5-8 times (round trip per cycle) using short strokes 3 in. (76mm) from base allowing bubbles to disappear during each stroke.



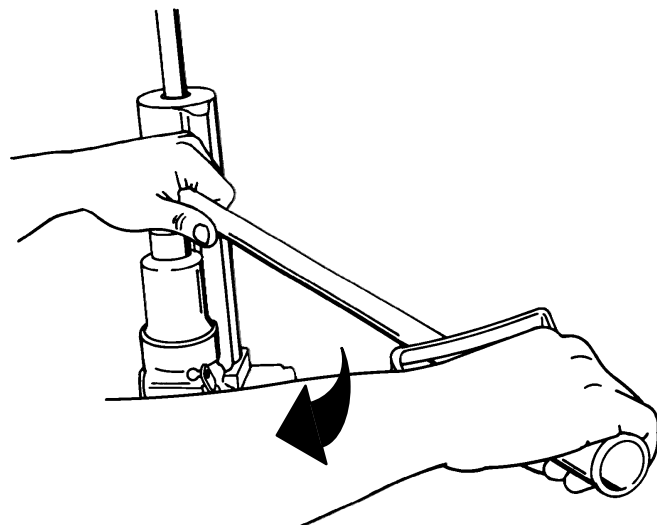
7. Allow unit to stand five minutes then proceed to cycle unit 2-3 more times using short strokes. No air bubbles should appear from accumulator port at this time.
8. With oil level well above accumulator port, slowly pull rod to full up position.
9. Install accumulator making sure air bubbles do not enter system.



10. Tighten accumulator snugly at this time.



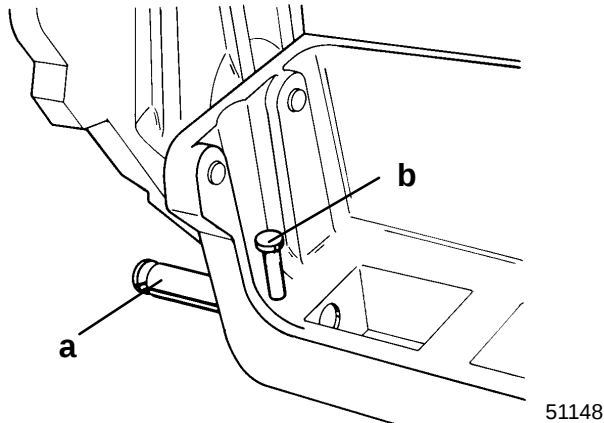
11. With cam lever remaining open (facing down), remove tilt assembly from oil and secure in soft jawed vise. Torque accumulator to 35 lb. ft. (47 N·m).





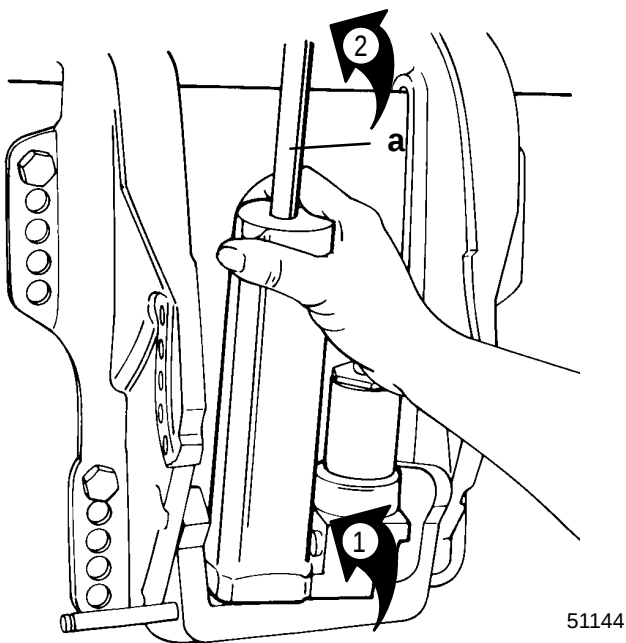
# Manual Tilt System Installation

1. Apply 2-4-C Marine Lubricant to lower pivot pin hole and pivot pin surface.
2. Start lower pivot pin into pivot pin hole and position lower dowel pin (retained) in its hole.



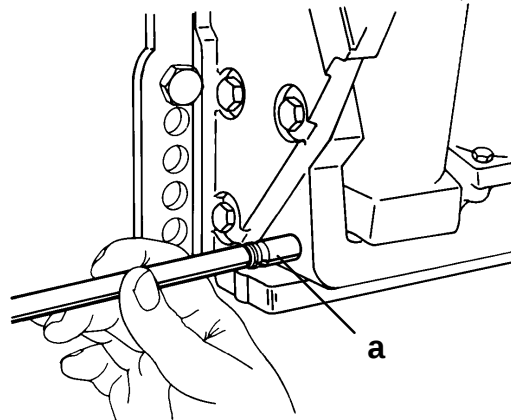
a - Lower Pivot Pin  
b - Lower Dowel Pin

3. Reinstall manual tilt system, bottom first. Reconnect release valve link rod.



a - Manual Tilt System

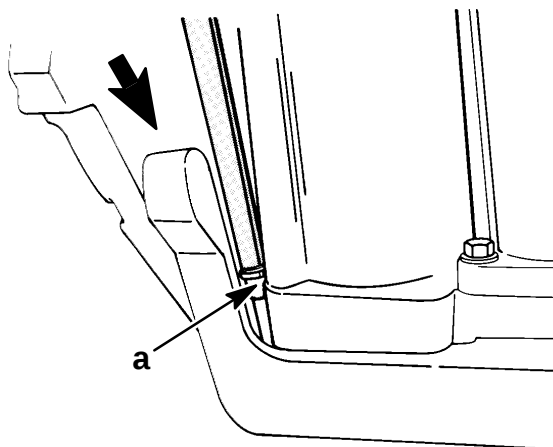
4. Using a suitable punch, drive lower pivot pin into clamp bracket and trim cylinder assembly until pivot pin is flush with outside surface.



51147

a - Lower Pivot Pin

5. Using a punch, drive lower dowel pin in until seated.

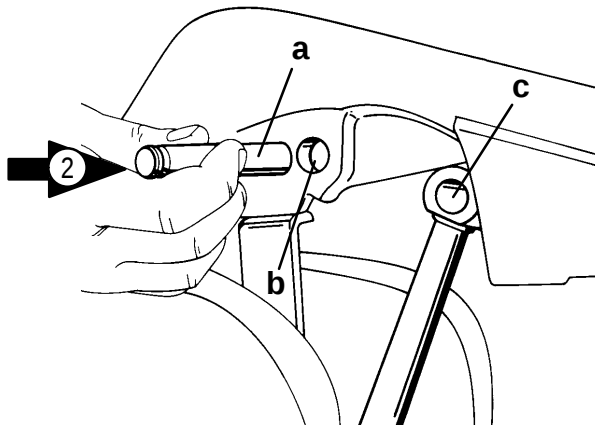


51148

a - Lower Dowel Pin



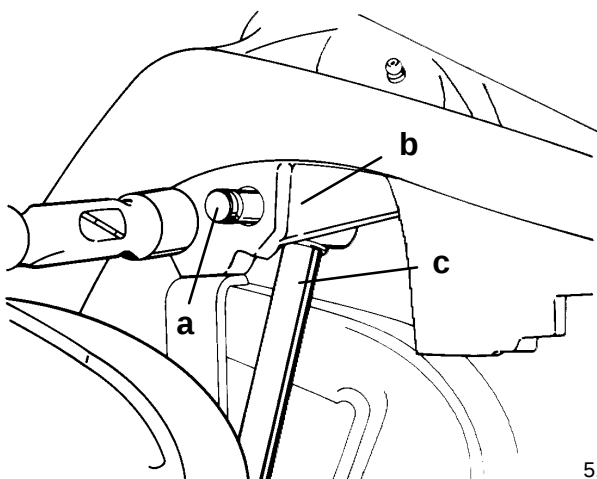
6. Apply 2-4-C Marine Lubricant (92-90018A12) to surface of upper pivot pin, pivot pin hole and shock rod hole.



51146

- a - Pivot Pin  
b - Pivot Pin Bore  
c - Shock Rod Bore

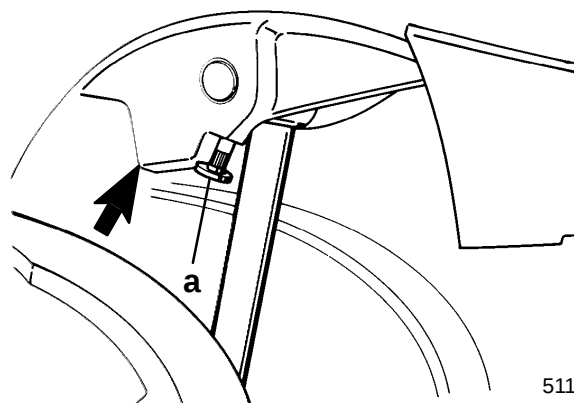
7. Using a mallet, drive upper pivot pin into swivel bracket and through shock rod until pivot pin is flush with swivel bracket.



51148

- a - Pivot Pin  
b - Swivel Bracket  
c - Shock Rod

8. Drive upper dowel pin (a) into its hole until seated.



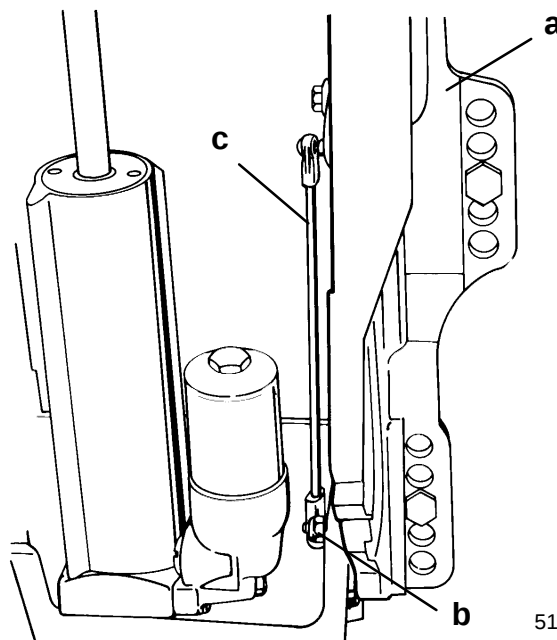
51147

- a - Dowel Pin

9. Check manual release cam adjustment. Cam must open and close freely. Adjust link rod as necessary.

## Manual Release Valve Adjustment

1. With outboard in full up position, place tilt lock lever forward.
2. Lift cam lever (with link rod) to full up position.



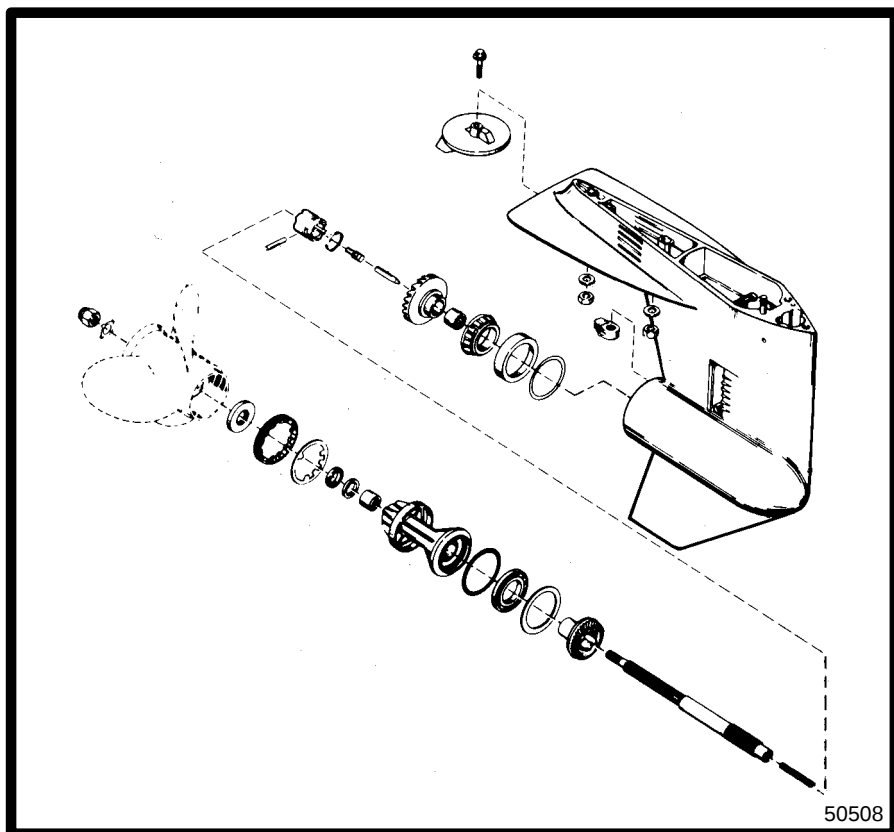
51143

- a - Tilt Lock Lever  
b - Cam Lever  
c - Link Rod

3. Link rod end must snap onto ball of tilt lock lever without moving tilt lock lever or cam lever.



# LOWER UNIT



6

A

## GEAR HOUSING



# Table of Contents

|                                               | Page  |
|-----------------------------------------------|-------|
| Special Tools .....                           | 6A-1  |
| Quicksilver Lubricants and Service Aids ..... | 6A-1  |
| Gear Housing Assembly - Drive Shaft           |       |
| Components .....                              | 6A-2  |
| Torque Specifications .....                   | 6A-2  |
| Lubrication/Sealant Application Points .....  | 6A-2  |
| Gear Housing Assembly - Propeller Shaft       |       |
| Components .....                              | 6A-3  |
| Torque Specifications .....                   | 6A-3  |
| Lubrication/Sealant Application Points .....  | 6A-3  |
| Draining and Inspecting Gear Housing          |       |
| Lubricant .....                               | 6A-4  |
| Trim Tab/Propeller Removal .....              | 6A-4  |
| Gear Housing Removal .....                    | 6A-5  |
| Gear Housing Disassembly .....                | 6A-5  |
| Water Pump Removal .....                      | 6A-6  |
| Bearing Carrier and Propeller Shaft           |       |
| Removal .....                                 | 6A-8  |
| Drive Shaft and Pinion Gear                   |       |
| Removal .....                                 | 6A-10 |
| Lubrication Sleeve Removal .....              | 6A-11 |
| Forward Gear and Bearing Removal .....        | 6A-12 |
| Shift Shaft Removal .....                     | 6A-12 |
| Drive Shaft Needle Bearing                    |       |
| Removal .....                                 | 6A-13 |
| Cleaning and Inspection .....                 | 6A-13 |
| Gear Housing/Bearing Carrier                  |       |
| Castings .....                                | 6A-13 |
| Bearings .....                                | 6A-13 |
| Ball/Roller Bearings .....                    | 6A-13 |
| Needle Bearing .....                          | 6A-14 |
| Propeller Shaft .....                         | 6A-14 |
| Forward, Reverse and Pinion Gears .....       | 6A-14 |
| Sliding Clutch .....                          | 6A-15 |
| Cam Follower .....                            | 6A-15 |
| Water Pump Components .....                   | 6A-15 |
| Drive Shaft .....                             | 6A-15 |
| Shift Shaft .....                             | 6A-16 |

|                                           | Page  |
|-------------------------------------------|-------|
| Gear Housing Reassembly .....             | 6A-16 |
| Drive Shaft Needle Bearing                |       |
| Installation .....                        | 6A-16 |
| Shift Shaft Bushing Reassembly and        |       |
| Installation .....                        | 6A-16 |
| Lubrication Sleeve Installation .....     | 6A-17 |
| Forward Gear and Bearing                  |       |
| Reassembly .....                          | 6A-17 |
| Bearing Carrier Reassembly .....          | 6A-18 |
| Forward Gear Race Installation .....      | 6A-19 |
| Drive Shaft Reassembly and                |       |
| Installation .....                        | 6A-19 |
| Checking Pinion Gear Depth .....          | 6A-20 |
| Propeller Shaft Reassembly and            |       |
| Installation .....                        | 6A-20 |
| Bearing Carrier Installation .....        | 6A-21 |
| Checking Forward Gear Backlash .....      | 6A-23 |
| Water Pump Reassembly and                 |       |
| Installation .....                        | 6A-23 |
| Gear Housing Installation .....           | 6A-25 |
| Filling Gear Housing with Lubricant ..... | 6A-27 |
| Propeller/Trim Tab Installation .....     | 6A-27 |



## Special Tools

| Description              | Part No.   |
|--------------------------|------------|
| Cover Nut Tool           | 91-91947   |
| Slide Hammer             | 91-34568A1 |
| Puller Jaws              | 91-46086A1 |
| Puller                   | 91-27780   |
| Universal Puller Plate   | 91-37241   |
| Mandrel                  | 91-24273   |
| Shift Shaft Bushing Tool | 91-23033   |
| Shimming Tool            | 91-89670   |
| Dial Indicator Gauge     | 91-58222A1 |
| Dial Indicator Adaptor   | 91-83155   |
| Backlash Indicator Rod   | 91-78473   |
| Puller Bolt              | 91-85716   |
| Mandrel*                 | 91-37312   |
| Mandrel*                 | 91-37311   |
| Mandrel*                 | 91-38628   |
| Mandrel*                 | 91-36569   |
| Driver Rod*              | 91-37323   |
| Mandrel                  | 91-31361   |
| Mandrel                  | 91-86290   |

\*From Bearing Puller & Installation Kit  
(P/N 91-31229A5)

## Quicksilver Lubricants and Service Aids

| Description                       | Part No.    |
|-----------------------------------|-------------|
| Special Lubricant 101             | 92-13872A1  |
| Loctite Grade "A" (271)           | 92-32609-1  |
| Needle Bearing Assembly Lubricant | 92-42649A-1 |
| Gear Lube                         | *           |
| 2-4-C Marine Lubricant            | *           |

\* See Quicksilver Accessories Guide for part numbers.

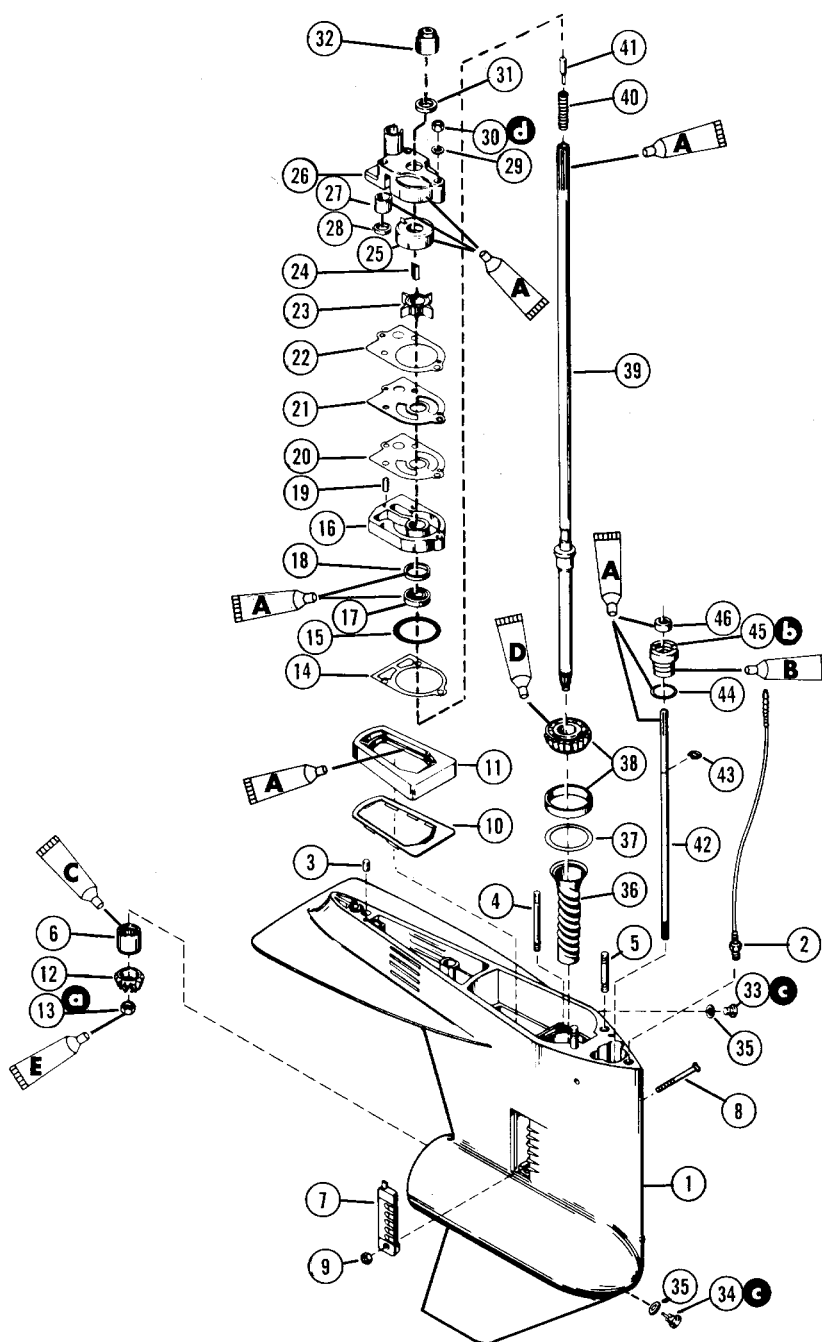


# Gear Housing Assembly - Drive Shaft Components

- 1 - Gear Housing
- 2 - Speedometer Hose
- 3 - Dowel Pin (2)
- 4 - Stud (3)
- 5 - Stud (2)
- 6 - Needle Bearing
- 7 - Water Inlet
- 8 - Screw
- 9 - Locknut
- 10- Plate, Nylon
- 11- Seal
- 12- Pinion Gear
- 13- Pinion Nut
- 14- Gasket
- 15- O-ring
- 16- Water Pump Base
- 17- Oil Seal
- 18- Oil Seal
- 19- Dowel Pin (2)
- 20- Gasket
- 21- Face Plate
- 22- Gasket
- 23- Impeller
- 24- Drive Key
- 25- Insert
- 26- Water Pump Body
- 27- Seal
- 28- Washer, Nylon
- 29- Washer
- 30- Nut
- 31- Centrifugal Slinger, Rubber
- 32- Seal, Rubber
- 33- Vent Screw
- 34- Fill Screw
- 35- Gasket (2)
- 36- Lubrication Sleeve
- 37- Shim(s)
- 38- Tapered Bearing
- 39- Drive Shaft
- 40- Spring
- 41- Pin
- 42- Shift Shaft
- 43- "E" Clip
- 44- O-ring
- 45- Bushing
- 46- Oil Seal

## Lubrication/Sealant Application Points

- A** 2-4-C Marine Lubricant (P/N 92-90018A12)
- B** Special Lubricant 101 (P/N 92-13872A1)
- C** Needle Bearing Assembly Lubricant (P/N 92-42649A-1)
- D** Quicksilver Gear Lubricant (P/N 92-13783A24)
- E** Loctite Grade A "271" (P/N 92-32609-1)



## Torque Specifications

- a** 50 lb. ft. (67.8 N·m)
- b** 17 lb. ft. (23 N·m)
- c** 60 lb. in. (6.8 N·m)
- d** 30 lb. in. (3.4 N·m)

50506



# Gear Housing Assembly - Propeller Shaft Components

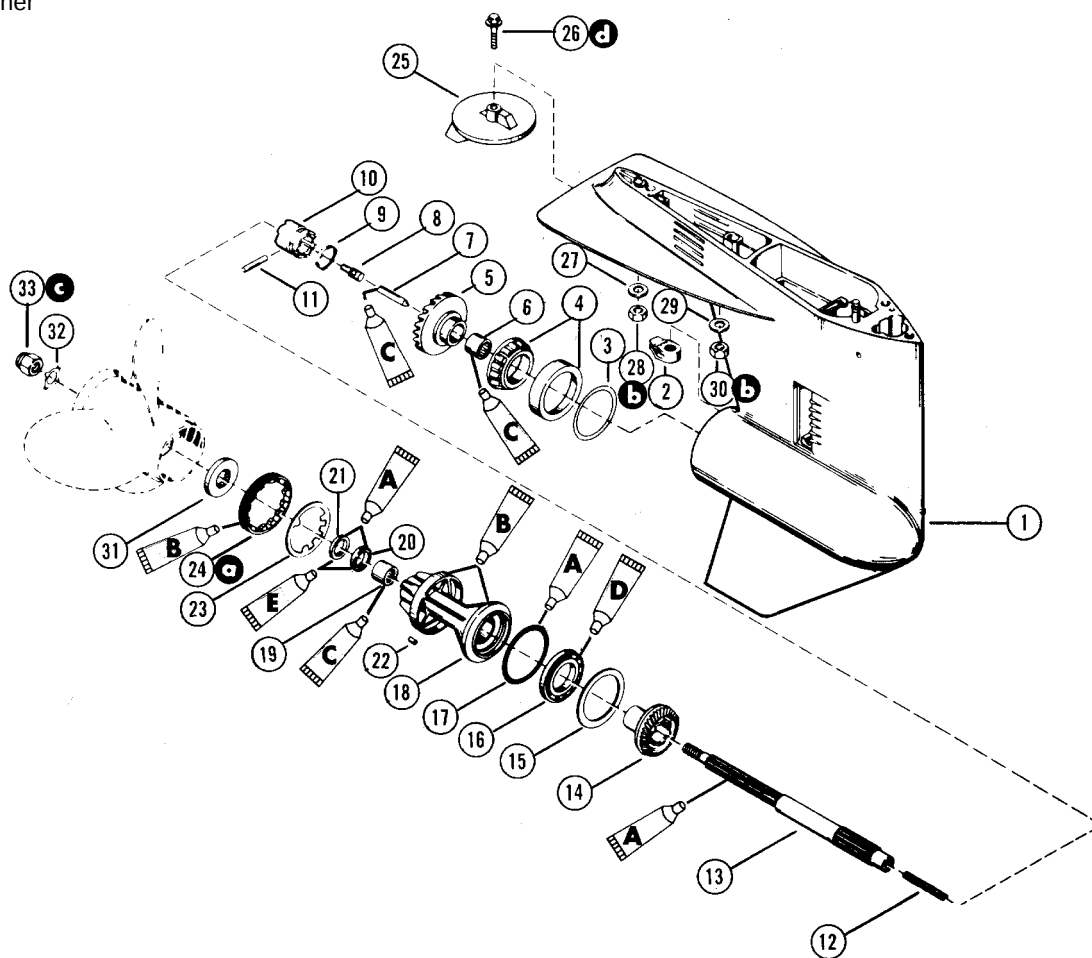
- 1 - Gear Housing
- 2 - Shift Cam (Number Side Toward Top of Gear Case)
- 3 - Shim(s)
- 4 - Bearing and Race
- 5 - Forward Gear
- 6 - Needle Bearing
- 7 - Cam Follower
- 8 - Guide Block
- 9 - Spring
- 10- Sliding Clutch
- 11- Cross Pin
- 12- Spring
- 13- Propeller Shaft
- 14- Reverse Gear
- 15- Thrust Washer
- 16- Ball Bearing
- 17- O-ring
- 18- Bearing Carrier
- 19- Needle Bearing
- 20- Oil Seal
- 21- Oil Seal
- 22- Alignment Key
- 23- Tab Washer
- 24- Cover Nut
- 25- Trim Tab
- 26- Bolt
- 27- Washer
- 28- Locknut
- 29- Washer
- 30- Locknut
- 31- Thrust Hub
- 32- Locking Washer

## Torque Specifications

- a** 100 lb. ft. (135.6 N·m)
- b** 60 lb. ft. (81.4 N·m)
- c** 55 lb. ft. (74.6 N·m)
- d** 20 lb. ft. (27.1 N·m)

## Lubrication/Sealant Application Points

- A** 2-4-C Marine Lubricant (P/N 92-90018A12)
- B** Special Lubricant 101 (P/N 92-13872A1)
- C** Needle Bearing Assembly Lubricant (P/N 92-42649A-1)
- D** Quicksilver Gear Lubricant (P/N 92-13783A24)
- E** Loctite Grade A "271" (P/N 92-32609-1)



50508

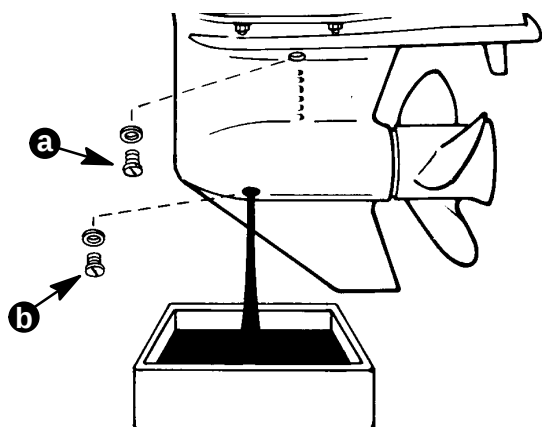


## Draining and Inspecting Gear Housing Lubricant

### ⚠ WARNING

If gear housing is installed on outboard, disconnect (and isolate) spark plug leads to avoid accidental starting when working near propeller.

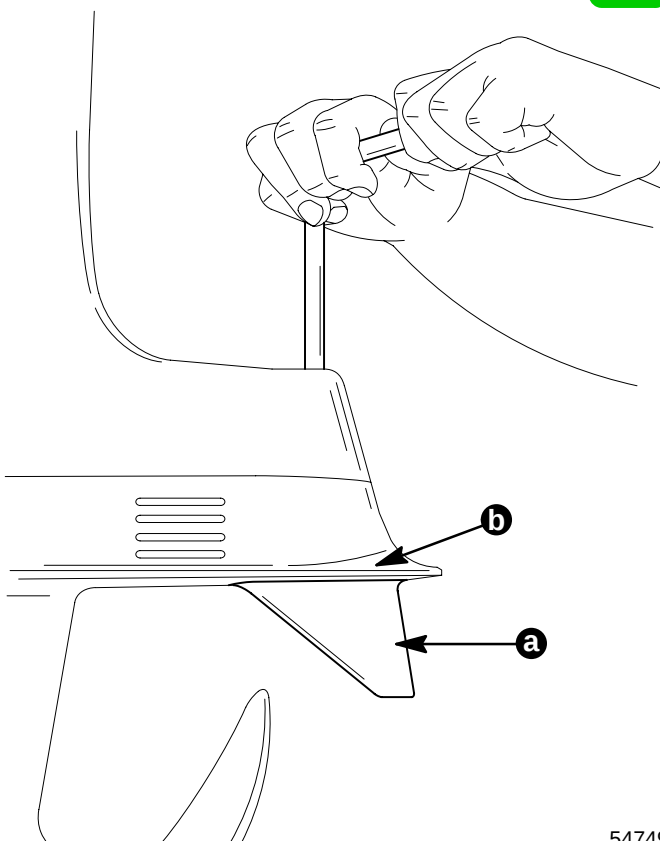
1. With gear housing in normal running position, place a clean pan under housing and remove vent screw and gasket (a) and fill/drain screw and gasket (b).



26473

## Trim Tab/Propeller Removal

1. Place reference mark on trim tab (a) and anti-ventilation plate (b) to allow trim tab to be reinstalled at the same angle.
2. Remove nylon plug from drive shaft housing and remove bolt securing trim tab to gear housing.

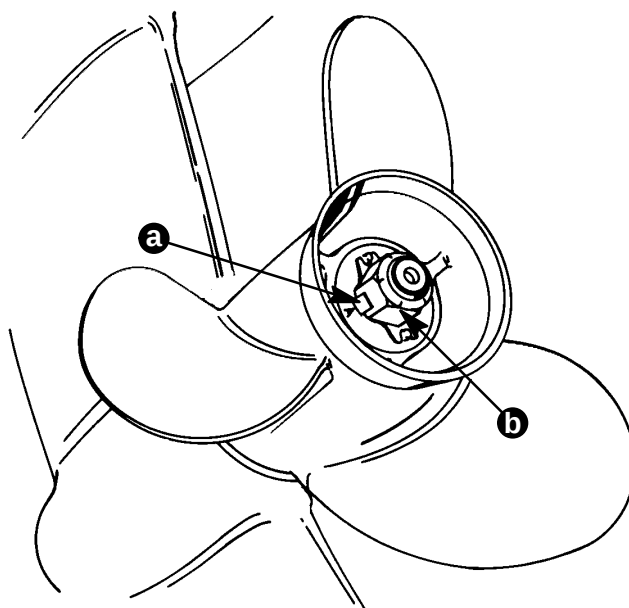


54749

### ⚠ WARNING

If gear housing is not removed before attempting to remove or install the propeller, remove (and isolate) spark plug leads from spark plugs to prevent outboard from starting accidentally.

3. Bend tabs (a) away from propeller nut (b).

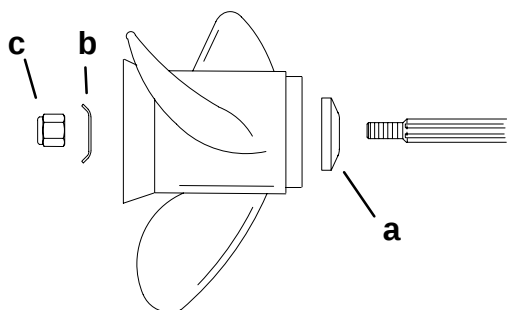


51119



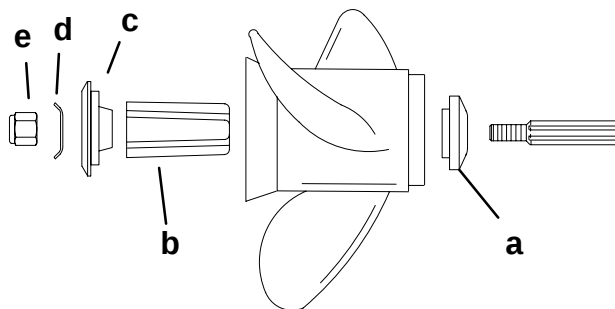
4. Place a block of wood between gear case and propeller to hold propeller and remove propeller nut.
5. Remove propeller and components from shaft.

### Flo-Torq I Drive Hub Propellers



- a - Forward Thrust Hub
- b - Propeller Nut Retainer
- c - Propeller Nut

### Flo-Torq II Drive Hub Propellers



- a - Forward Thrust Hub
- b - Replaceable Drive Sleeve
- c - Rear Thrust Hub
- d - Propeller Nut Retainer
- e - Propeller Nut

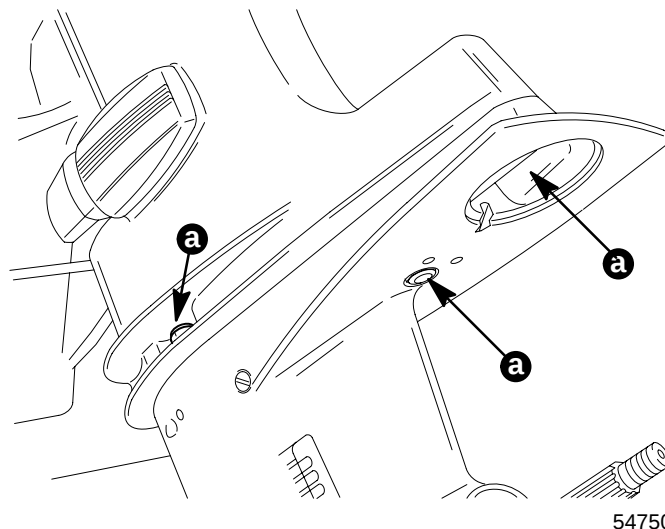
## Gear Housing Removal

### **⚠ WARNING**

To prevent outboard from accidentally starting, remove (and isolate) spark plug leads from spark plugs prior to removing gear housing.

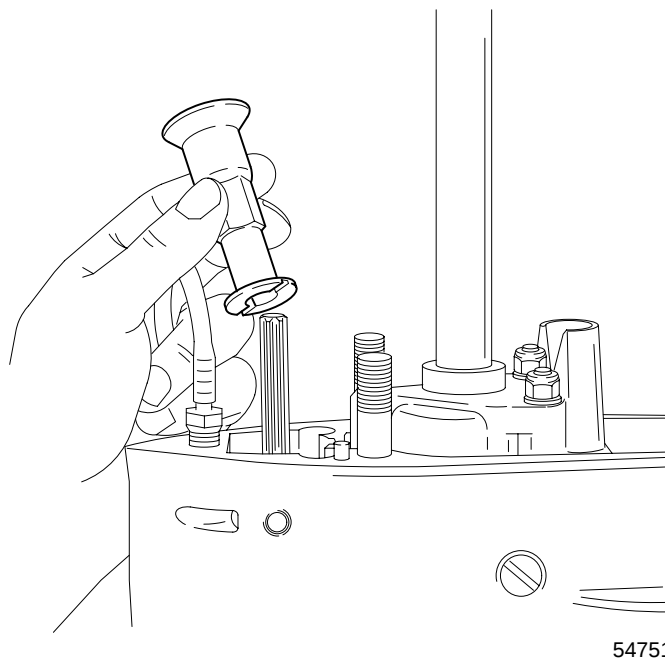
1. Remove and isolate spark plug leads.
2. Shift outboard into forward gear.
3. Tilt outboard to full "UP" position.

4. Remove four lock nuts (a) securing gear housing to drive shaft housing (one not shown).
5. Remove gear housing.



## Gear Housing Disassembly

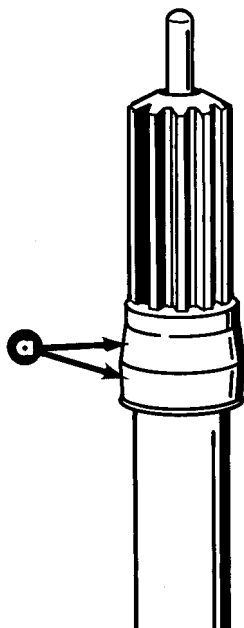
1. Place gear housing in soft jawed vise.
2. Remove shift shaft guide from shift shaft.





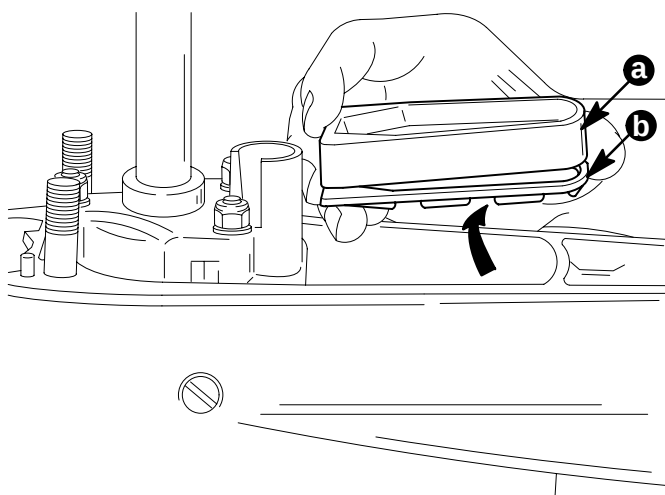
3. Remove seal (a) from drive shaft.

**NOTE:** Outboard S/N 0C245675 and above will not have seal on drive shaft due to improved lower end cap design.



51188

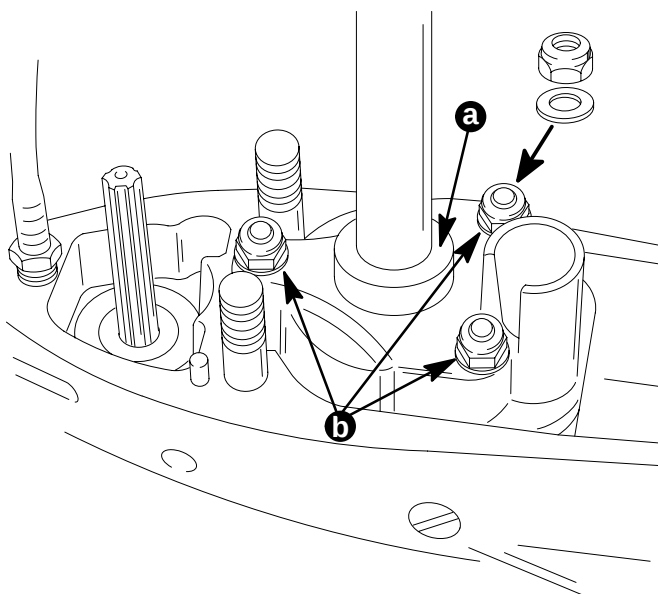
4. Remove seal (a) and plate (b) from gear housing.



54752

## Water Pump Removal

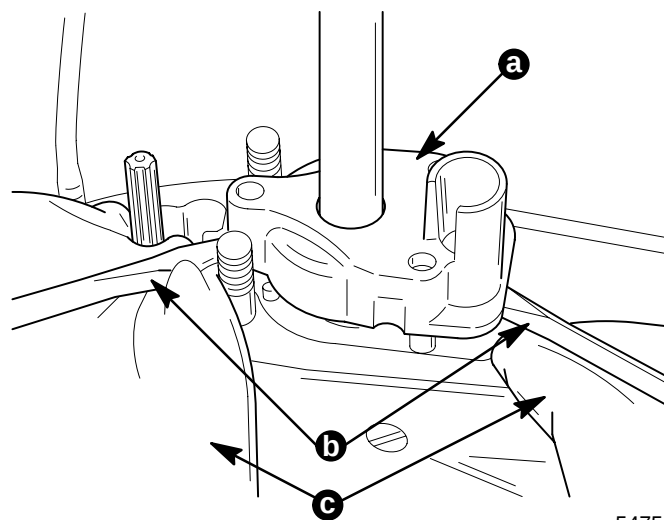
1. Remove centrifugal slinger (a) and three lock nuts and washers (b).



54753

2. Remove water pump body.

3. Inspect body for cracks, distortion or melting. Replace if necessary.

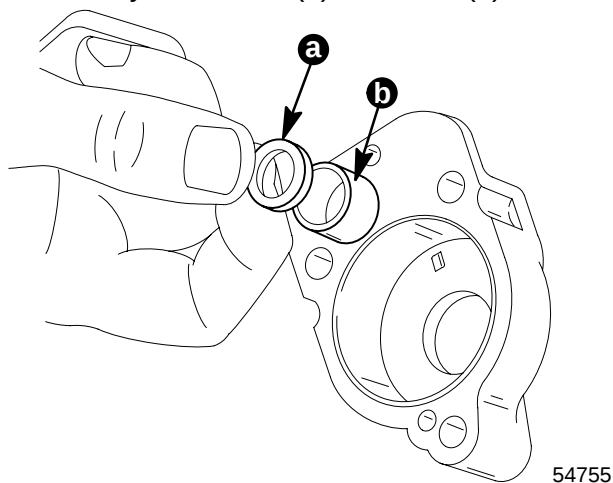


54754

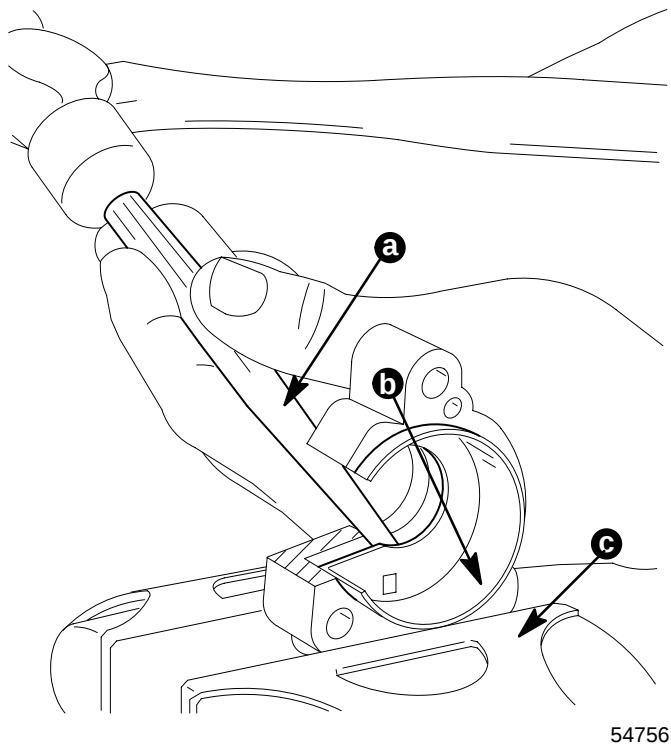
- a - Water Pump Body
- b - Screwdrivers
- c - Shop Cloths



4. Remove nylon washer (a), and seal (b).



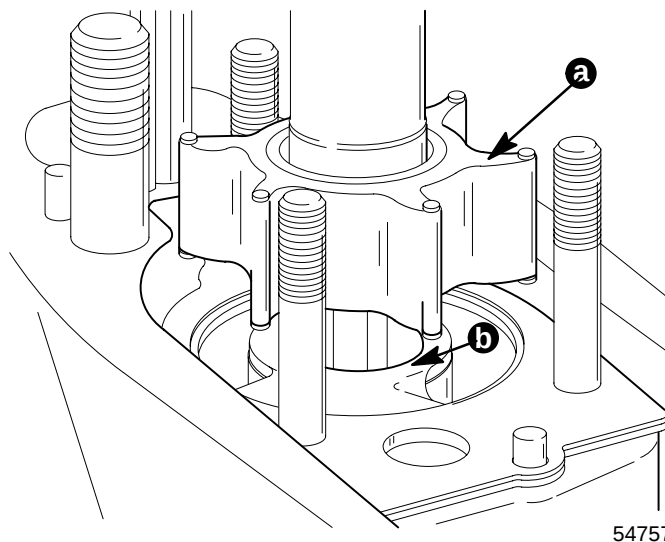
5. Inspect water pump for grooves; if grooved, replace insert.



a - Punch  
b - Insert  
c - Vise

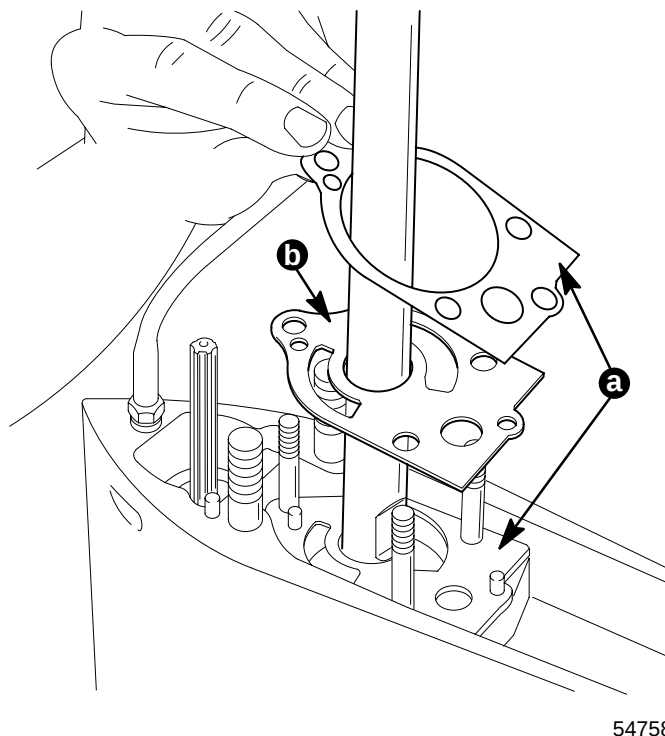
**IMPORTANT:** When performing gear housing repairs that require water pump impeller removal, it is recommended that the impeller be replaced. If impeller must be reused DO NOT install in reverse to original rotation or premature impeller failure will occur. Original rotation is clockwise.

6. Remove impeller (a) and drive key (b) from drive shaft. If necessary use a punch and hammer to drive impeller upward off drive shaft. In extreme instances, the impeller center hub must be split with chisel. Take care not to damage drive shaft.



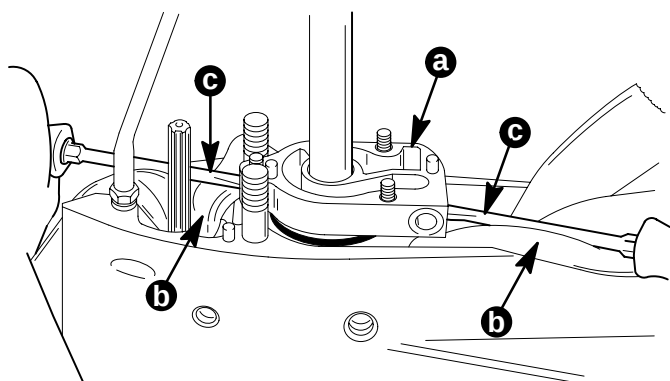
7. Remove gaskets (a) and face plate (b).

8. Inspect face plate for grooves. If grooved, replace face plate.





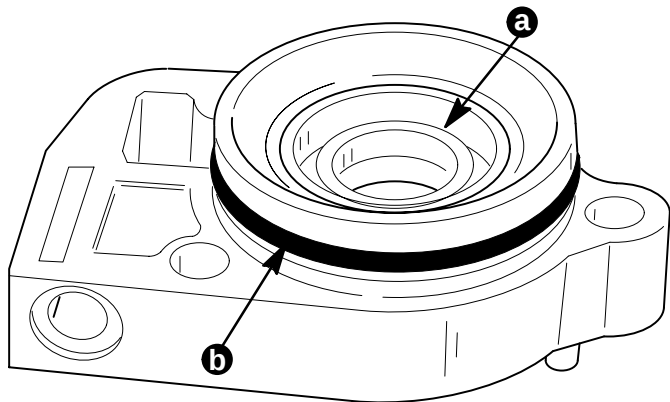
9. Remove water pump base and gasket.
10. Inspect base and replace if cracked, distorted, or melted.



54759

- a - Water Pump Base  
b - Shop Cloths  
c - Screwdrivers

11. Remove (and discard) seals (a) and O-ring (b).

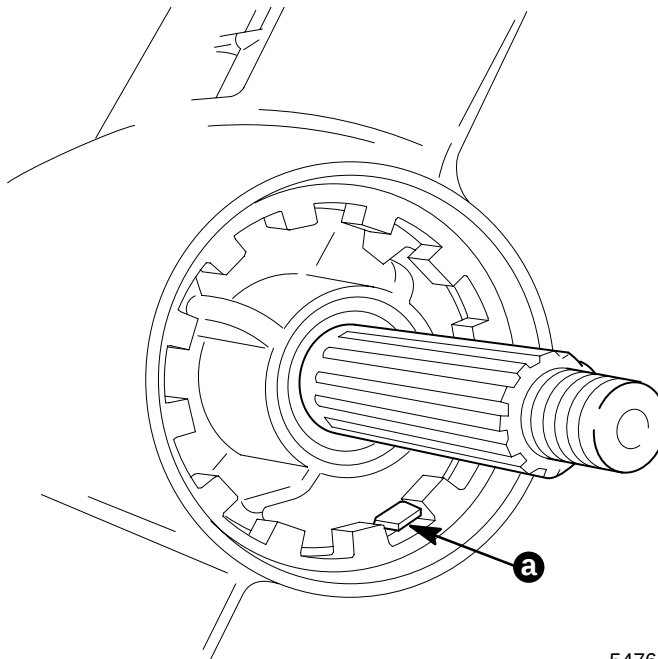


54760

## Bearing Carrier and Propeller Shaft Removal

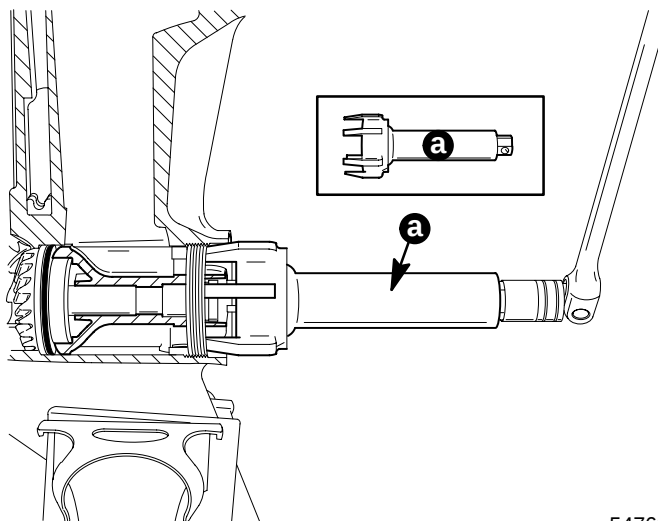
**IMPORTANT:** For proper retention between housing and cover nut, it is recommended that **PLASTIC** cover nut **NOT** be reused. Replace as required.

1. Bend lock tab (a) away from cover nut slot.



54761

2. Remove cover nut using cover nut tool.

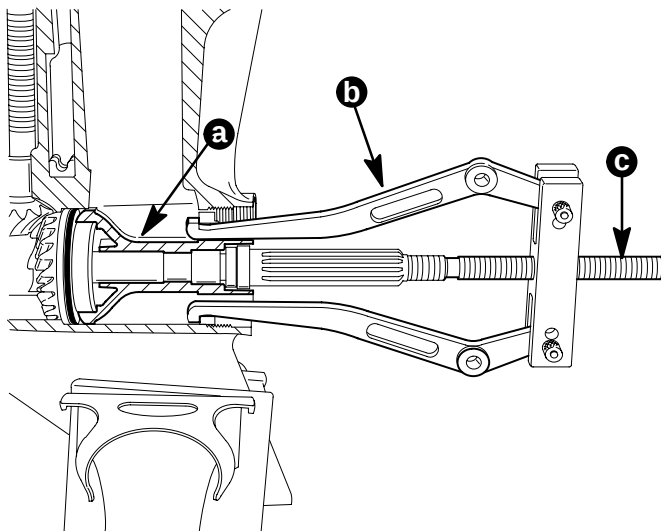


54762

- a - Cover Nut Tool (91-91947)



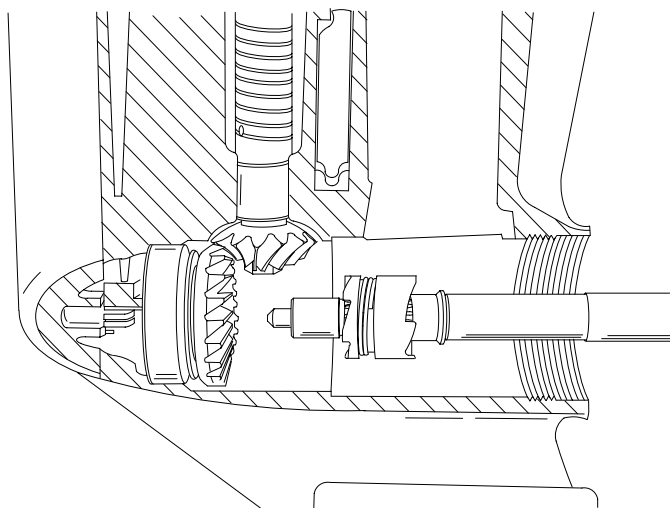
3. Remove bearing carrier from gear housing using puller jaws and bolt.



54763

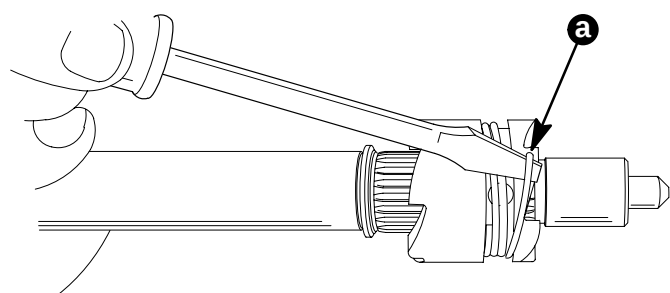
- a - Bearing Carrier  
b - Puller Jaws (19-46086A1)  
c - Puller Bolt (91-85716)

4. Remove propeller shaft from gear housing.



54764

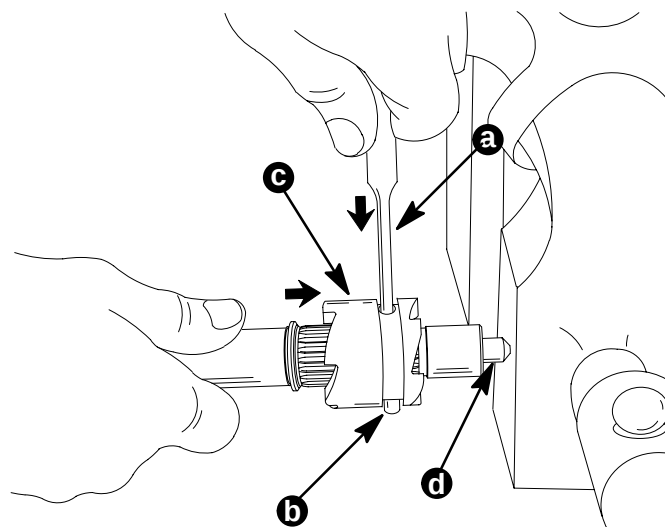
5. Remove spring (a) from sliding clutch.



54765

6. Remove cross pin.

7. Remove remaining components from propeller shaft.

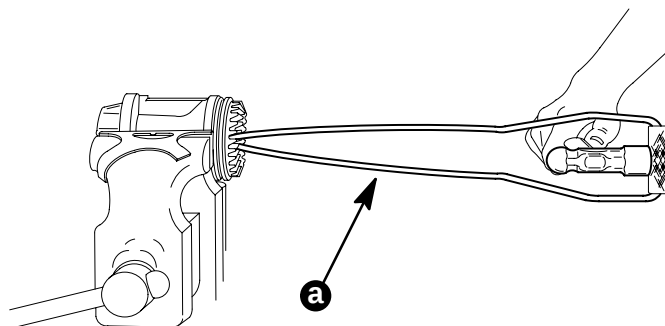


54766

- a - Punch  
b - Cross Pin  
c - Sliding Clutch  
d - Cam Follower

8. Inspect cam follower for pitting, scoring or rough surface. replace cam follower AND shift cam if damage to cam follower has occurred.

9. Remove reverse gear using puller.

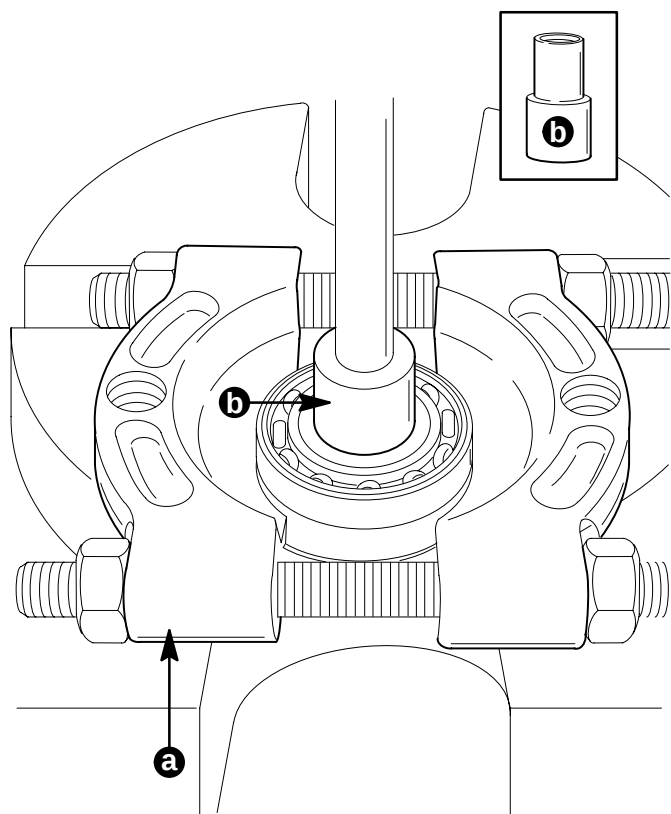


54767

- a - Puller (91-27780)



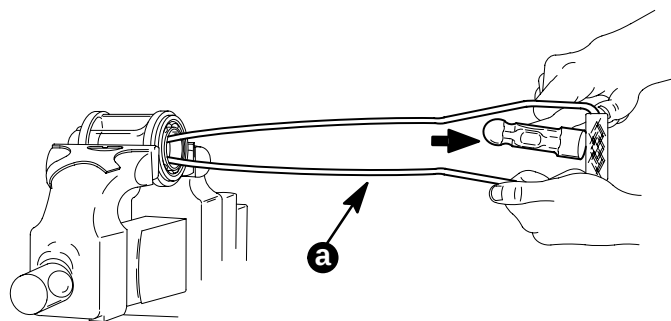
10. Inspect reverse gear ball bearing. If bearing is rusted or does not roll freely, replace bearing.



54768

a - Universal Puller Plate (91-37241)  
b - Mandrel (91-37312)

#### Bearing on Reverse Gear

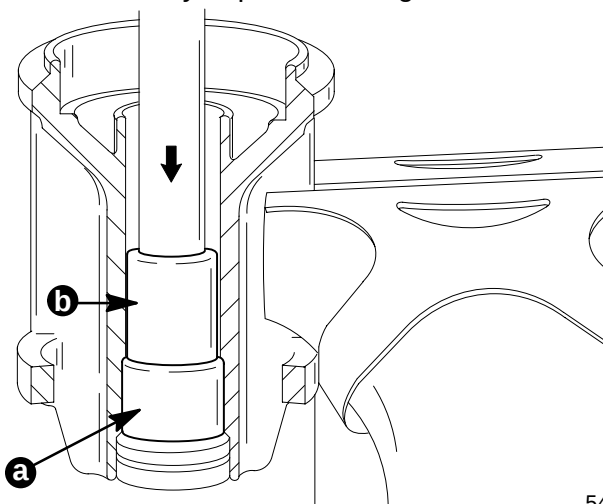


54769

a - Puller (91-27780)

#### Bearing in Bearing Carrier

11. Inspect bearing (a). If bearing is rusted or does not roll freely, replace bearing.

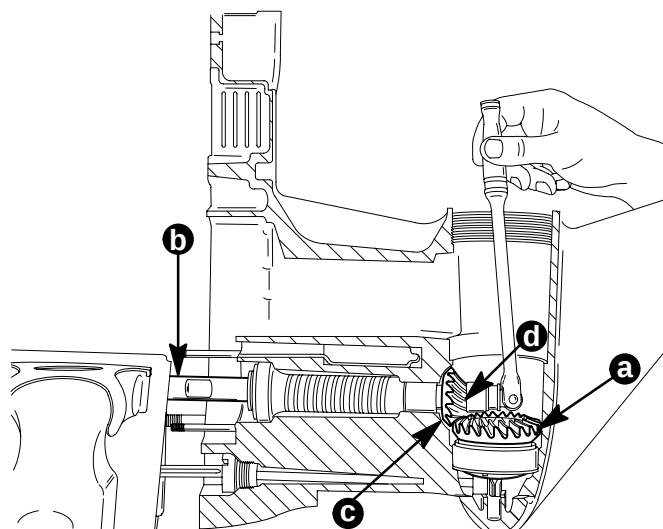


54770

a - Bearing  
b - Mandrel (91-24273)

### Drive Shaft and Pinion Gear Removal

1. Place gear housing assembly in to padded vise as shown.
2. Remove pinion nut.
3. Remove drive shaft from gear housing.



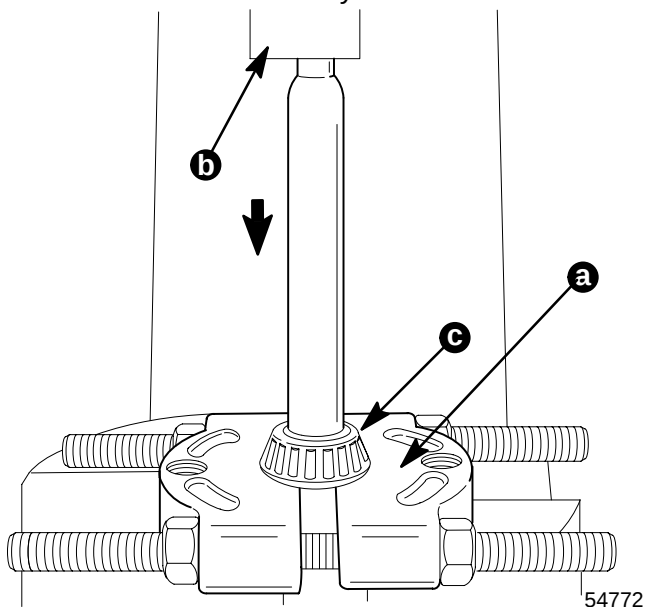
54771

a - Forward Gear  
b - Drive Shaft  
c - Pinion Gear  
d - Pinion Nut (Hidden; Flat Side Away from Pinion Gear)

4. Remove pinion gear and forward gear assembly from housing.

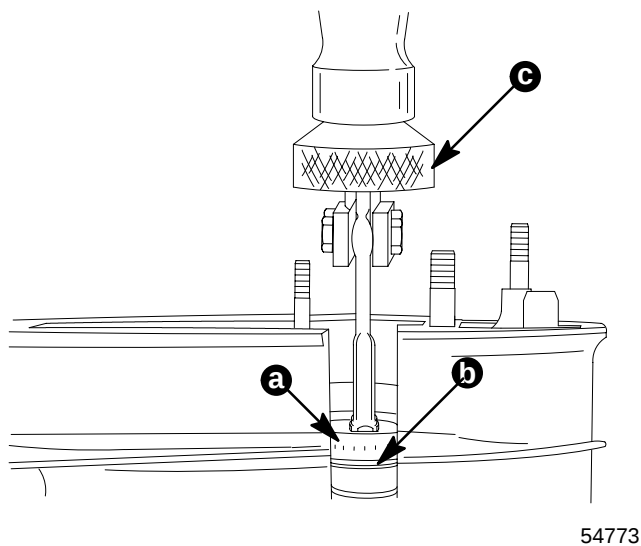


5. If tapered drive shaft bearing is rusted or does not roll freely, or if race is damaged, replace bearing and race as an assembly.



- a - Universal Puller Plate (91-37241)  
b - Press  
c - Tapered Bearing

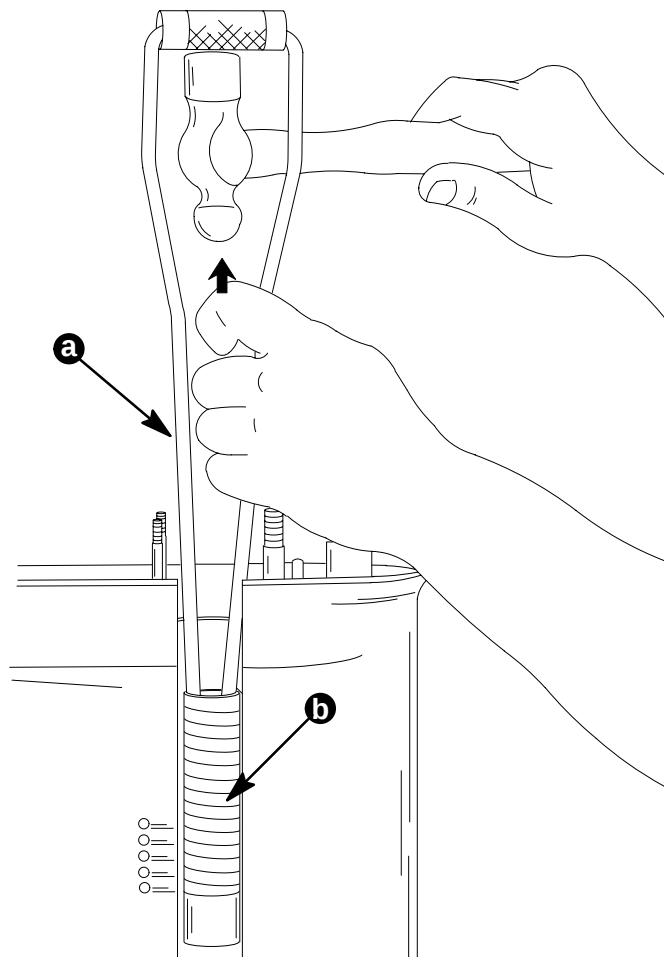
6. Remove bearing race using slide hammer.



- a - Race  
b - Shim(s)  
c - Slide Hammer (91-34569A1)

## Lubrication Sleeve Removal

1. Remove lubrication sleeve using puller.

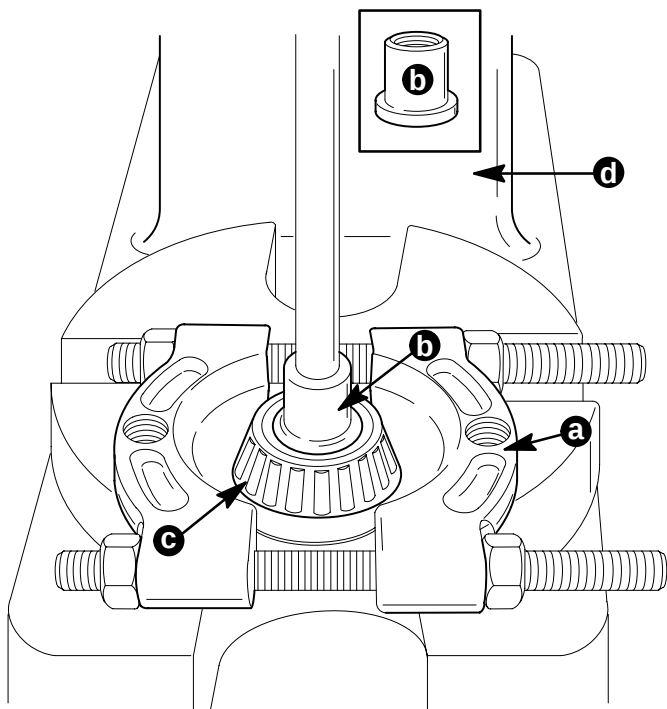


- a - Puller (91-27780)  
b - Lubrication Sleeve



## Forward Gear and Bearing Removal

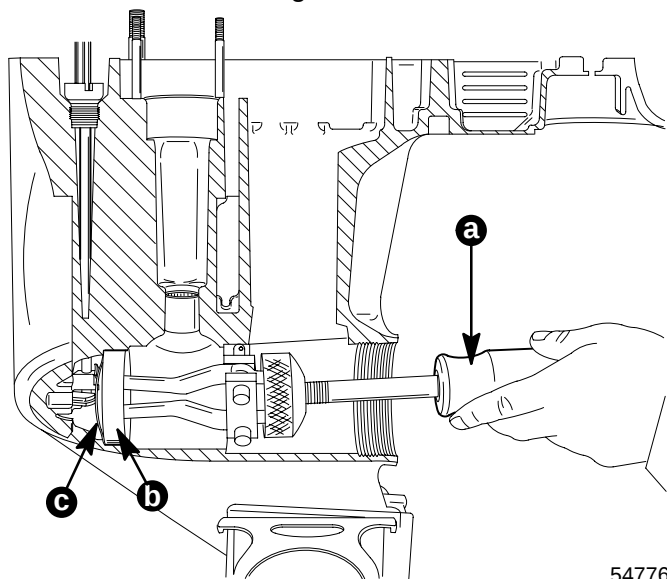
1. If tapered forward gear bearing is rusted or does not roll freely, or if race is damaged, replace bearing and race as an assembly.
2. Remove bearing as shown.



54775

- a - Universal Puller Plate (91-37241)
- b - Mandrel (36569)
- c - Bearing
- d - Press

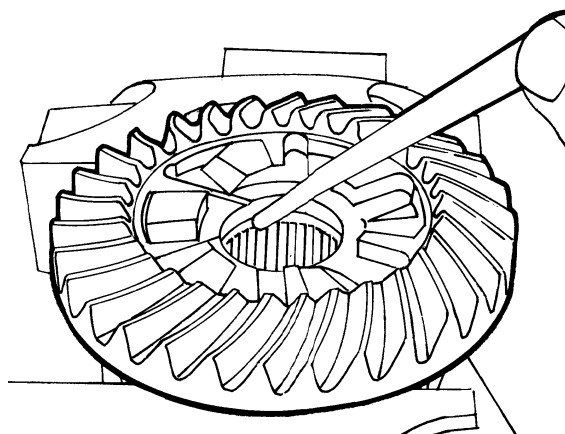
3. Remove race using slide hammer.



54776

- a - Slide Hammer (91-34569)
- b - Bearing Race
- c - Shim(s)

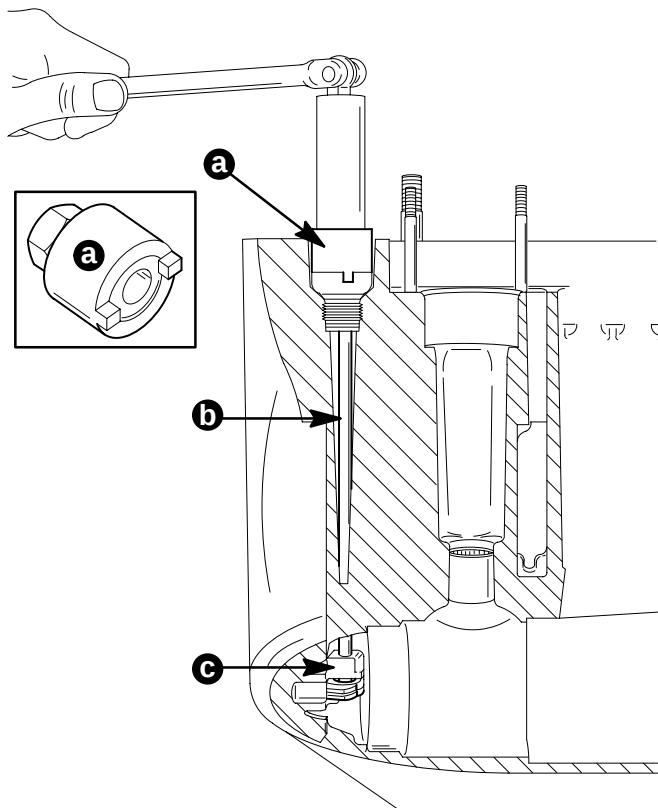
4. Replace bearing (a) if it is rusted or does not roll freely. Use punch and hammer to remove bearing.



19203

## Shift Shaft Removal

1. Remove shift shaft bushing.
2. Remove shift shaft (b) and shift cam (c) from gear housing.

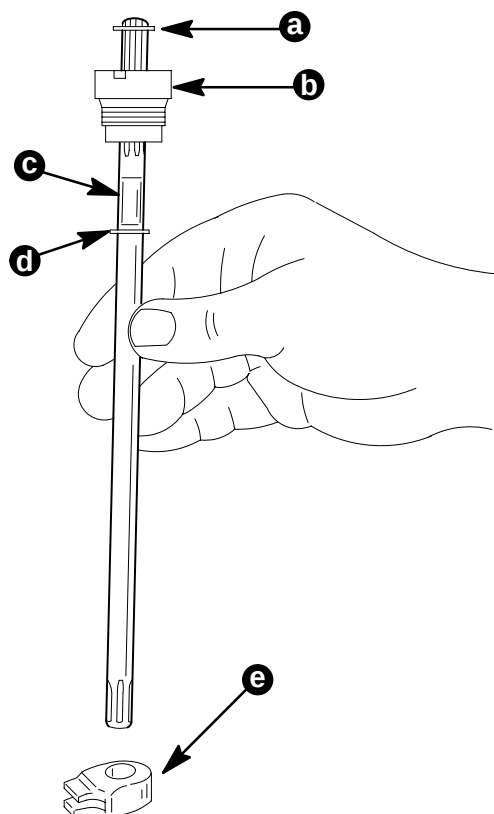


54777

- a - Shift Shaft Bushing Tool (91-23033)
- b - Shift Shaft
- c - Shift Cam

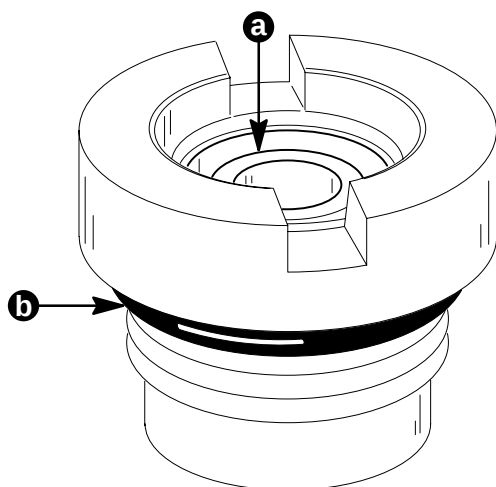


3. Remove components from shift shaft.



- a - Rubber Washer
- b - Bushing
- c - Seal Surface
- d - "E" Clip
- e - Shift Cam

4. Remove (and discard) seal (a) and O-ring (b).

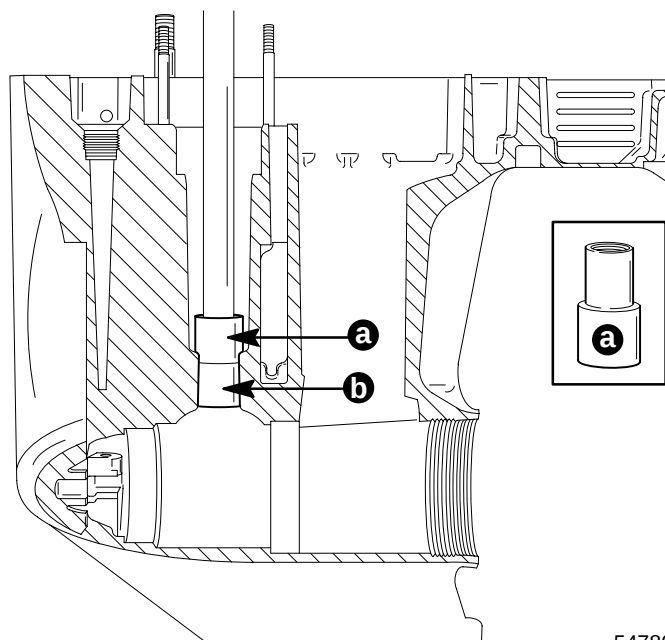


54778

54779

## Drive Shaft Needle Bearing Removal

1. If bearing is rusted or does not roll freely, replace bearing.



54780

- a - Mandrel (91-37312)
- b - Needle Bearing

## Cleaning and Inspection

### Gear Housing/Bearing Carrier Castings

1. Thoroughly clean gear housing/bearing carrier castings. Be sure all old gasket material is removed from mating surfaces and that carbon deposits have been removed from exhaust passages.
2. Inspect castings for cracks or fractures.
3. Check sealing surfaces for nicks, deep grooves and distortion which could cause leaks.
4. Check water passages for obstructions.

## Bearings

### BALL/ROLLER BEARINGS

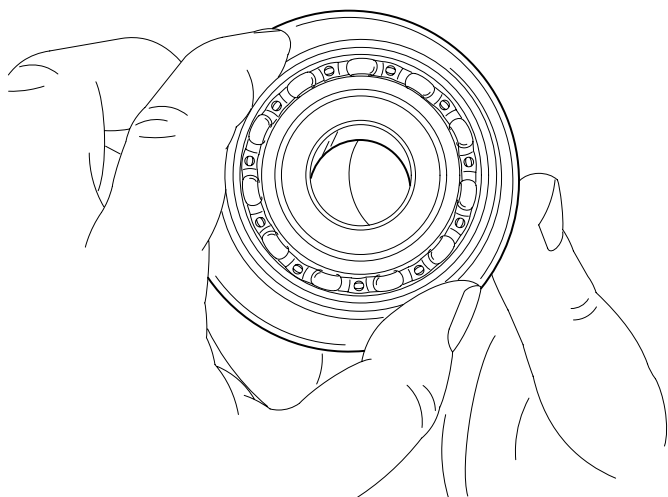
#### ⚠ CAUTION

**DO NOT spin-dry ball/roller bearings with compressed air.**

1. Clean bearing in solvent and dry with compressed air.



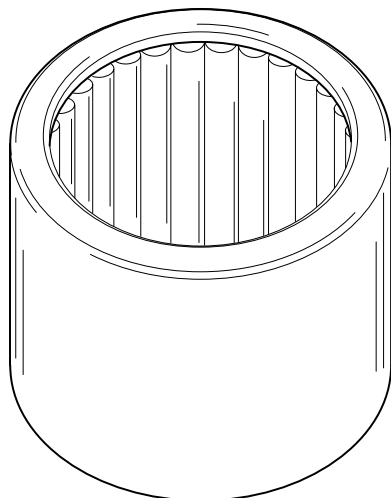
- Bearing should be free of rust stains.
- Attempt to work inner bearing race in-and-out. There should not be excessive play.
- Lubricate bearing with Quicksilver Gear Lube. Rotate inner bearing race. Bearing should have smooth action. If ball bearing sounds or feels rough or has catches, remove and discard bearing. Refer to Disassembly preceding.



54781

## NEEDLE BEARING

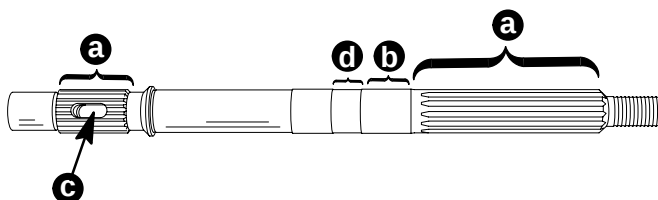
- Clean needle bearings in solvent and dry with compressed air.
- replace bearing if needles are rusted, fractured, worn, galled, discolored, or if area of shaft that bearing contact is worn or pitted.



54782

## Propeller Shaft

- Replace propeller shaft if any of the following conditions exist:
  - Splines are twisted or worn.
  - Oil Seal surfaces are deeply grooved; allowing water to enter gear housing.
  - Sliding clutch slot worn.
  - Bearing surface is pitted, worn, rusted, or contain imbedded metal particles.



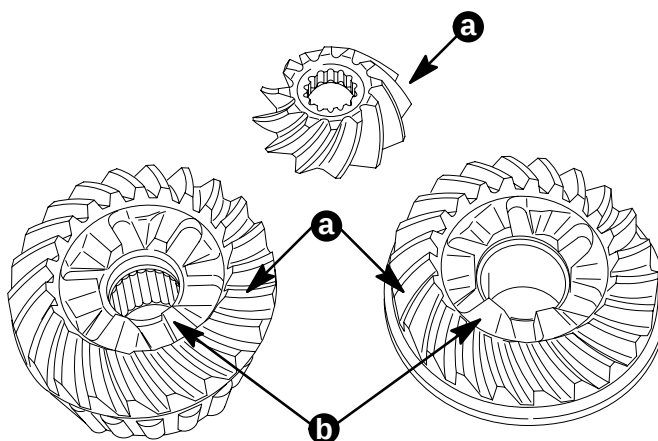
54783

- Check propeller shaft for straightness. Place shaft on either balance wheels or "V" blocks and rotate shaft while observing spline area for bend (wobble).

If movement recorded is more than .006 in. (.152mm), replace bent shaft.

## Forward, Reverse and Pinion Gears

- Replace gear if gear teeth (a) or clutch teeth (b) are chipped or worn.

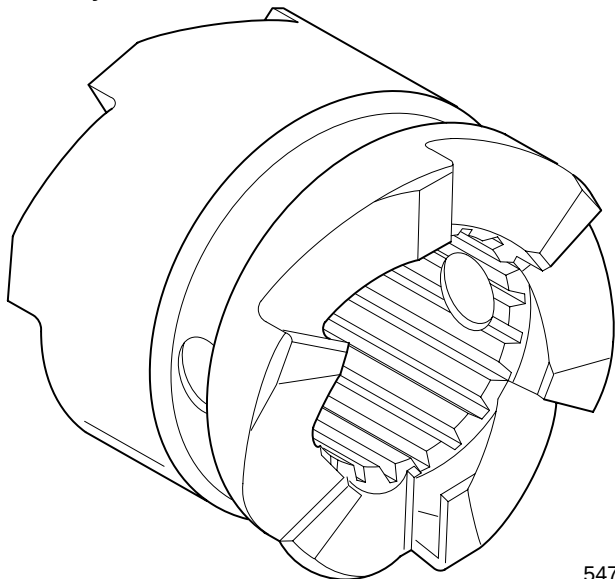


54784



## Sliding Clutch

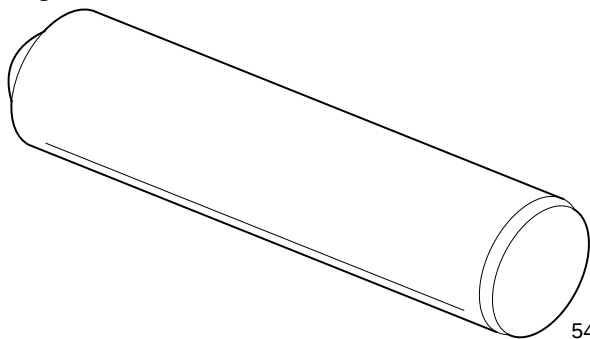
1. Inspect sliding clutch. Check reverse gear slide clutch jaws, if jaws are rounded replace as necessary. Rounded clutch jaws can be caused by the following:
  - Improper shift cable adjustment.
  - Engine idle speed (RPM) too high when shifting.
  - Shifting outboard from neutral to reverse too slowly.



54785

## Cam Follower

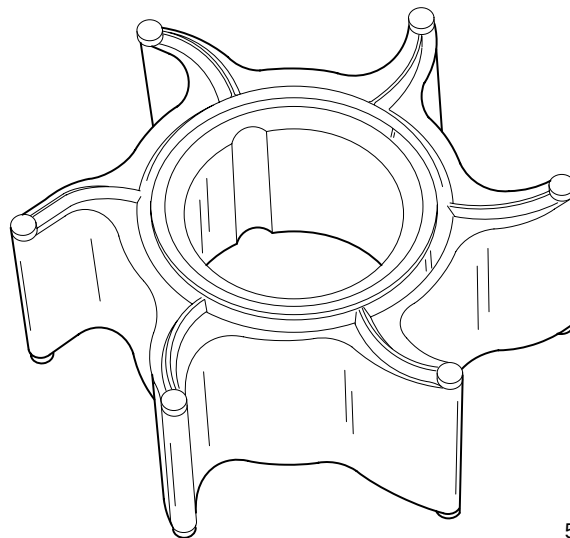
1. Replace cam follower if end of follower shows signs of wear.



54786

## Water Pump Components

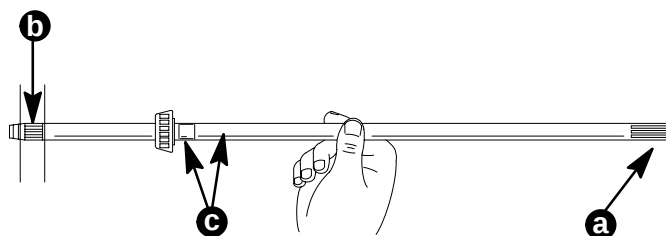
1. Inspect impeller. Replace impeller if any of the following conditions exist:
  - Impeller blade(s) are cracked, torn, or worn.
  - Impeller is glazed or melted (caused by operation without sufficient water supply).
  - Rubber portion of impeller is not bonded to impeller hub.



54787

## Drive Shaft

1. Inspect drive shaft. Replace drive shaft if any of the following exists:
  - Bent drive shaft.
  - Twisted splines
  - Damaged drive shaft oil seal/needle bearing surfaces.



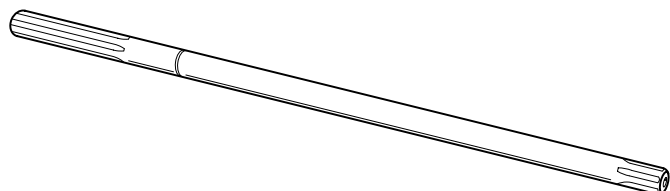
54788

- a - Splines  
b - Needle Bearing Surface  
c - Oil Seal Surface



## Shift Shaft

1. Inspect shift shaft and cam. Replace components if any of the following exists:
  - Corroded or worn shift shaft splines (both ends).
  - Grooves in shift shaft seal surface.
  - Worn shift cam.

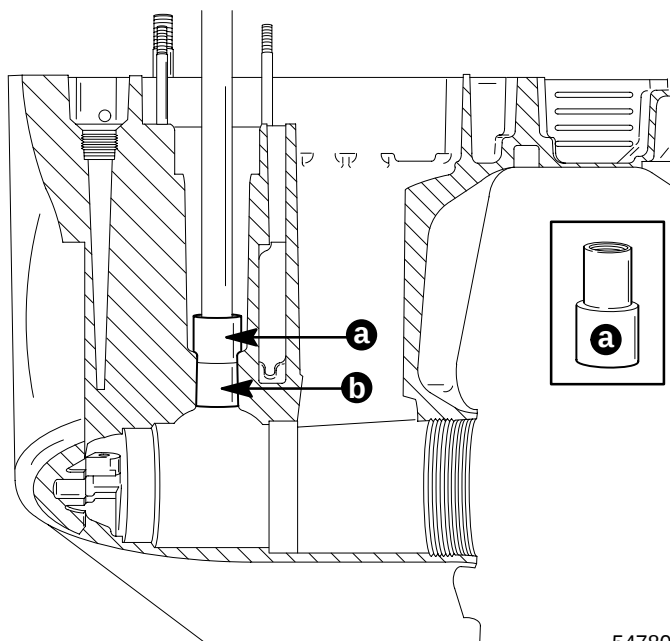


54789

## Gear Housing Reassembly

### Drive Shaft Needle Bearing Installation

1. Drive needle bearing into housing until approximately even with drive shaft cavity.

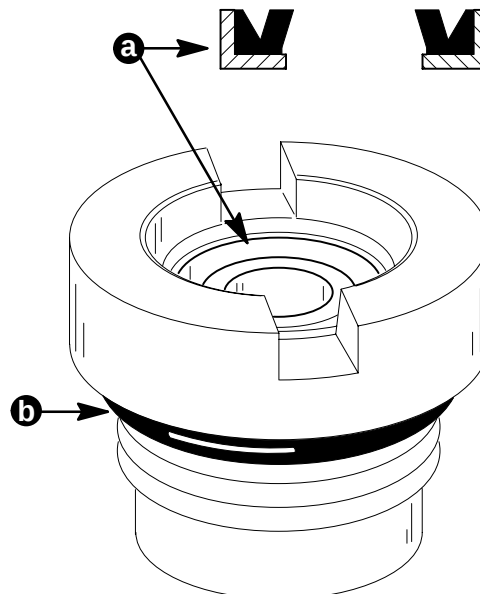


54780

- a - Mandrel (91-37312)  
b - Needle Bearing (Numbered Side Up)

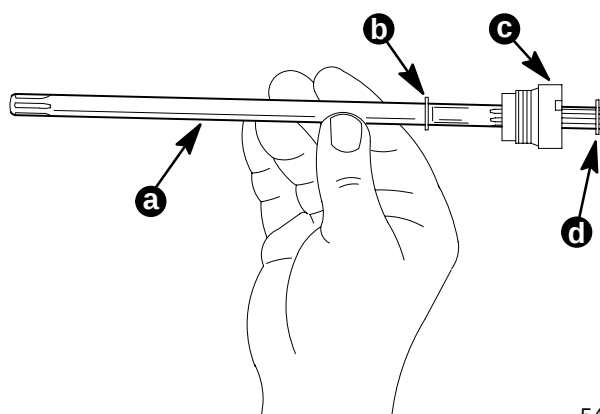
## Shift Shaft Bushing Reassembly and Installation

1. Press new oil seal (a) into bushing with lip of seal away from threaded end of bushing. Install new O-ring (b).
2. Lubricate lip of seal and O-ring with Quicksilver 2-4-C Marine Lubricant.



54779

3. Assemble shift shaft.
4. Apply Quicksilver Special Lubricant 101 to threads of shift shaft bushing.

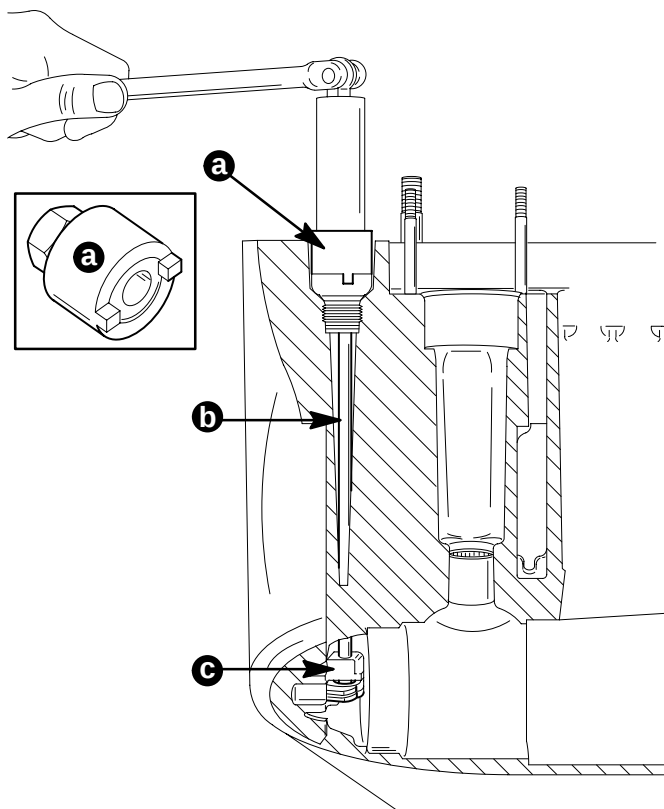


54790

- a - Shift Shaft  
b - "E" Clip  
c - Bushing  
d - Rubber Washer



- Place shift cam (Number Side Up) into gear housing and install shift shaft assembly. Torque bushing to 17 lb. in. (23 N·m).



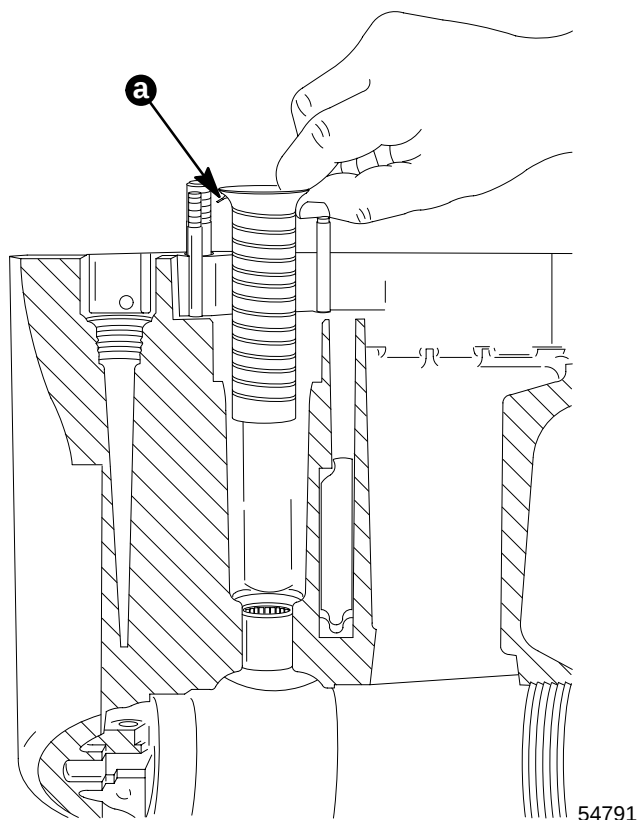
54777

- a - Shift Shaft Bushing Tool (91-23033)
- b - Shift Shaft
- c - Shift Cam (Numbered Side Up)

## Lubrication Sleeve Installation

- Install lubrication sleeve into gear housing.

**NOTE:** Lip of lubrication sleeve must be below drive shaft bearing race shim shoulder. If lip is above shoulder, the drive shaft needle bearing may not be seated deep enough.

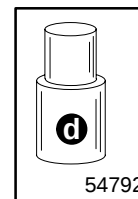


54791

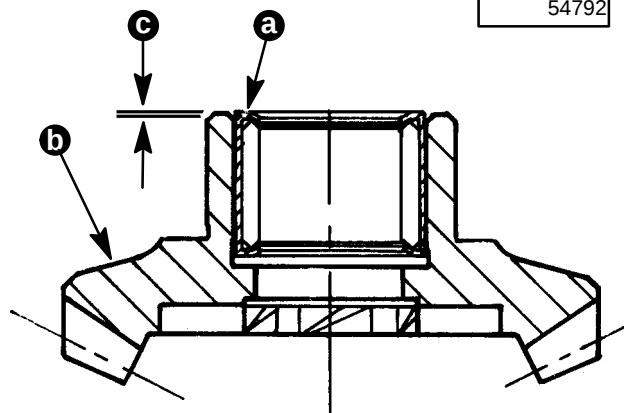
a - Tab (Position Towards Front of Gearcase)

## Forward Gear and Bearing Reassembly

- Press needle bearing (numbered side toward mandrel) into gear until dimensions (c) is obtained.



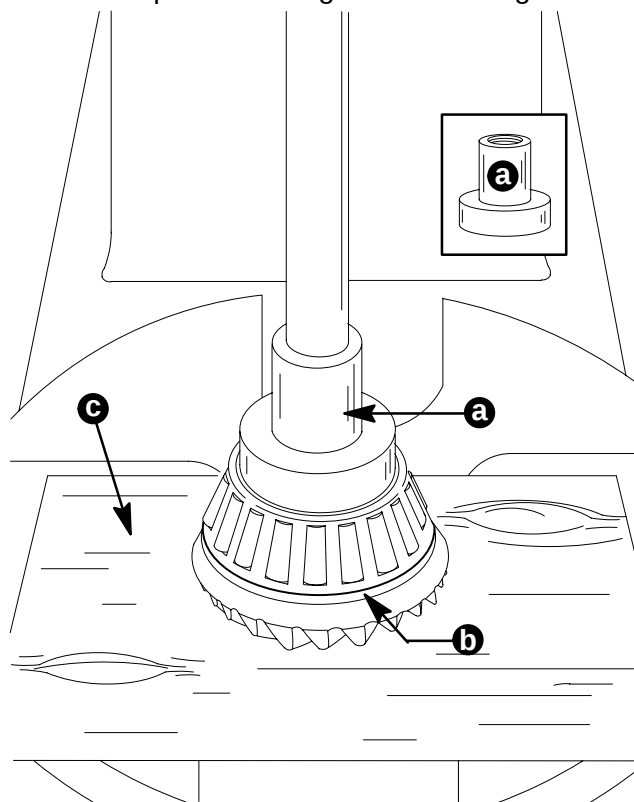
54792



- a - Needle Bearing
- b - Gear
- c - Bearing Flush with Shoulder to .020 in. (.508mm) Recessed
- d - Mandrel (91-37311)



2. Press tapered bearing onto forward gear.



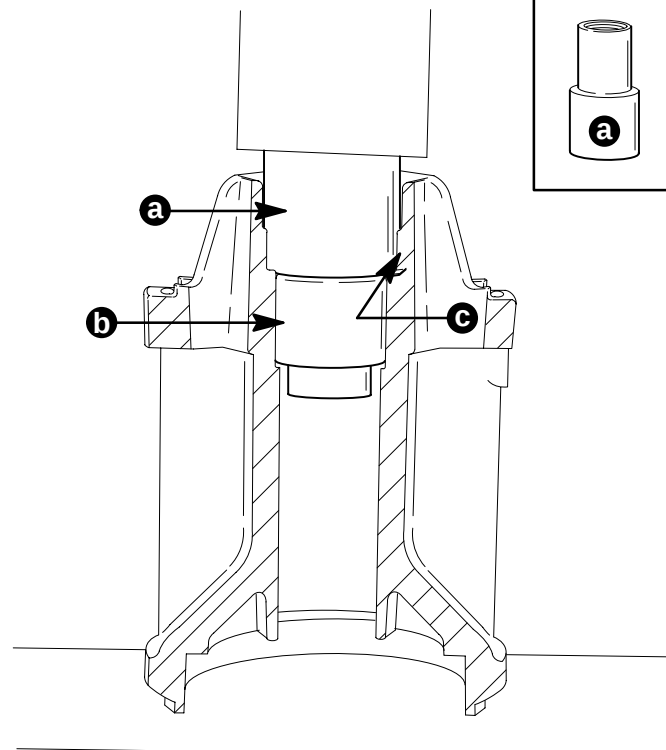
54793

- a - Mandrel (MUST Contact Inner Bearing Race Only) (91-38628)
- b - Inner Bearing Race MUST BE Tight Against Shoulder of Gear
- c - Wood

## Bearing Carrier Reassembly

**IMPORTANT: Do not force bearing into carrier or damage may occur to bearing.**

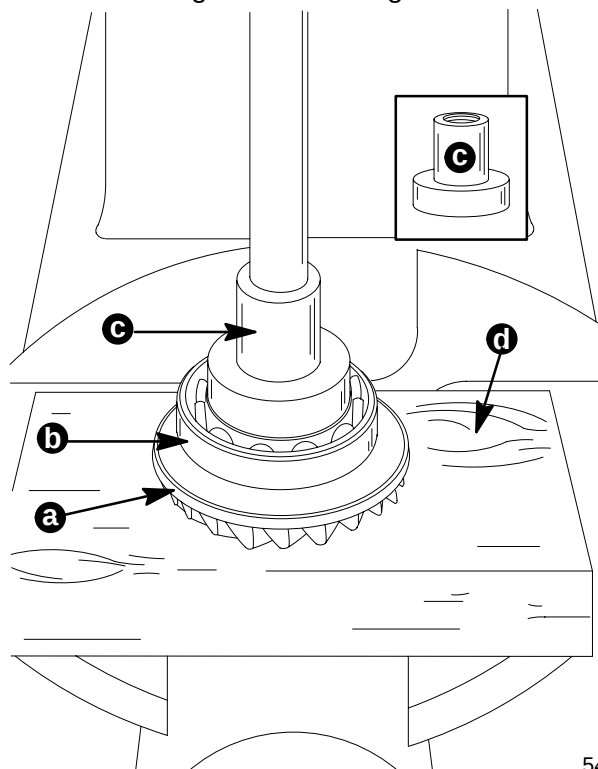
1. Press needle bearing into bearing carrier until bearing edge is just below bearing carrier seal edge.



54794

- a - Mandrel (91-37321)
- b - Needle Bearing
- c - Seal Edge

2. Press bearing onto reverse gear until seated.

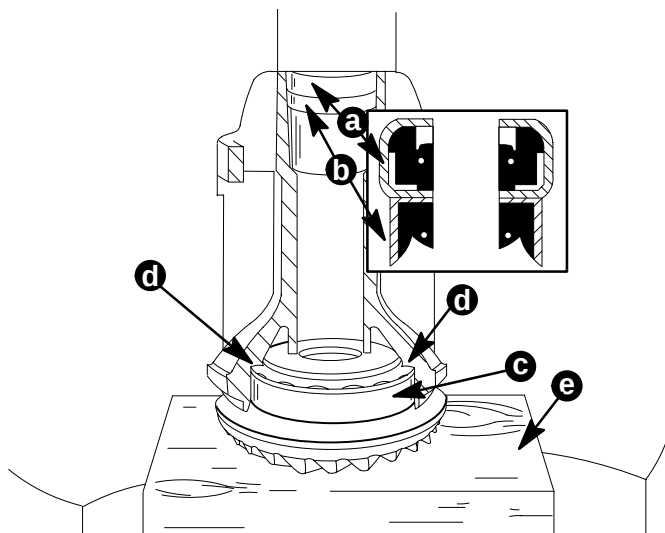


54795

- a - Thrust Washer (Beveled Side Toward Gear)
- b - Bearing
- c - Mandrel (91-38628)
- d - Wood



3. Apply Loctite Grade "A" onto O.D. of seals and press into bearing carrier.
4. Apply 2-4-C Marine Lubricant onto I.D. of seals
5. Lubricate O.D. of ball bearing with Quicksilver Needle Bearing Lubricant and press into bearing carrier.

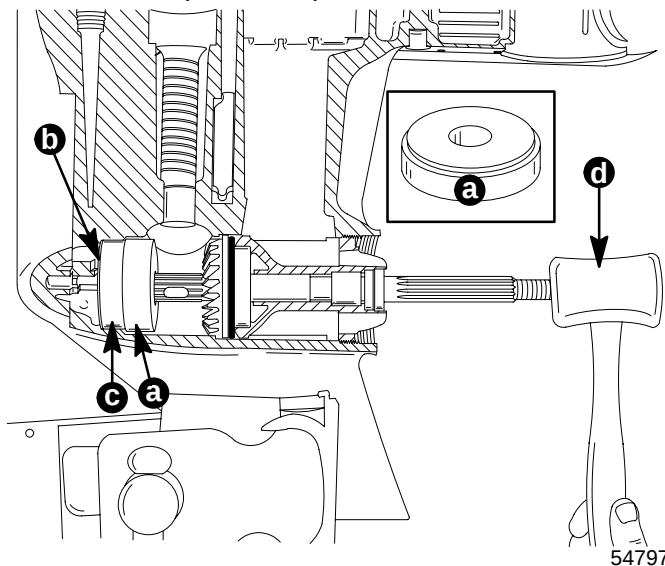


54796

- a - Fish Line Cutter Seal (Cutter Seal Sharp Edge Towards Propeller)
- b - Seal (Lip or Seal Towards Reverse Gear)
- c - Ball Bearing
- d - Flush
- e - Wood

## Forward Gear Race Installation

1. Install shim(s).
2. carefully drive bearing race into gear housing until seated (as shown).

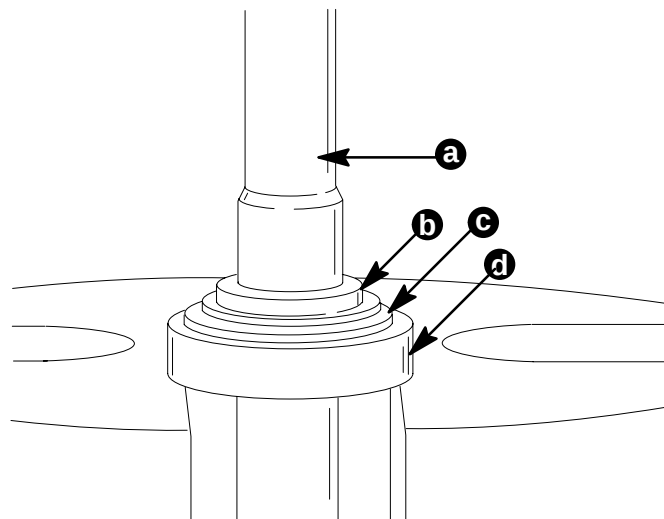


54797

- a - Mandrel (91-31361)
- b - Shim(s)
- c - Bearing Race
- d - Lead Hammer

## Drive Shaft Reassembly and Installation

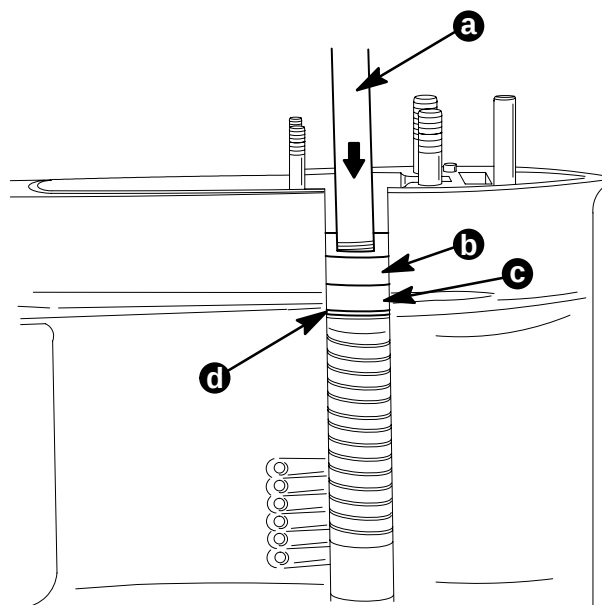
1. Press tapered bearing onto drive shaft until inner bearing race bottoms on shoulder.



54798

- a - Power Head End of Drive Shaft
- b - Shoulder
- c - Tapered Bearing
- d - Outer Race

2. Install shim(s).
3. Drive bearing into gear housing until seated.

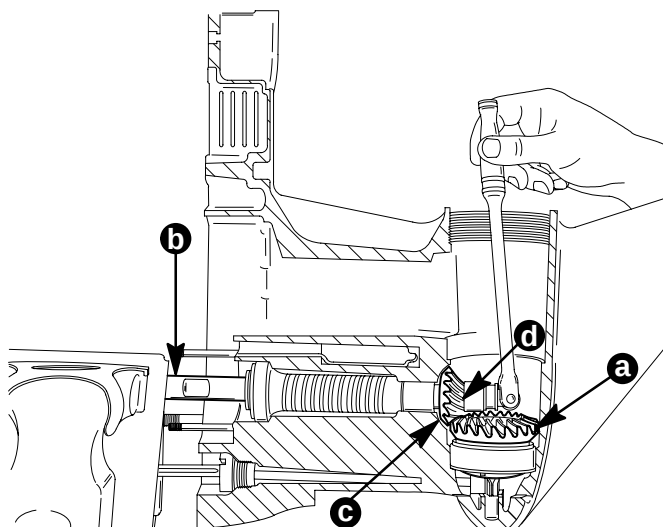


54799

- a - Driver Rod
- b - Mandrel (91-86290)
- c - Bearing Race
- d - Shim(s)



4. Apply Loctite Grade "A" onto threads of new pinion nut and install components.
5. Clamp drive shaft in soft jawed vise and torque pinion nut to 50 lb. ft. (67.8 N·m).



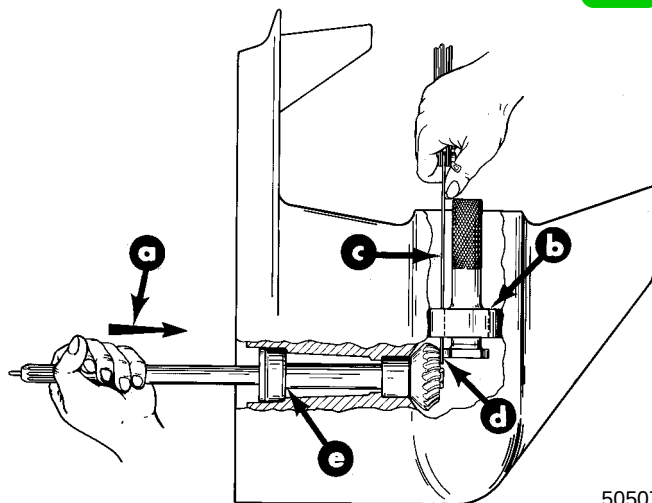
54771

- a - Forward Gear Assembly
- b - Drive Shaft
- c - Pinion Gear
- d - Pinion Nut (Hidden; Flat Side Away from Pinion Gear)

## Checking Pinion Gear Depth

**IMPORTANT:** Read entire shimming procedure before attempting any change in shim thickness.

1. Clean reverse gear shoulder and diameter of propeller shaft cavity.
2. Insert shimming tool (91-89670) into gear housing until it bottoms out.
3. Align access hole in shimming tool with pinion gear.
4. Rotate drive shaft several times with down pressure applied to seat drive shaft tapered bearing.
5. With down pressure applied, determine pinion gear depth by inserting a feeler gauge through access hole in shimming tool.
6. The correct clearance between pinion gear and shimming tool is .025 in. (0.64mm).
7. If clearance is incorrect, add or subtract shim(s) under drive shaft tapered bearing race to raise or lower pinion gear.
8. Add Loctite Grade "A" to threads of pinion nut when reinstalling.

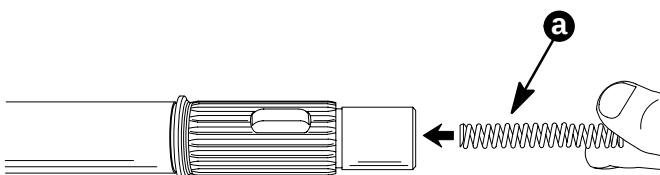


50507

- a - Apply Pressure in Direction of Arrow
- b - Shimming Tool
- c - Feeler Gauge
- d - Obtain .025 in. (0.64mm) Clearance Between Shimming Tool and Pinion Gear

## Propeller Shaft Reassembly and Installation

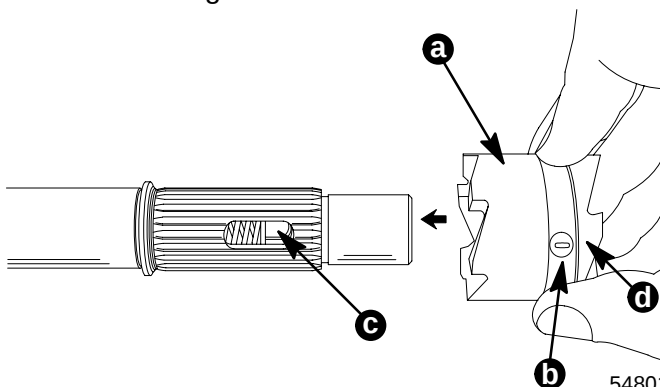
1. Insert spring into propeller shaft.



54800

- a - Spring

2. Install sliding clutch.

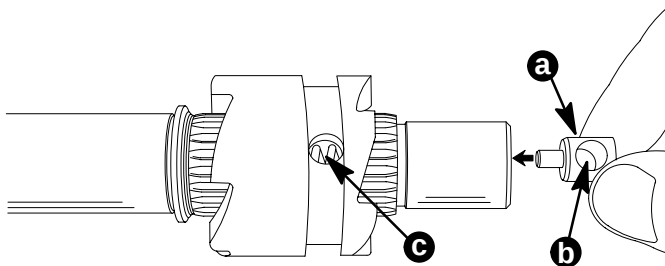


54801

- a - Sliding Clutch
- b - Hole [Must Align with Slot (c)]
- c - Slot
- d - Short Side

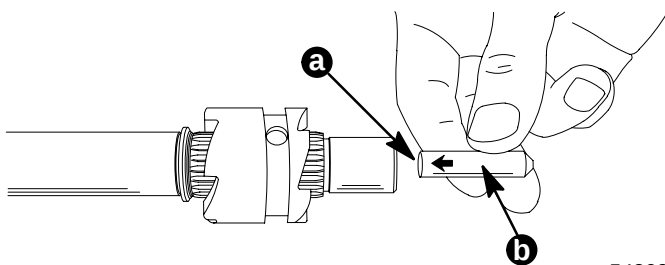


3. Insert guide block (a) into propeller shaft. Cross pin hole (b) MUST align with hole (c).



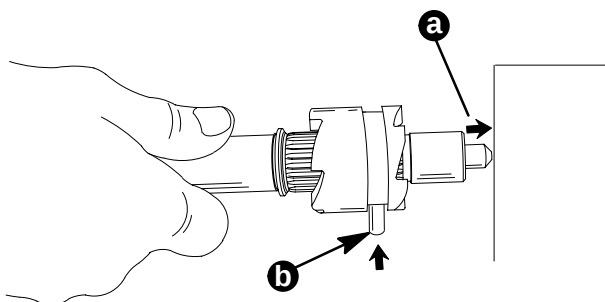
54802

4. Apply thin coat of Quicksilver Needle Bearing Assembly Lubricant on flat side (a) of cam follower (b), and install cam follower.



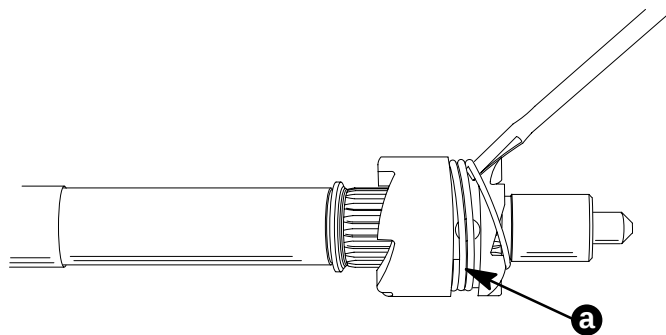
54803

5. Install cross pin.



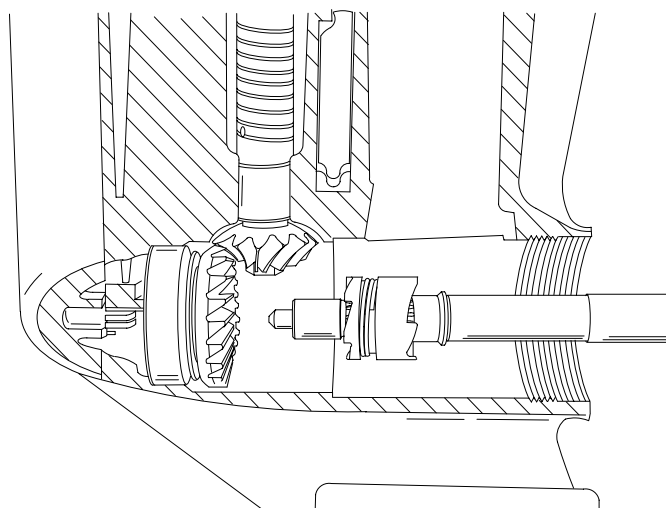
a - Apply Pressure in this Direction  
b - Cross Pin

6. Install spring (a).



54805

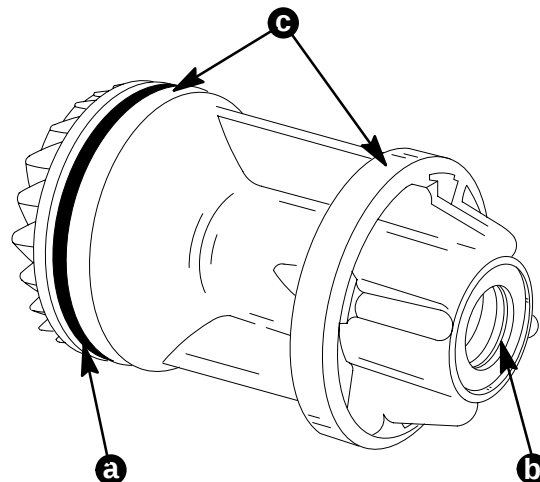
7. Place propeller shaft into forward gear.



54764

## Bearing Carrier Installation

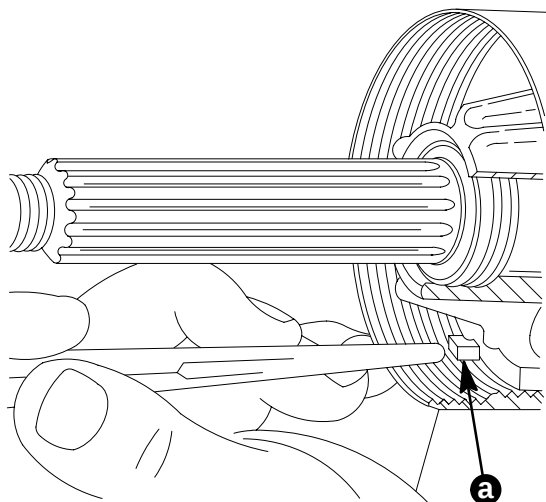
1. Install O-ring (a).
2. Apply 2-4-C Marine Lubricant on O-ring (a) and seal lips (b).
3. Coat surfaces (c) with Special Lubricant 101.



54806



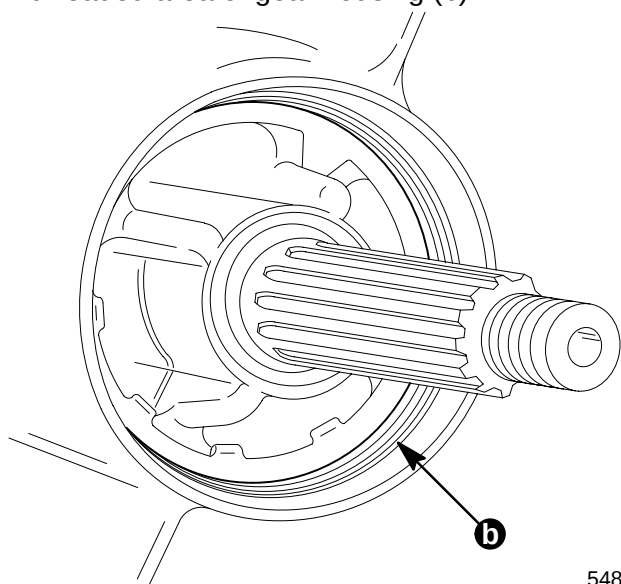
4. Push bearing carrier into gear housing while rotating drive shaft to engage pinion gear teeth with reverse gear teeth.
5. Install alignment key (a).



54807

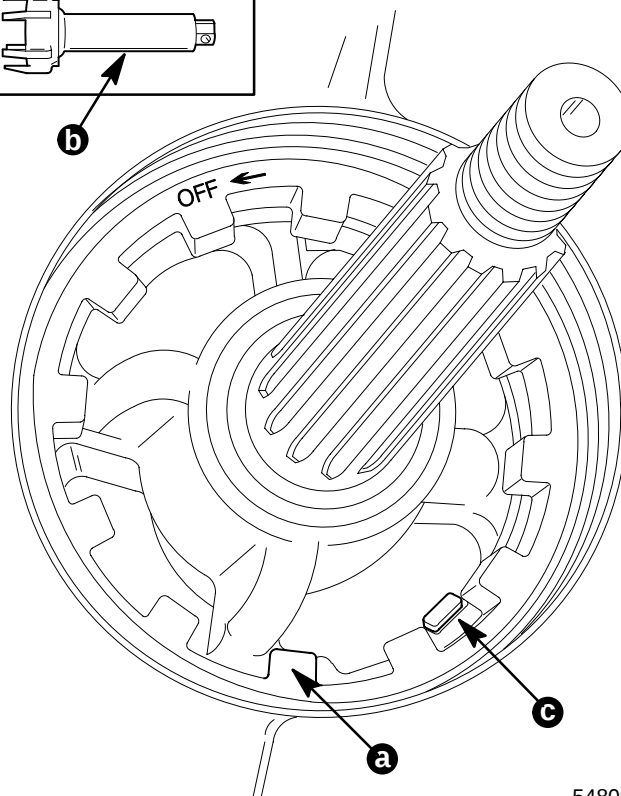
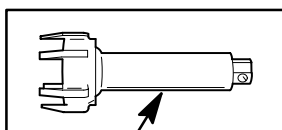
**IMPORTANT:** For proper retention between housing and cover nut, it is recommended that **PLASTIC** cover nut **NOT** be reused. Replace as required.

6. Apply Quicksilver Special Lubricant 101 onto threaded area of gear housing (b).



54808

7. Install cover nut (a) with the word "OFF" visible. Torque cover nut to 100 lb. ft. (136 N·m) using cover nut tool (91-91947) (b).
8. Bend one of lock tabs (c) into slot in cover nut.
9. Bend remaining tabs towards front of gear housing.



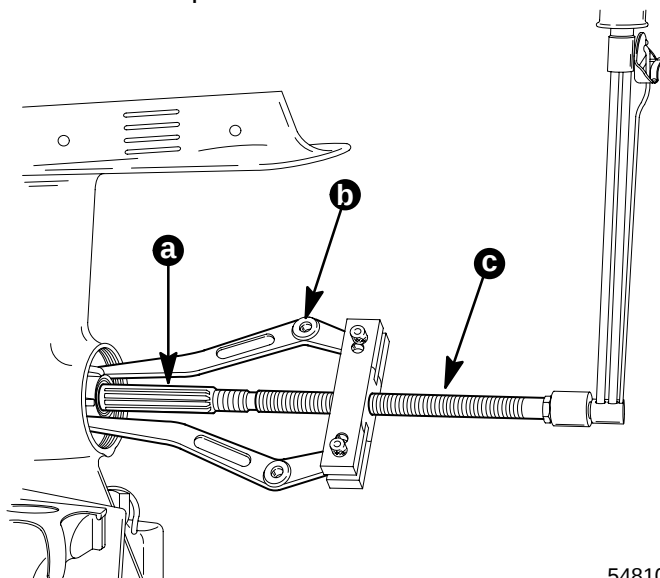
54809



## Checking Forward Gear Backlash

**NOTE:** Read entire procedure before attempting any change in shim thickness.

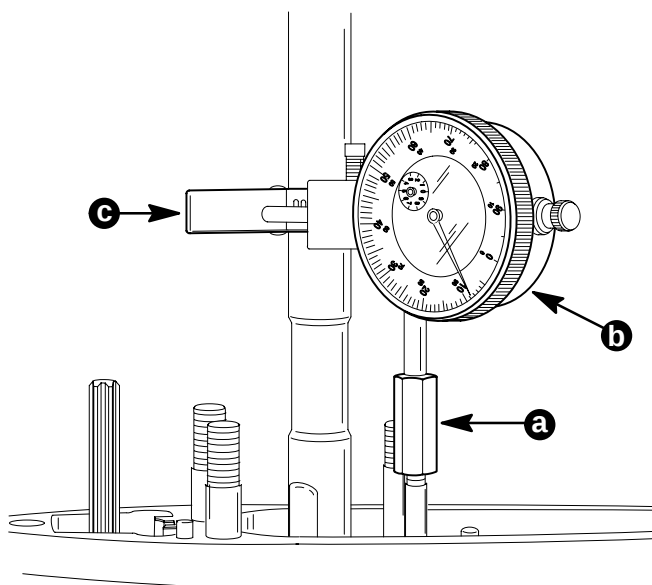
1. Obtain correct pinion gear depth. Refer to "Checking Pinion Gear Depth" preceding.
2. Install components as shown.



54810

- a - Propeller Shaft
- b - Puller Jaws (91-46086A1)
- c - Puller Bolt (91-85716) Torque to 45 lb. in. (5.1 N-m)

3. Rotate drive shaft 5 to 10 revolutions. This will properly seat forward gear tapered roller bearing.
4. Install components as shown.
5. Position dial indicator on line 4 of backlash indicator tool.



54811

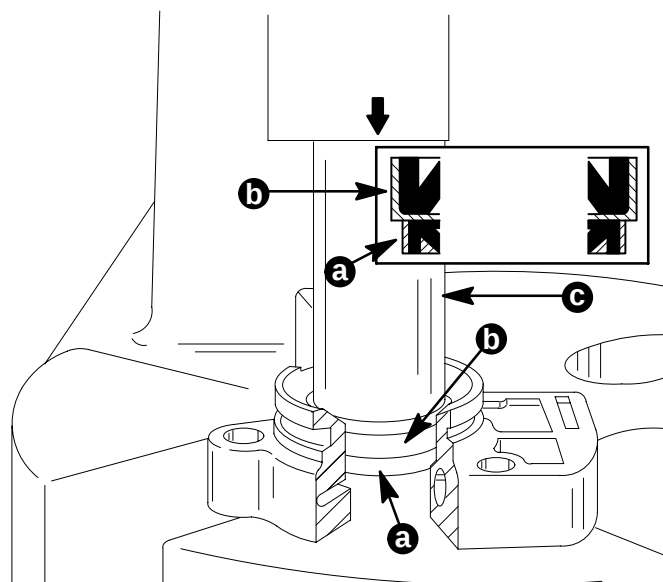
- a - Dial Indicator Adaptor Kit (91-83155)
- b - Dial Indicator (91-58222A1)
- c - Backlash Indicator Tool (91-78473)

6. Lightly turn drive shaft back-and-forth (no movement should be noticed at propeller shaft).
7. Dial indicator registers amount of backlash. Backlash should be between .007 in. and .010 in. (0.178mm to 0.254mm).
8. If backlash is less than minimum specification, remove shim(s)\* from front of forward gear bearing race to obtain correct backlash. When reinstalling pinion nut apply Loctite 271 on threads of nut.
9. If backlash is more than maximum specification, add shim(s)\* in front of forward gear bearing race to obtain correct backlash. When reinstalling pinion nut, apply Loctite 271 to threads of nut.

\*By adding or subtracting .001 in. (0.025mm) shim, the backlash will change approximately .00125 in. (0.032 mm).

## Water Pump Reassembly and Installation

1. Apply 2-4-C Marine Lubricant on I.D. of oil seals.
2. Press seals into water pump base.

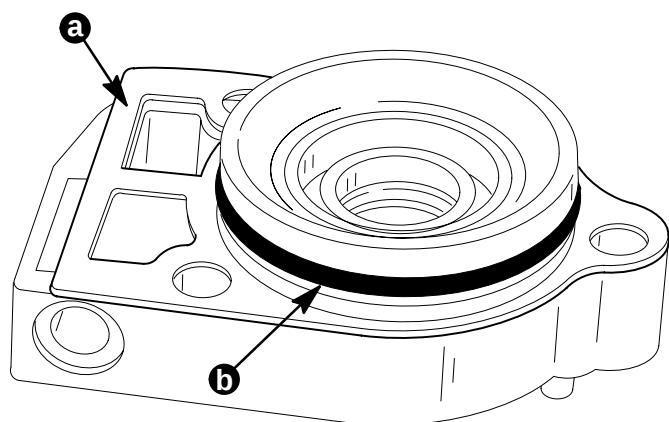


54812

- a - "Narrow" Seal (Lip Away from Mandrel)
- b - "Wide" Seal (Lip Toward Mandrel)
- c - Mandrel

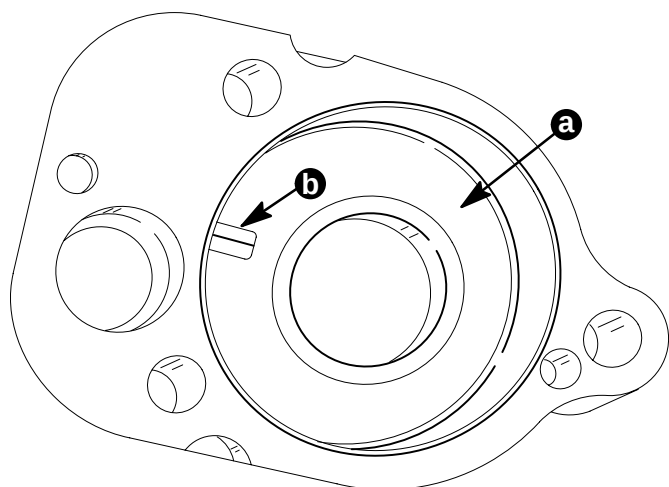


3. Install gasket (a) and O-ring (b).



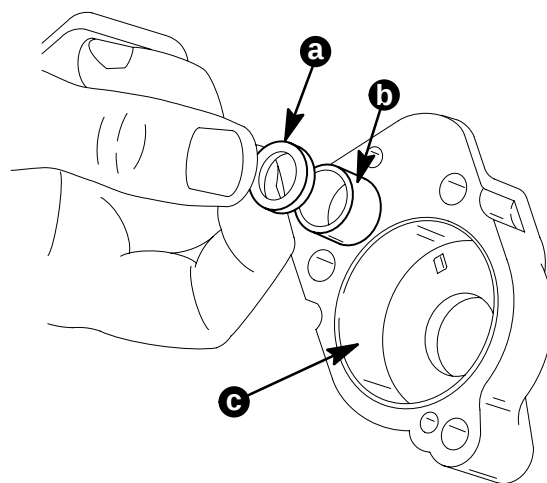
54813

4. Coat insert area of water pump body with Quicksilver 2-4-C Marine Lubricant and install insert (a) making sure locating tab (b) enters hole in body. Wipe off excess lubricant.



54814

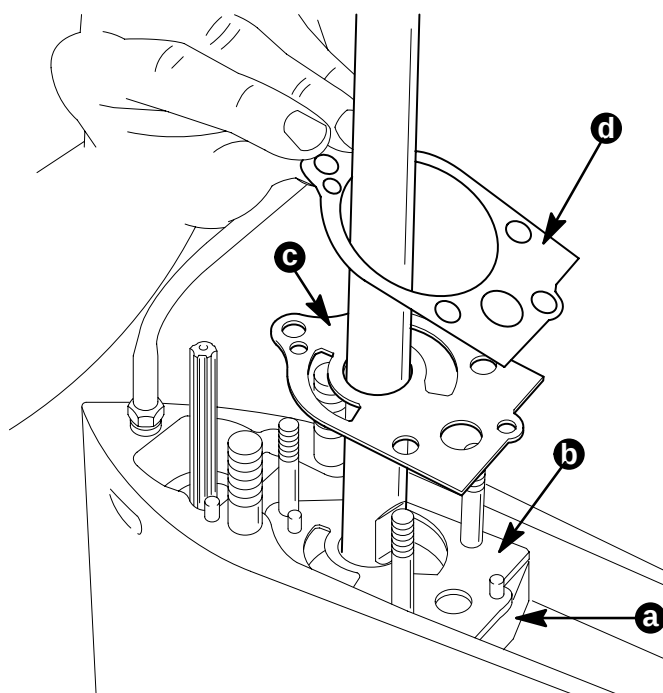
5. Install seal and washer. Apply Quicksilver 2-4-C Marine Lubricant to I.D. of insert and seal.



54755

- a - Cupped Nylon Washer (Cupped Side Towards Seal)  
b - Seal  
c - Insert

6. Install components as shown.



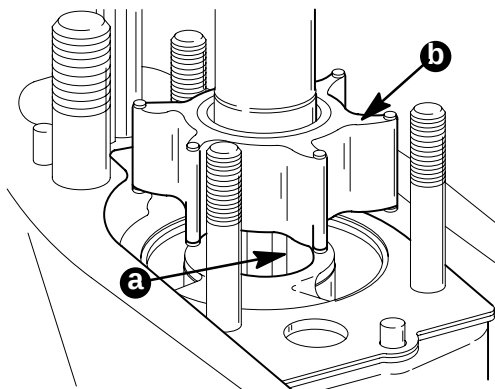
54758

- a - Water Pump Base  
b - Gasket  
c - Face Place  
d - Gasket



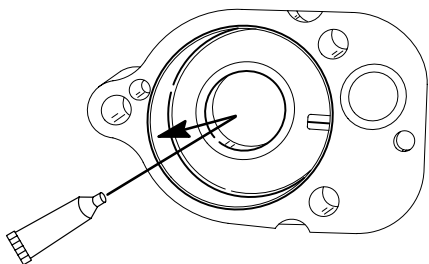
**IMPORTANT:** When performing gear housing repair that requires removal of water pump impeller, it is recommended that the impeller be replaced. If it is necessary, however, to re-use the impeller, **DO NOT** install in reverse to original rotation, or premature impeller failure will occur. Original rotation is clockwise.

7. Install impeller drive key (a) and impeller (b). Hold drive key in place using Quicksilver 2-4-C Marine Lubricant.

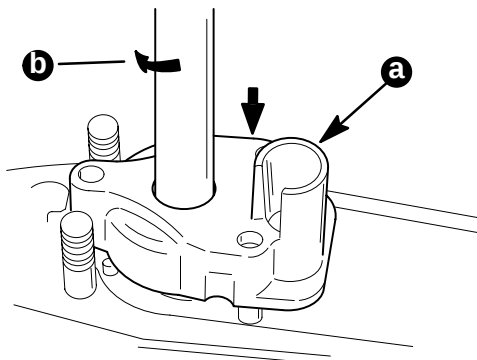


54757

8. Lubricate inside diameter of the water pump body with Quicksilver 2-4-C Marine Lubricant.

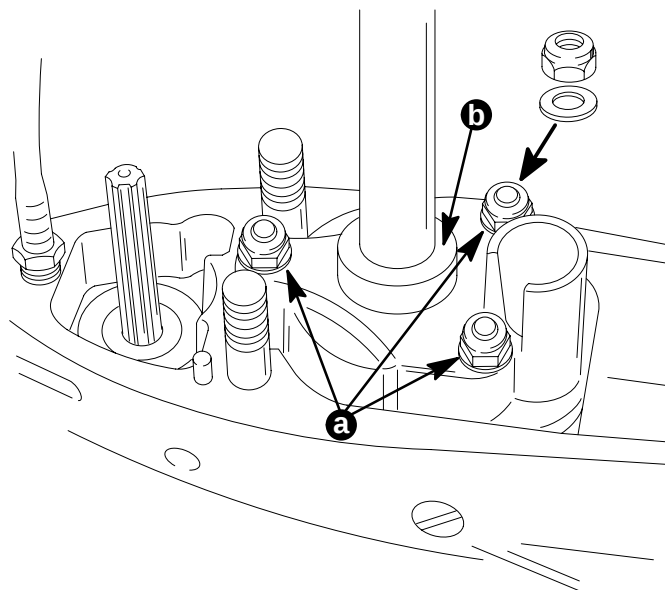


9. Rotate drive shaft clockwise while pushing water pump body down over impeller.



a - Water Pump Body  
b - Turn Drive Shaft Clockwise

10. Install locking nuts and washers (a) and centrifugal slinger (b).



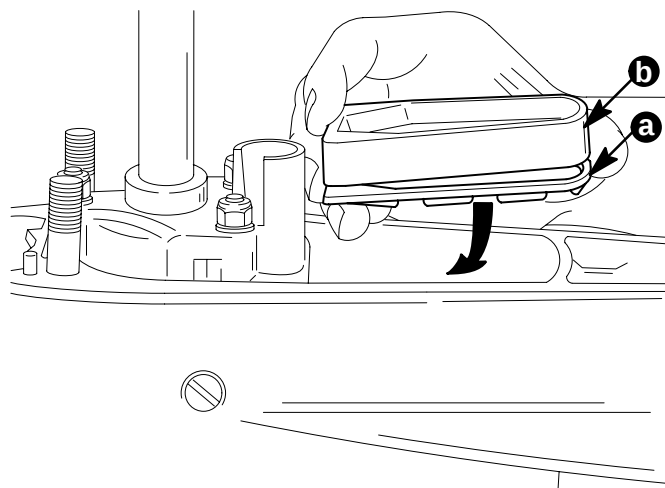
54753

## Gear Housing Installation

### **⚠ WARNING**

When installing gear housing, remove (and isolate) spark plug leads from spark plugs to avoid accidental outboard starting.

1. Remove and isolate spark plug leads.
2. Tilt outboard to full up position and engage tilt lock lever.
3. Install plate (a) "ribbed side down" and seal (b) "tapered side up" into gear housing. Lubricate inside of seal with Quicksilver 2-4-C Marine Lubricant.

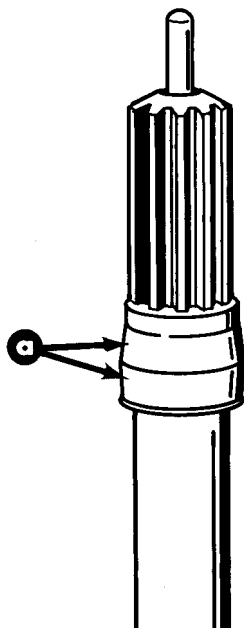


54752



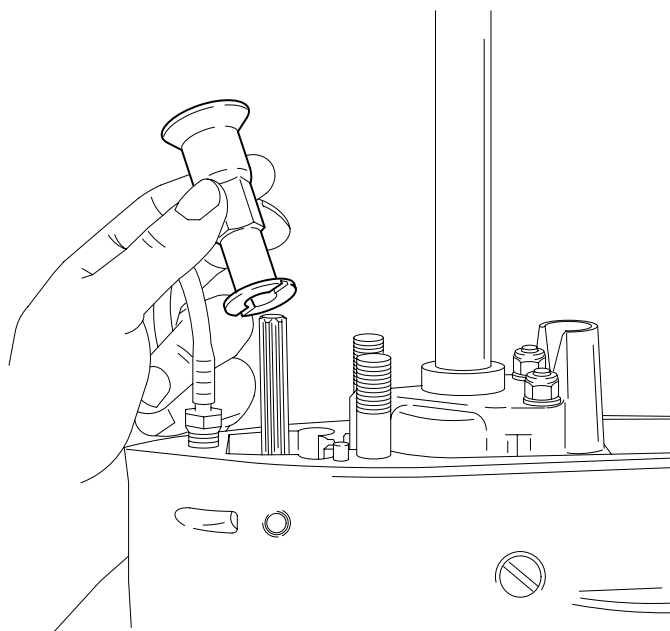
4. Install rubber seal (a) to drive shaft.

**NOTE:** Outboard S/N 0C295675 and above will not have seal on drive shaft due to improved lower end cap design.



51188

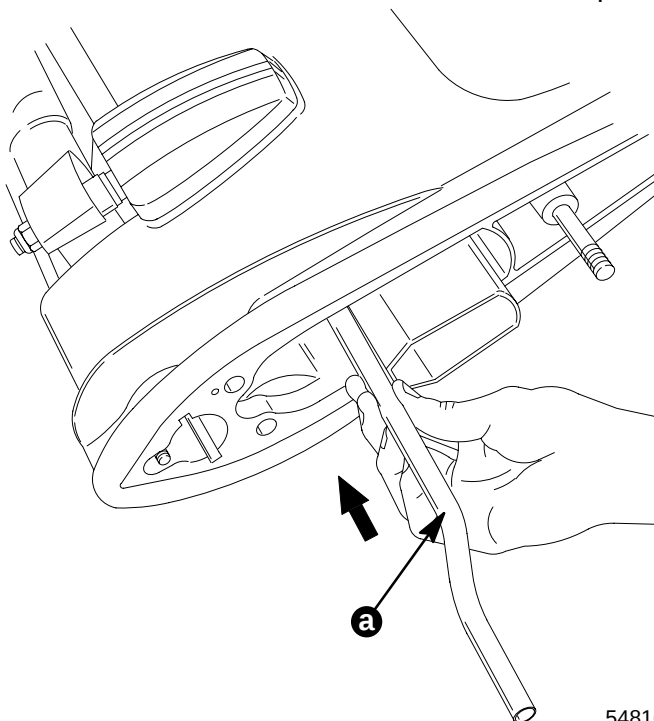
5. Shift gear housing to forward position; propeller shaft will not rotate counterclockwise.  
6. Install shift shaft guide.



54751

7. Apply Quicksilver 2-4-C Marine Lubricant to drive shaft splines, shift shaft splines and I.D. of water tube seal. DO NOT apply lubricant to top of shift shaft or drive shaft.

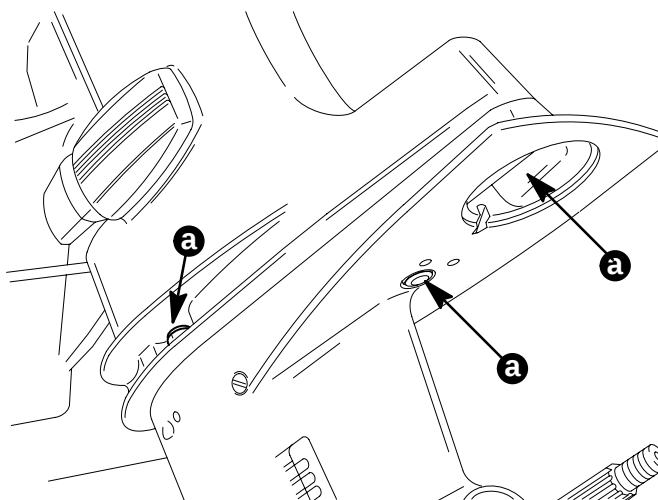
8. Install water tube (a) into drive shaft housing and insert into seal located at bottom of exhaust plate.



54816

**NOTE:** If drive shaft splines will not align with crankshaft splines (while performing step 10.), turn propeller shaft while gear housing is being pushed toward drive shaft housing.

9. Position gear housing so that the drive shaft is protruding into drive shaft housing.  
10. Move gear housing up toward drive shaft housing while aligning upper shift shaft splines with shift shaft coupler splines, water tube with water tube seal, and crankshaft splines with drive shaft splines.  
11. Install lock nuts and washer (4) securing gear housing to drive shaft housing.  
12. Torque lock nuts (a) to 40 lb. ft. (54 N·m).

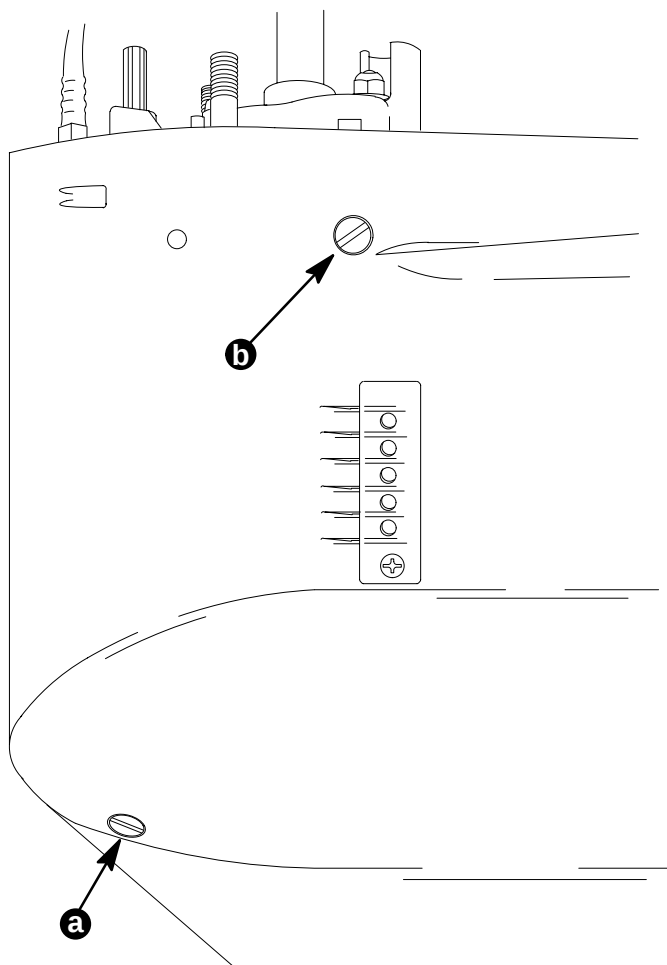


54750



## Filling Gear Housing with Lubricant

1. Install new gaskets on fill and vent screws.
2. With gear housing in vertical position, fill gear case thru "Fill" hole (a) using Quicksilver Gear Lube until lubricant flows thru "Vent" hole (b) and no air bubbles are visible.
3. Drain approximately one fluid ounce (30cc) of lubricant from gear housing to allow for lubricant expansion.
4. Install "vent" screw. Remove lubricant tube and quickly install "Fill" screw.



- a - "Fill" Screw (with Gasket)  
b - "Vent" Screw (with Gasket)

54817

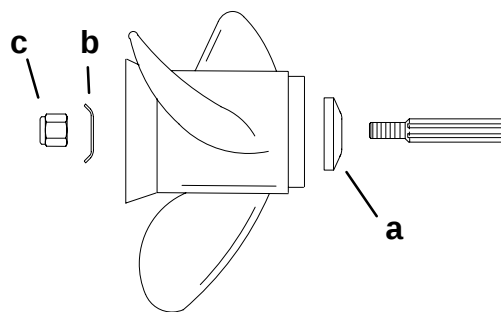
## Propeller/Trim Tab Installation

### ⚠ WARNING

**Remove (and isolate) spark plug leads from spark plugs when installing propeller.**

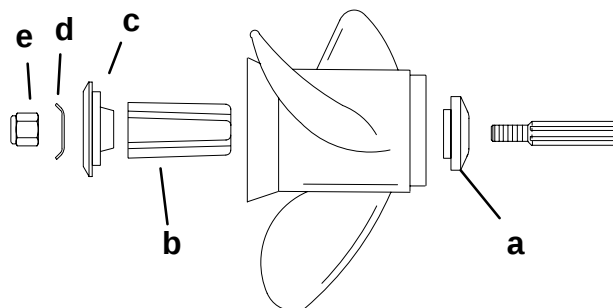
1. Remove (and isolate) spark plug leads from spark plugs.
2. Apply a thin coat of lubricant to propeller shaft splines with Quicksilver 2-4-C Marine Lubricant.
3. Install components as shown.

### Flo-Torq I Drive Hub Propellers



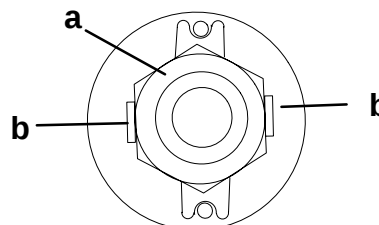
- a - Forward Thrust Hub  
b - Propeller Nut Retainer  
c - Propeller Nut

### Flo-Torq II Drive Hub Propellers



- a - Forward Thrust Hub  
b - Replaceable Drive Sleeve  
c - Rear Thrust Hub  
d - Propeller Nut Retainer  
e - Propeller Nut

4. Tighten propeller nut to 55 lb. ft. (75 N·m). Bend tabs against nut.

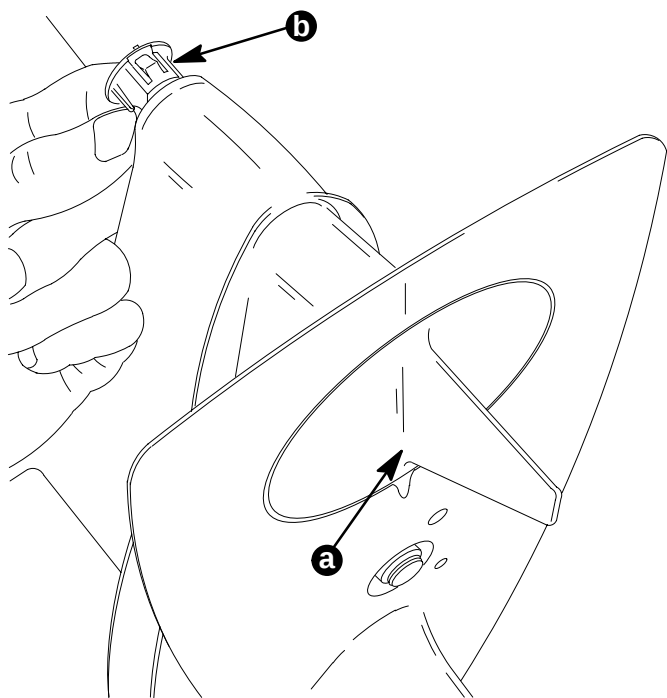


- a - Propeller Nut - Torque To 55 lb. ft. (75 N·m)  
b - Bend Tabs Against Nut



5. Install trim tab (a). Torque bolt to 20 lb. ft. (27.1 N·m).

6. Install nylon plug (b).



54818

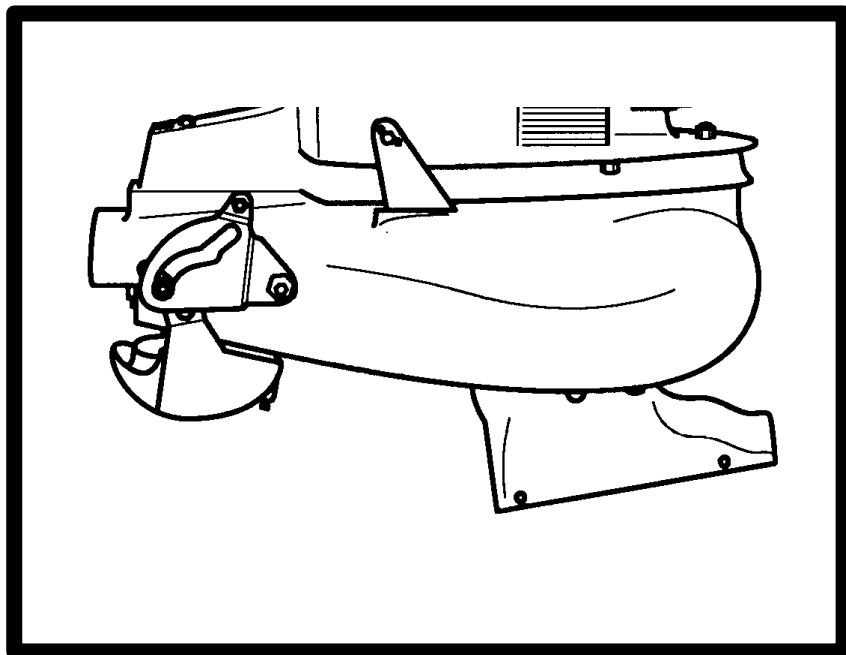
7. Check shift operation as follows:

- a. Place shift lever in forward gear. Gear housing should ratchet when propeller shaft is turned clockwise and resistance should be felt when propeller shaft is turned counter-clockwise.
- b. Place shift lever in neutral. Propeller shaft should rotate freely in either direction.
- c. While rotating propeller shaft, place shift lever in reverse gear. Resistance should be felt when propeller shaft is rotated in either direction.

**IMPORTANT:** If shift operation is not as described, preceding, the gear housing must be removed and the cause corrected.



# LOWER UNIT



6

B

**JET DRIVE**



# Table of Contents

|                                              | Page  |
|----------------------------------------------|-------|
| Notes .....                                  | 6B-1  |
| Jet Pump Assembly .....                      | 6B-2  |
| Selecting A Boat Best Suited For Jet Power . | 6B-4  |
| Engine Horsepower Selection .....            | 6B-4  |
| Transom Height of the Boat .....             | 6B-5  |
| Locate Centerline of The Outboard .....      | 6B-5  |
| Outboard Mounting Height .....               | 6B-5  |
| Water Testing .....                          | 6B-6  |
| Checking for Cavitation .....                | 6B-6  |
| Shift Cable Installation .....               | 6B-7  |
| Lubricating The Drive Shaft Bearing .....    | 6B-8  |
| Impeller Removal and Installation .....      | 6B-8  |
| Steering Pull Adjustment .....               | 6B-10 |
| Impeller Clearance Adjustment .....          | 6B-10 |

|                                              | Page  |
|----------------------------------------------|-------|
| Worn (Dull) Impeller .....                   | 6B-10 |
| Liner Replacement .....                      | 6B-11 |
| Jet Drive Removal and Installation .....     | 6B-11 |
| Water Pump Removal and Installation .....    | 6B-12 |
| Bearing Carrier Removal and Installation ... | 6B-12 |
| Bearing Carrier Disassembly .....            | 6B-13 |
| Bearing Carrier Reassembly .....             | 6B-13 |
| Installing Lower Seals .....                 | 6B-13 |
| Installing Upper Seals .....                 | 6B-14 |
| Installing Drive Shaft Ball Bearing .....    | 6B-14 |
| Installing Drive Shaft .....                 | 6B-14 |
| Installing Upper Seal Housing .....          | 6B-15 |
| Jet Drive Tiller Handle Adaptor Kit .....    | 6B-16 |
| Installation Instructions .....              | 6B-16 |

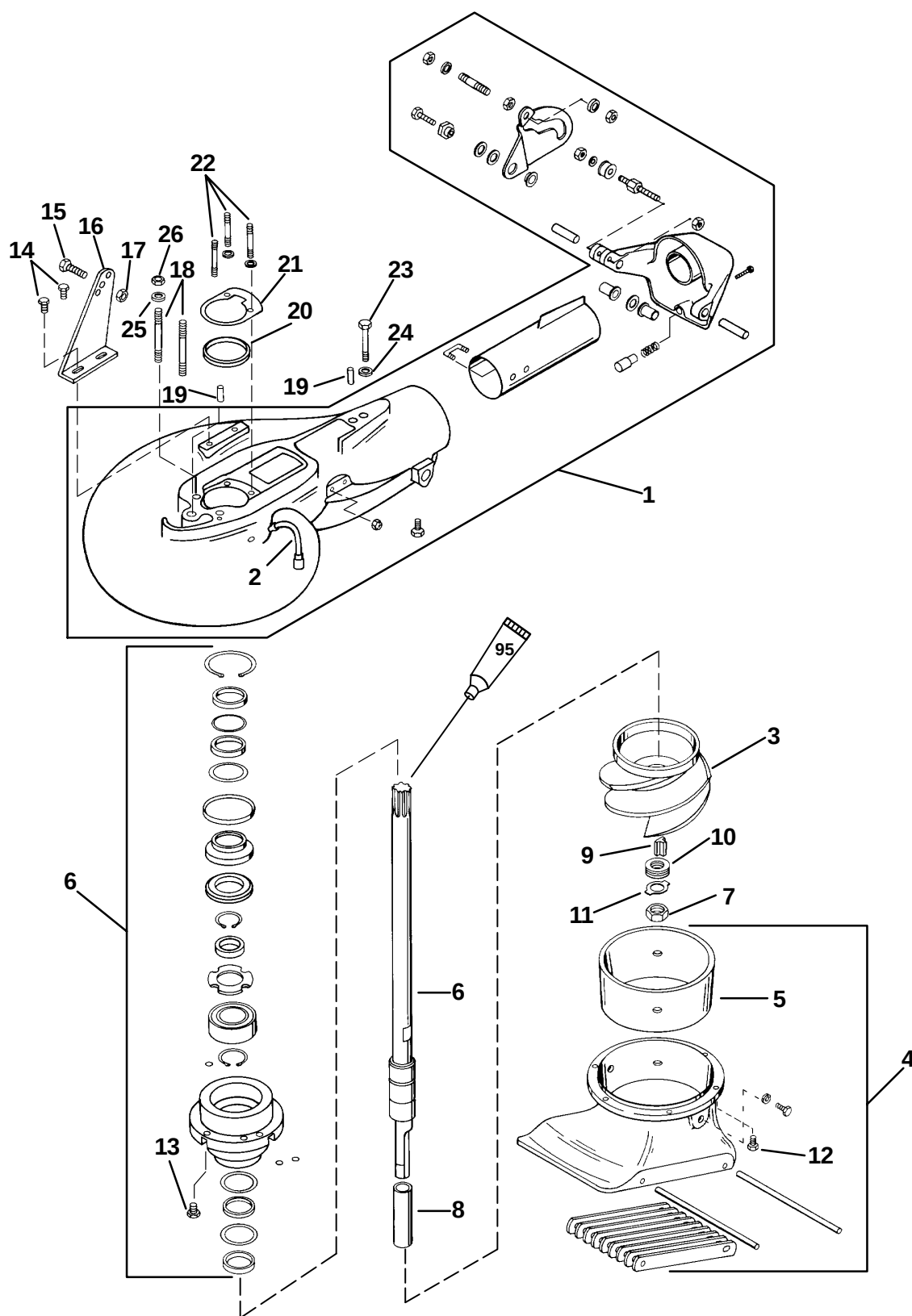


**Notes:**





# Jet Pump Assembly



95 2-4-C With Teflon (92-825407A12)



## Jet Pump Assembly

| REF. NO. | QTY. | DESCRIPTION             | TORQUE  |         |      |
|----------|------|-------------------------|---------|---------|------|
|          |      |                         | lb. in. | lb. ft. | N·m  |
| 1        | 1    | HOUSING–pump            |         |         |      |
| 2        | 1    | HOSE–lube               |         |         |      |
| 3        | 1    | IMPELLER                |         |         |      |
| 4        | 1    | HOUSING–intake          |         |         |      |
| 5        | 1    | LINER                   |         |         |      |
| 6        | 1    | SHAFT–drive             |         |         |      |
| 7        | 1    | NUT                     |         |         |      |
| 8        | 1    | SLEEVE–shaft            |         |         |      |
| 9        | 1    | KEY                     |         |         |      |
| 10       | 8    | SHIM                    |         |         |      |
| 11       | 1    | TAB WASHER              |         |         |      |
| 12       | 6    | SCREW (1/4-20 x .75)    | 96      | 8       | 10.8 |
| 13       | 4    | SCREW (1/4-20 x .875)   | 70      |         | 7.9  |
| 14       | 2    | SCREW (1/4-20 x .625)   | 70      |         | 7.9  |
| 15       | 1    | SCREW (.312-18 x 1.25)  |         |         |      |
| 16       | 1    | BRACKET                 |         |         |      |
| 17       | 1    | NUT                     | 160     | 13.3    | 18.1 |
| 18       | 2    | STUD                    |         |         |      |
| 19       | 2    | PIN–dowel               |         |         |      |
| 20       | 1    | RING SUPPORT–water pump |         |         |      |
| 21       | 1    | GASKET–water pump base  |         |         |      |
| 22       | 3    | STUD (1/4 x 2-5/8")     |         |         |      |
| 23       | 1    | SCREW (3/8-16 x 3")     |         | 22.5    | 30.5 |
| 24       | 1    | WASHER                  |         |         |      |
| 25       | 2    | WASHER                  |         |         |      |
| 26       | 2    | NUT                     |         | 60      | 81.3 |



# Selecting A Boat That Is Best Suited For Jet Power

To obtain the best performance from the jet drive, the boat should have the following features:

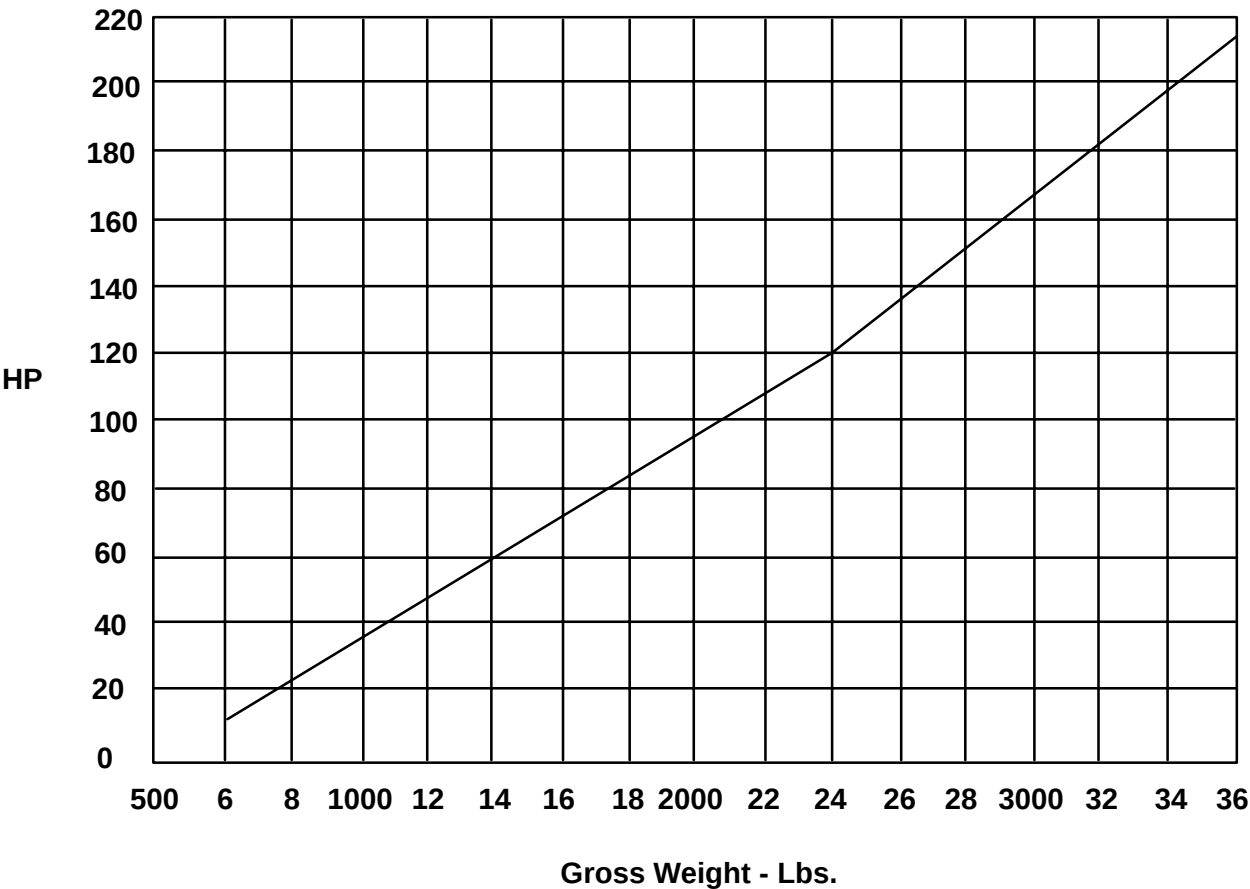
- 1. The boat should be as light as possible.
- 2. The boat should have hull and transom that is designed for use with a jet drive.
- 3. The boat should be at least 13 feet in length.

# Engine Horsepower Selection

A boat operating at slow speed requires considerably more depth than one which is planing on the surface of the water. It is important therefore to use sufficient horsepower and not to overload your boat beyond its ability to plane. See the following table.

## Engine Horsepower Selection

The following table is based on experience obtained with sled-type boats using outboard jets. The gross weights shown includes the outboard, boat, people, and all the gear carried. For a given horsepower loading beyond these weights will give less than good performance.





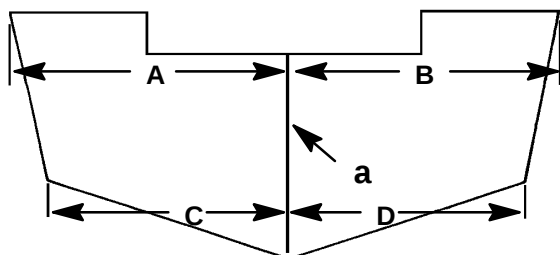
## Transom Height of the Boat

Outboards with jet drives will be mounted approximately 7 inches higher on the transom than propeller driven outboards. This requires outboards that have a 15 in. shaft length to be installed on boats having a 22 in. transom height and outboards that have a 20 in. shaft length to be installed on boats having a 27 in. transom height.

If the boat transom is of insufficient height, and the outboard cannot be installed to the recommended height, contact the boat manufacturer for recommended procedure to build up the boat transom.

## Locate Centerline Of The Outboard

Locate (and mark with pencil) the vertical centerline of boat transom.



a - Centerline of Transom

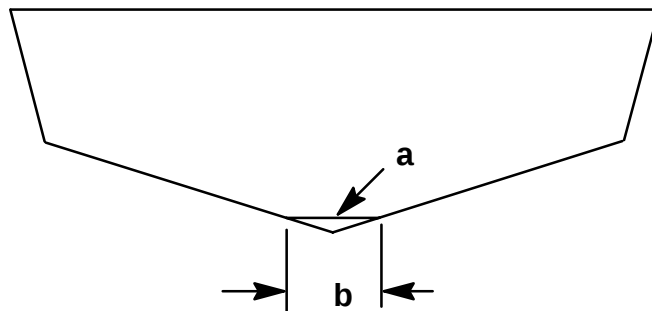
## Outboard Mounting Height

The initial outboard mounting height setting will work good for most applications, however, because of different boat/hulls designs, the setting should be re-checked by test-running the boat. Refer to Water Testing.

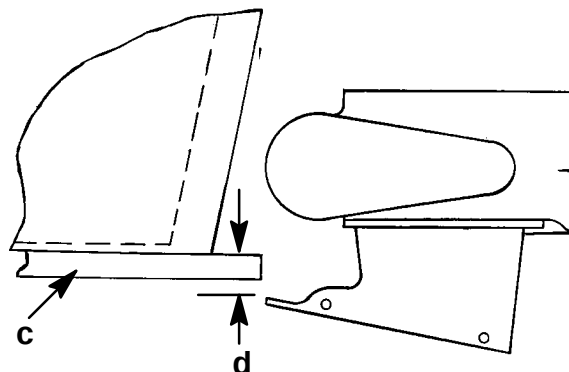
- Installing the outboard too high on the transom will allow the water intake to suck in air and cause cavitation. (Cavitation will cause the engine to over-speed in spurts and reduce thrust). This condition should be avoided by proper height setting.
- Installing the outboard too low on the transom will allow excessive drag.

## SETTING OUTBOARD MOUNTING HEIGHT ON BOATS WITH "V" BOTTOM HULLS

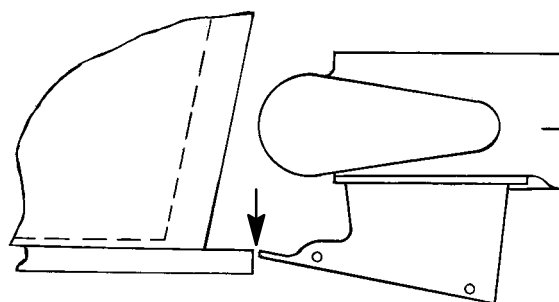
1. Measure the width of the leading edge on the water intake housing. Make a horizontal line (a) on the transom up from the "V" bottom the same length as the width of the water intake housing (b).



2. Place (center) the outboard on the boat transom so that the transom brackets are resting on top of the transom. Temporarily fasten the outboard to the transom using two C-clamps.
3. Position the outboard in a vertical position.
4. Line up a straight edge (c) along the bottom of the boat with the horizontal line made in Step 1 and measure the distance between the horizontal line and top front edge of the water intake housing (d).



5. Raise The outboard up on the transom the distance measured in Step 4. Use a straight edge and recheck the mounting height. The top edge of the water intake housing should be lined up with the horizontal line made in Step 1.

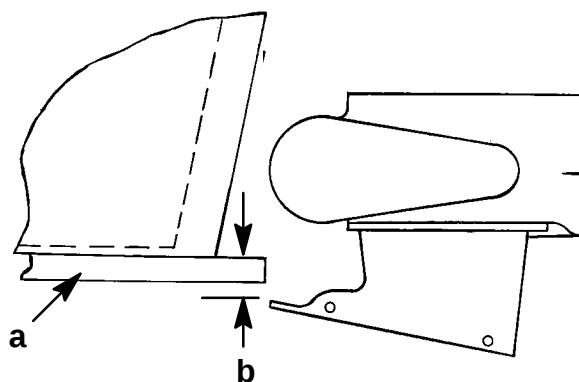


6. Fasten outboard to the transom at this height.



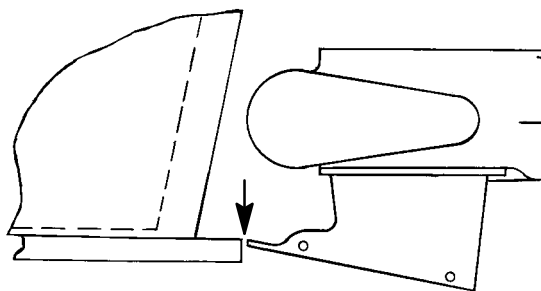
## SETTING OUTBOARD MOUNTING HEIGHT ON BOATS WITH FLAT BOTTOM HULLS

1. Place (center) the outboard on the boat transom so that the transom brackets are resting on top of the transom. Temporarily fasten the outboard to the transom using two C-clamps.
2. Position the outboard in a vertical position.
3. Place a straight edge along the bottom of the boat as shown and measure the distance between the bottom of the boat and top front edge of the water intake housing.



- a - Straight Edge  
b - Top Edge of Water Intake Housing

4. Raise the outboard up on the transom the distance measured in Step 3. Use a straight edge and recheck the mounting height. The top edge of the water intake housing should be in line with the bottom of the boat as shown.



5. Fasten outboard to the transom at this height.

## Water testing

### Checking for Cavitation

Making the initial outboard height setting should be close to the optimum setting for the outboard. However because of the hull design of some boats, obstructions or imperfections in the hull ahead of the water intake may require this setting to change in order to prevent cavitation at running speeds.

When operating the boat, the outboard drive shaft should be vertical when planing or tilted toward the boat in order to provide a scooping angle on the water intake. Tilting the outboard out beyond a vertical position reduces the scoop angle and can cause impeller slippage and cavitation. If the angle of the boat transom does not allow the drive shaft to be positioned vertically, a Wedge kit should be installed behind the transom brackets to increase the tilt-in angle.

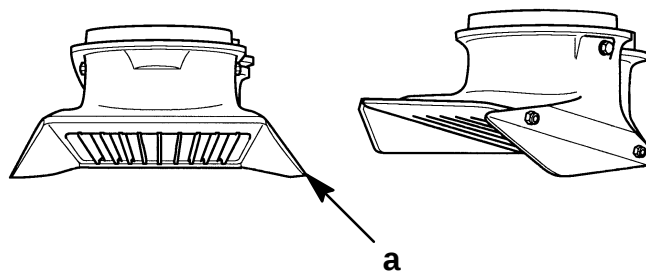
**NOTE:** *Slight cavitation in sharp turns and rough water is acceptable but excessive cavitation is harmful to the outboard and should be avoided.*

Test run the boat. If cavitation occurs (air enters the pump causing loss of thrust, engine over-speeds erratically), the first thing to try is lowering the outboard height 1/4 in. This can be accomplished by elongating the drilled mounting holes in the boat transom by 1/4 in.

If cavitation still exists after lowering the outboard 1/4 in., it may be helpful to seek advice from the boat manufacturer.

A number of other options are available to further reduce cavitation.

1. Water intake fin kit – Available from the Specialty Mfg. Co. for jet models 30 thru 140. The purpose of these fins is to ram more water into the intake and shield the forward sides of the intake from the entrance of air. This kit will help reduce cavitation when running with the wind in a chop.



- a - Intake Fin Kit

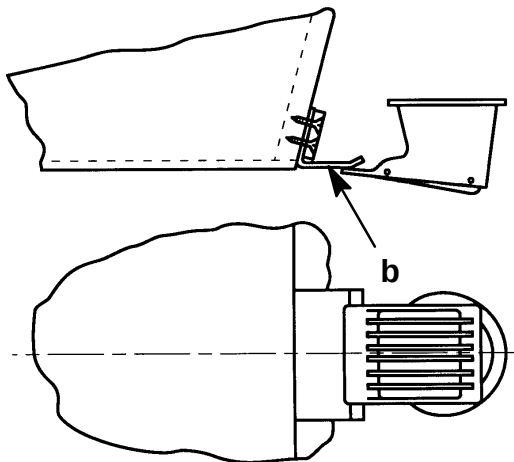
Water Intake Fin Kit Part No.1186 for jet models 45 thru 140 and Part No. 1185 for jet model 30 is available from:  
Specialty Mfg. Co.  
2035 Edison Ave.  
San Leandro, CA 94577



## Water testing

### Checking for Cavitation (Continued)

2. Rough Water Plate – Using this type of plate may be helpful in reducing cavitation when running in windy rough water conditions where air is sucked-in the water intake when jumping waves. Install a 1/32 in. metal plate that extends from the hull bottom to the top of the water intake housing. This plate tends to reduce air intake as well as reduce spray.



b - Rough Water Plate

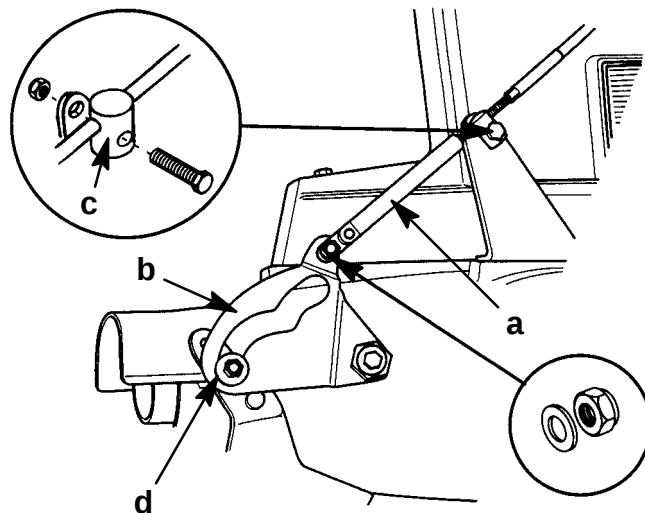
## Shift Cable Installation

### ⚠ WARNING

The shift cable must be adjusted to lock the reverse gate against unexpected engagement (caused by water pressure hitting the gate) while operating the boat in forward. Activation of the reverse gate will cause sudden unexpected stopping of the boat. Sudden stopping may cause occupants to be thrown within the boat or even out of the boat. This action may result in serious injury or death.

1. Attach shift cable to the shift cam with flat washer and locknut as shown. Tighten locknut against the flat washer, then back-off the locknut 1/4 turn.
2. Place remote control handle into full forward position.
3. Adjust the brass barrel on the shift cable so that roller is at the full end of travel (bottom) in the shift cam when the remote control is in full forward.

4. Attach the brass barrel to the bracket with bolt and locknut. Tighten the bolt until it seats against the barrel, then back-off the bolt 1/4 turn. Hold bolt from turning, and tighten locknut on bolt. The barrel must be free to pivot.



a - Shift Cable  
b - Shift Cam  
c - Barrel  
d - Roller

5. Recheck the shift cable adjustment in forward shift position. The correct shift adjustment will position the cam far enough on the roller in order to lock the the reverse gate into forward position. You should not be able to forcibly push up the reverse gate toward neutral. Pull on the reverse gate by hand to verify this.

**IMPORTANT:** The forward locking of the reverse gate must be met. If not, readjust the shift cable.

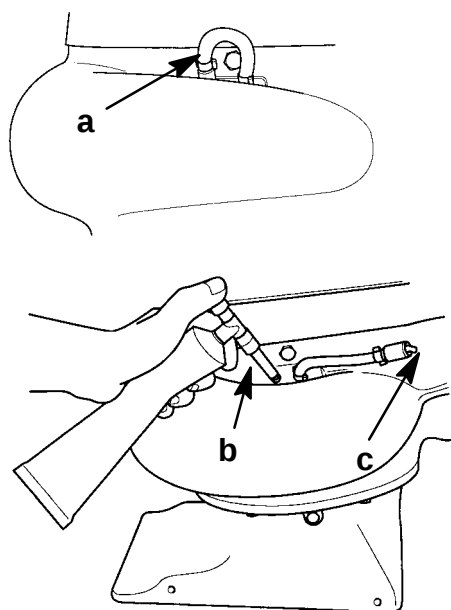


## Lubricating The Drive Shaft Bearing

**Recommended Lubrication** - Use Quicksilver 2-4-C w/Teflon, or Lubriplate 630-AA Grease.

**IMPORTANT:** It is important that you do not use a general-all-purpose grease for this bearing. The lubricant we recommend is a water resistant grease of the proper consistency for this application. If you use a substitute grease, be sure that it is water resistant and of the same consistency.

**Frequency of lubrication** - We recommend lubricating the drive shaft bearing after each day's use and after every 10 hours of operation. After every 30 hours of operation, pump in extra grease to purge out any moisture.



- a - Vent Hose
- b - Grease Gun
- c - Grease Exiting Vent Hose

**Lubricating Procedure** - Pull vent hose off the grease fitting. Pump in grease through the grease fitting (using the grease gun provided) until excess grease starts to exit the vent hose.

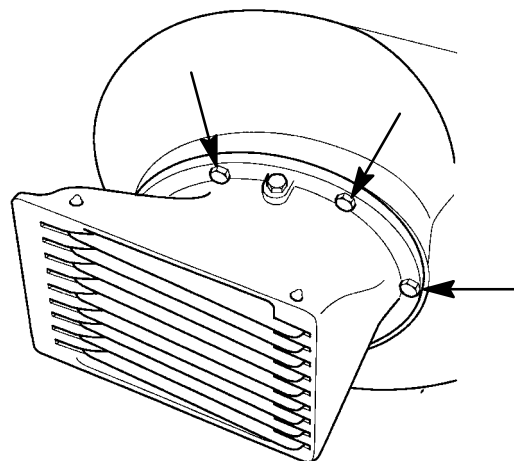
Reconnect the vent hose onto the grease fitting after greasing.

After 30 hours of operation, pump in extra grease to purge out any moisture. Visually inspecting the purged grease at this time will give you an indication of conditions inside the bearing housing. A gradual increase in moisture content indicates seal wear. If the grease begins to turn dark or dirty gray, the drive shaft bearing and seals should be inspected and replaced if necessary. Some discoloration of the grease is normal during the break-in period on a new set of seals.

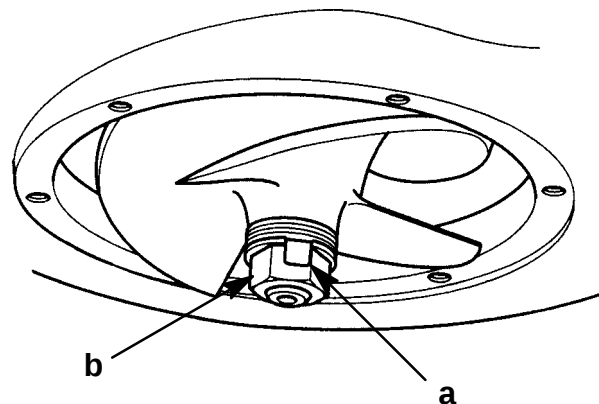
## Impeller Removal and Installation

### REMOVAL

1. Shift outboard to NEUTRAL (N) position.
2. Remove spark plug leads to prevent engine from starting.
3. Remove the water intake housing that is fastened with six screws.



4. Straighten the bent tabs on the impeller nut retainer and remove the impeller nut.
5. Pull impeller straight off the shaft. If the impeller is tight, use a hammer and block of wood to rotate the impeller (clockwise) on the shaft until the key-way is directly above the flat on the shaft. This will free the jammed key and allow removal.

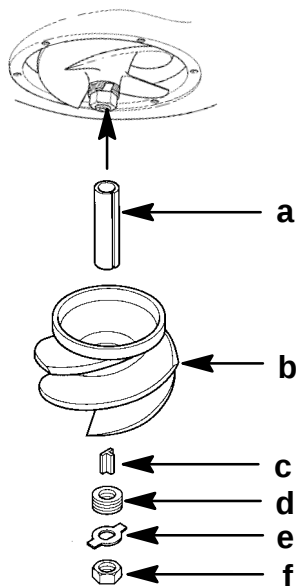


- a - Tab
- b - Nut



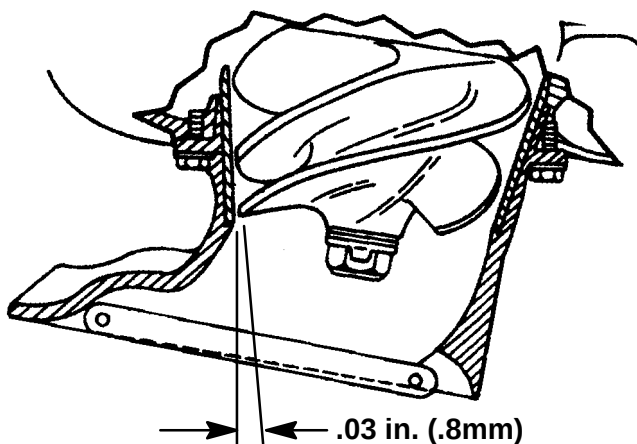
## INSTALLATION

1. Grease the drive shaft, shear key, and impeller bore. Place the plastic sleeve inside the impeller and install impeller, shear key, shims nut retainer, and impeller nut. Turn the nut tight on the shaft to remove any play between the impeller and shaft. If the tabs on the retainer do not line up with the flats on the nut, remove the nut and turn the retainer over and re-tighten the nut.

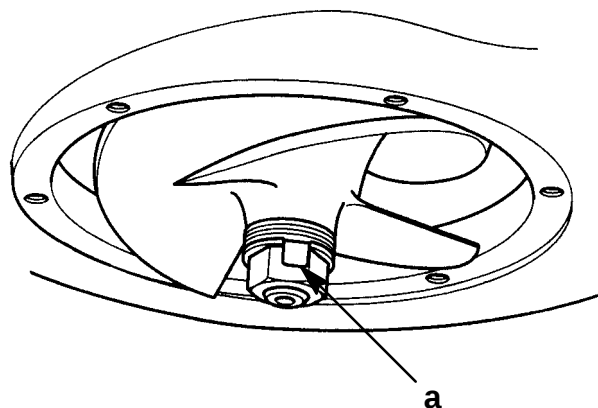


- a - Plastic Sleeve
- b - Impeller
- c - Shear Key
- d - Shims
- e - Nut Retainer
- f - Impeller Nut

2. Temporarily reinstall the water intake housing in order to check for impeller clearance. The clearance between the impeller and liner should be 0.030 in. (0.8 mm). Shim washers can be transferred to either side of the impeller to raise or lower the impeller to the correct clearance setting. The water intake housing can be shifted sideways a small amount in order to center the liner.

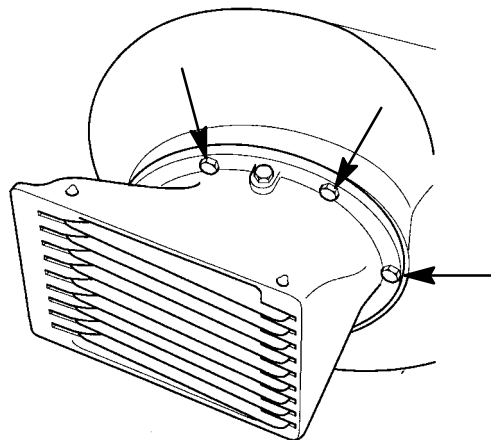


3. After setting the impeller height, tighten the impeller nut snug with a wrench. Secure impeller nut by bending tabs against the flats on the impeller nut.



a - Tabs

4. Reinstall the water intake housing with six bolts. Check clearance around the impeller to make sure the water intake housing is centered and not rubbing against the liner. Torque mounting bolts to 96 lb. in. (10.8 N·m).

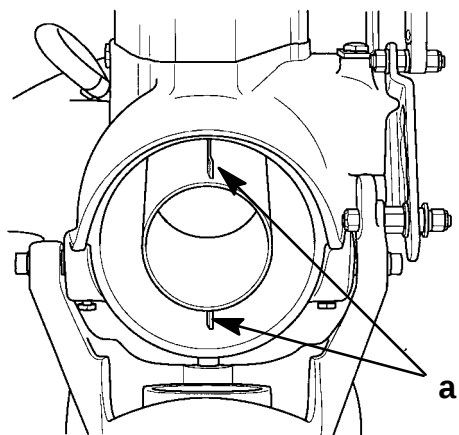


**NOTE:** If the outboard is used in salt water, apply Quicksilver Anti-Corrosion Grease around the entire mounting flange on the water intake housing and also to the threads on the six mounting bolts.



## Steering Pull Adjustment

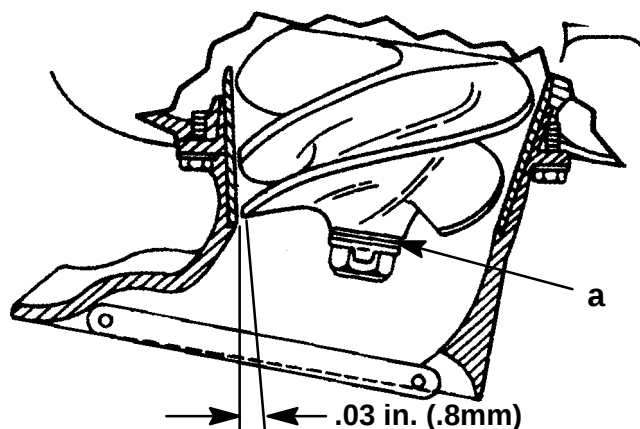
The steering on some boats will have the tendency to pull towards starboard. This pulling condition can be corrected by using a pliers and bending the ends of the exhaust fins  $\frac{1}{16}$  in. (1.5mm) toward the starboard side of the outboard.



a - Exhaust Fins

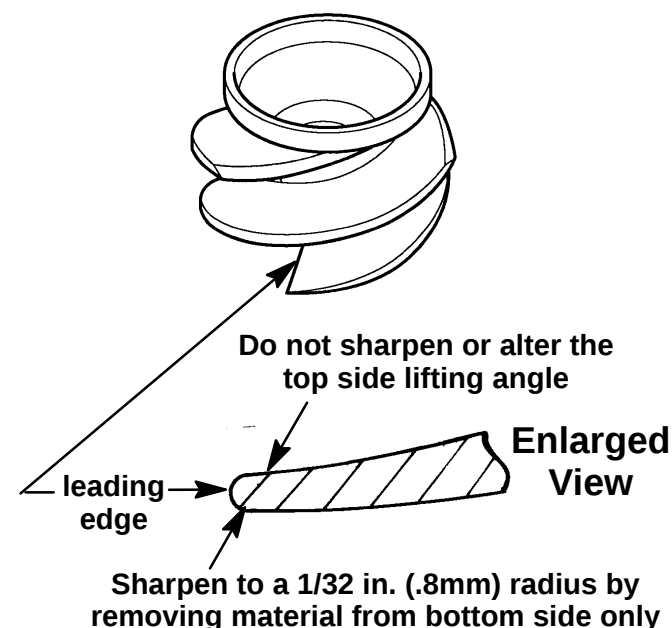
## Impeller Clearance Adjustment

1. The impeller should be adjusted so there is approximately 0.03 in. (0.8mm) clearance between the impeller edge and liner. Operating the jet drive in waters that contain sand and gravel can cause wear to the impeller blades, and the clearance will start to exceed 0.03 in. (0.8mm). As the blades wear, shims located in the stack outside of the impeller can be transferred behind the impeller. This will move the impeller further down into the tapered liner to reduce the clearance.
2. Check the impeller clearance by sliding a feeler gauge through the intake grate and measure the clearance between the impeller edge and liner. If adjustment is required, refer to Impeller Removal and Installation.



a - Shims

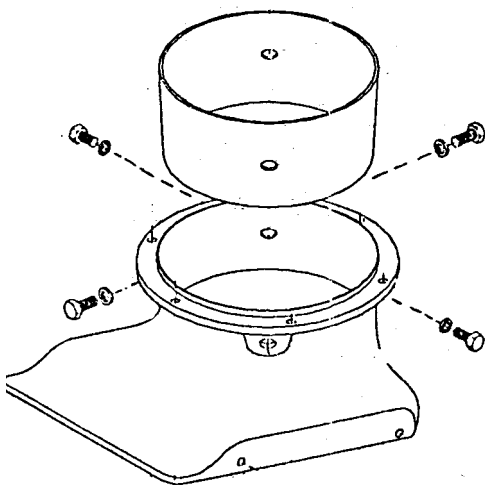
## Worn (Dull) Impeller



The intake of gravel through the pump can round off and wear the leading edges on the impeller. Some conditions you may experience from a worn impeller are: (1) a noticeable performance loss, especially on acceleration, (2) difficulty getting the boat on plane, or (3) an increase in engine RPM at wide open throttle. Check the impeller blades occasionally for damage. Use a flat file to resharpen the leading edges as shown.



## Liner Replacement



1. Mark the liner mounting bolts for reassembly into the same holes. Remove the bolts.
2. Remove the liner. If the liner is tight, tap on the inner edge of the liner with a long drift punch through the intake grate.

**NOTE:** Apply grease to the liner mounting bolt threads before assembly.

3. Position the liner into the water intake housing. Line up one of the liner bolts and lightly thread it in. It may be necessary to tap or press the liner into the water intake housing to locate the liner for installation of the remaining bolts. Torque bolts to 100 lbs. in. (11.2 N·m).
4. Grind off the ends of any bolts that may extend beyond the inner liner surface.

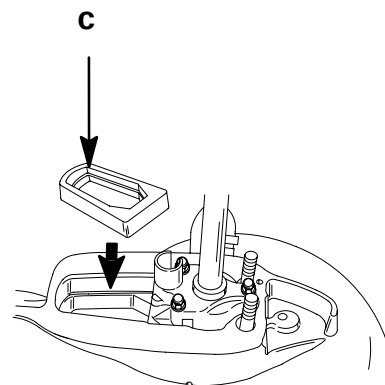
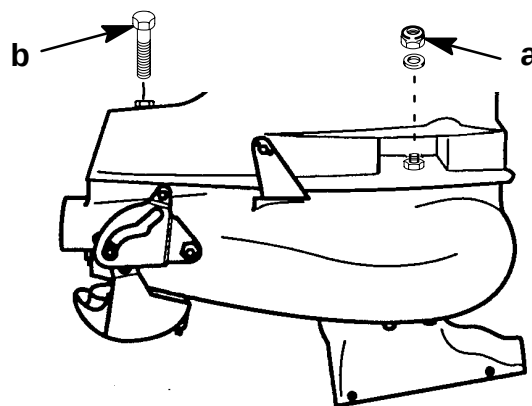
## Jet Drive Removal and Installation

### REMOVAL

1. Remove 2 locknuts and bolt securing jet drive to drive shaft housing and remove jet drive.

### INSTALLATION

1. Install the exhaust tube seal into the jet drive.
2. Install jet drive with bolt and locknuts as shown.



- a - Locknut and Washer (2) - Torque to 60 lb. ft. (81.4 N·m)  
b - Bolt - Apply Loctite to Threads and Torque to 22.5 lb. ft. (30.5 N·m)  
c - Seal - Exhaust Seal



# Water Pump Removal and Installation

## REMOVAL

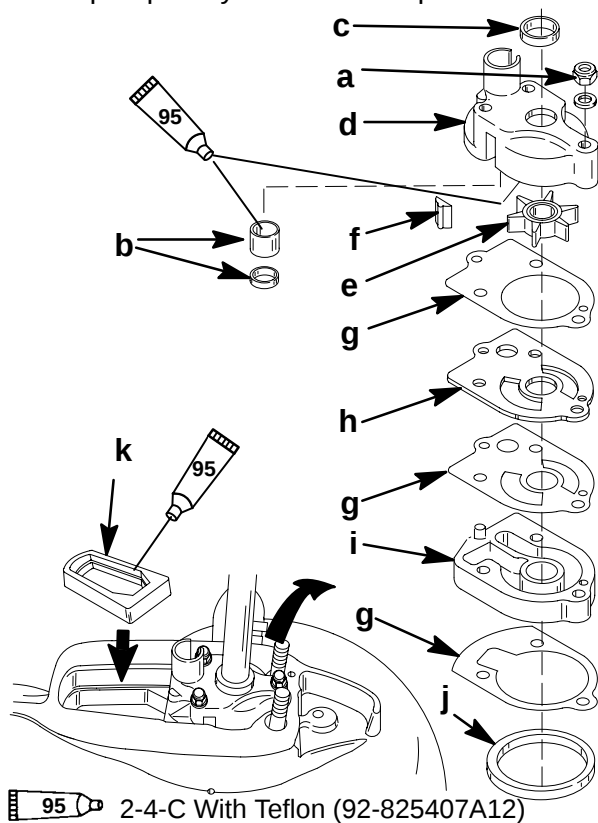
1. Remove water pump assembly as shown.

## INSTALLATION

**IMPORTANT:** If impeller being installed has been previously used and vanes have taken a "set," **DO NOT** install the impeller with the vanes reversed from their previous "set" as vane breakage will occur shortly after unit is returned to service.

**NOTE:** Apply a light coat of 2-4-C w/Teflon to inside of pump body to ease installation of body over impeller.

1. Seat the metal ring into the counter bore below the water pump.
2. Reassemble water pump assembly as shown. Rotate drive shaft **CLOCKWISE** while pressing water pump body down over impeller.



95 2-4-C With Teflon (92-825407A12)

- a - Locknut and Flat Washer (3), Torque to 30 lb. in. (3.4N·m)
- b - Water Tube Seal and Washer
- c - Rubber Ring
- d - Water Pump Body Assembly
- e - Impeller
- f - Key
- g - Gasket
- h - Plate
- i - Base
- j - Metal Ring
- k - Seal - Exhaust Tube (Place into Jet Drive Housing)

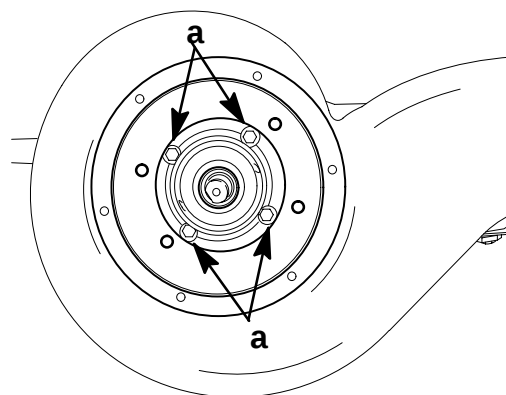
# Bearing Carrier Removal and Installation

## REMOVAL

1. Remove water assembly.
2. Remove 4 bolts securing bearing carrier to jet drive, and remove bearing carrier.

## INSTALLATION

1. Reinstall bearing carrier as shown.

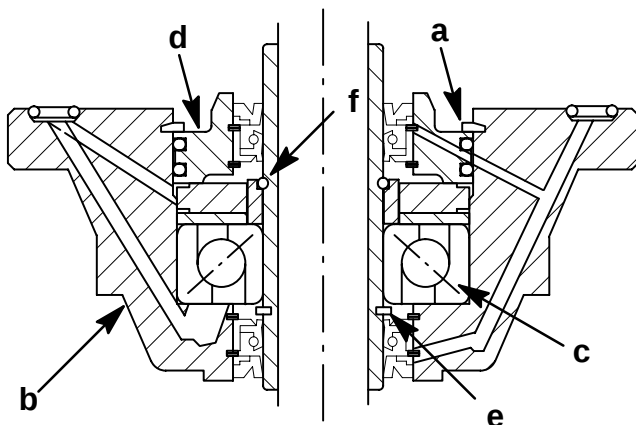


a - Bolts (4) Apply Loctite 271 to Threads, Torque to 70 lb. in. (7.9 N·m)



## Bearing Carrier Disassembly

1. Remove the large beveled snap ring from the bearing carrier.
2. Heat the bearing carrier with a torch only until you can barely touch it.
3. Hold the drive shaft vertical and bump the impeller end of the drive shaft against a wooden block causing the bearing carrier to slide down off the bearing.
4. Remove snap ring, press the ball bearing off the drive shaft. Leave the bearing thrust ring (located in the drive shaft groove) unless damaged.
5. Remove the seals and spiral retaining rings from the bearing carrier and the upper seal housing.
6. Clean all parts thoroughly and remove any burrs.



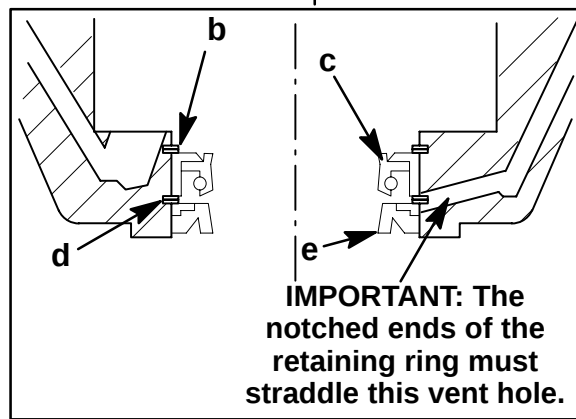
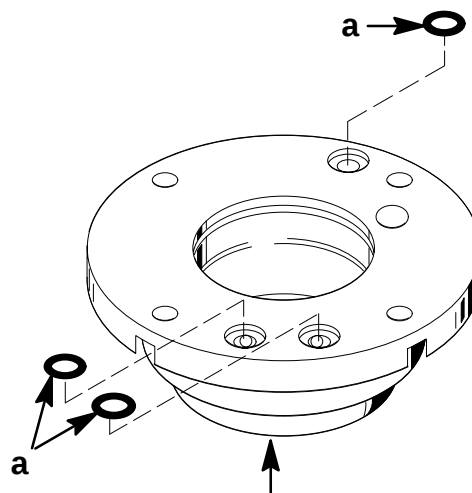
- a - Snap Ring
- b - Bearing Carrier
- c - Ball Bearing
- d - Upper Seal Housing
- e - Snap Ring
- f - Thrust Ring

## Bearing Carrier Reassembly

### Installing Lower Seals

Install seals into bearing carrier as follows:

1. Install O-ring seals into the top seats of the three passage holes.
2. Install spiral retaining ring into the inner ring groove.
3. Spread a film of grease around the inside bore of the seal surface before pressing in the seals.
4. Press in the garter spring seal against the inner retaining ring as shown. Fill the garter spring cavity in the seal with grease.
5. Install spiral retaining ring into the outer ring groove. Align the notched ends of the retaining ring to straddle the small vent hole drilled in the ring groove.
6. Press in the outer seal against the retaining ring as shown.
7. Grease all the seal lips.

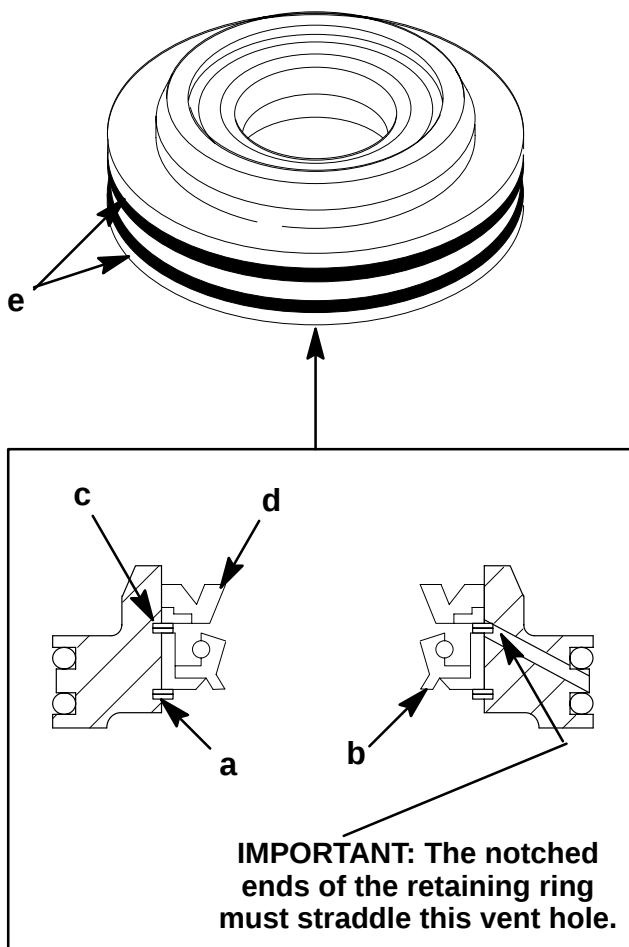


- a - O-rings
- b - Retaining Ring
- c - Spring Seal
- d - Retaining Ring
- e - Outer Seal



## Installing Upper Seals

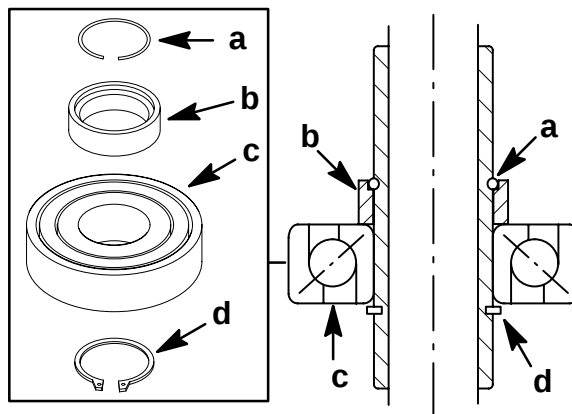
1. Install spiral retaining ring into the inner ring groove of the upper seal housing.
2. Spread a film of grease around the inside bore of the seal surface before pressing in the seals.
3. Press in the garter spring seal against the inner retaining ring. Fill the garter spring cavity in the seal with grease.
4. Install spiral retaining ring into the outer ring groove. Align the notched ends of the retaining ring to straddle the small vent hole drilled in the ring groove.
5. Press in the outer seal against the retaining ring.
6. Grease all the seal lips.
7. Grease the two O-ring seals and install them into the outer ring grooves.



- a - Retaining Ring
- b - Spring Seal
- c - Retaining Ring
- d - Outer Seal
- e - O-rings

## Installing Drive Shaft Ball Bearing

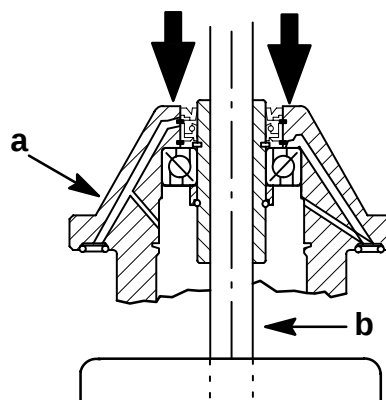
1. If removed, install the bearing thrust ring into the groove on the drive shaft.
2. Install collar onto the drive shaft. Press the new ball bearing onto the drive shaft, **pressing against the inner race only**. Press collar over the thrust ring, locking it in its groove. Install snap ring into drive shaft groove below the bearing.



## Installing Drive Shaft

1. Lubricate the seals and inside bore of the bearing carrier.
2. Place the drive shaft ("b" impeller end facing up) into a vise.
3. Heat the bearing carrier until it feels warm to the touch.
4. Place the bearing carrier onto the drive shaft. Square up the inner bore with the ball bearing and push the bearing carrier down until it bottoms out against the bearing. It may be necessary to lightly tap bearing carrier onto the bearing using a rubber hammer.

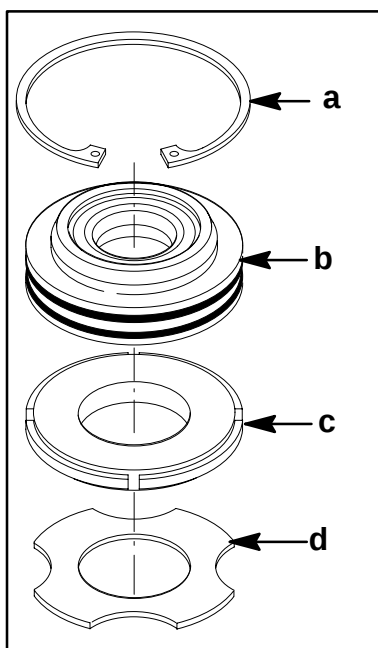
**NOTE:** Only a light pressing force is needed to press on the bearing carrier. It may be necessary to lightly tap the bearing carrier onto the bearing using a rubber hammer.



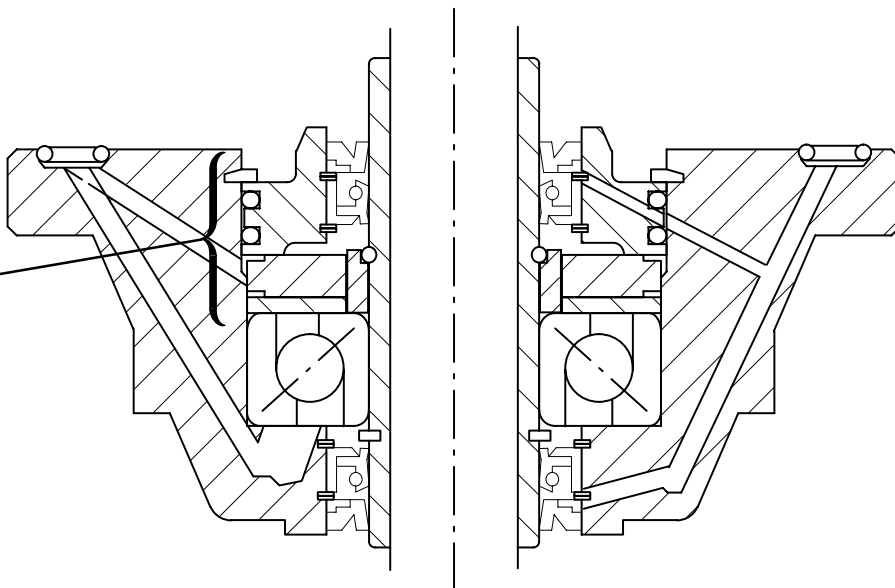
- a - Bearing Carrier
- b - Drive Shaft



5. Grease the upper seals and inside bore of the bearing carrier to ease entry of the seal housing.
6. Install the thrust washer against the ball bearing.
7. Install spacer, and the upper seal housing being careful not to damage the O-ring seals as they pass the snap ring groove. Only finger pressure should be necessary to push in the housing.
8. Install the beveled snap ring, beveled side facing up into the ring groove. Make sure the snap ring is fully seated into groove.



- a - Snap Ring  
b - Upper Seal Housing  
c - Spacer  
d - Thrust Washer





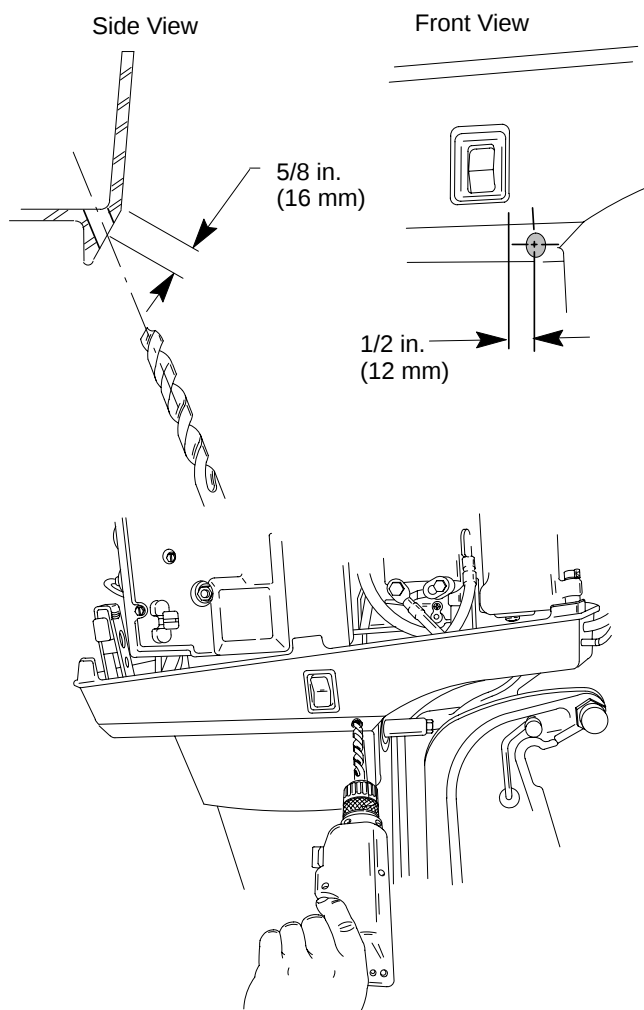
# Jet Drive Tiller Handle Adaptor Kit

## Installation Instructions

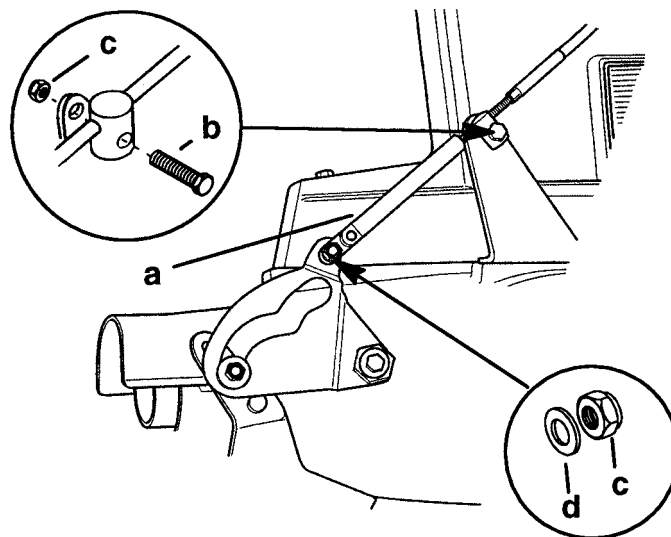
**NOTE:** This kit must be used in conjunction with the recommended Quicksilver tiller handle kit.

Install tiller handle kit (except shift cable connection and adjustment) using instructions provided with kit.

1. Drill hole in bottom cowl for cable routing as follows:
  - a. Locate the centerlines for the hole following the dimensions given in the illustration below. Use a center punch to mark center of hole.
  - b. Drill a 1/4 in. pilot hole and then a 9/16 in. hole angling up into the bottom cowl.

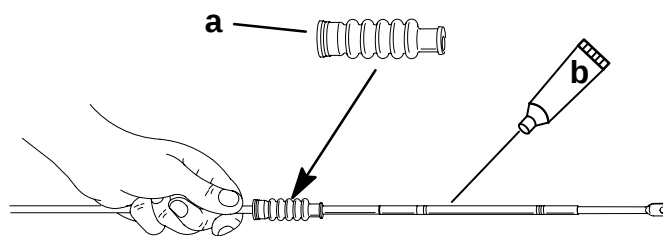


2. Install the shift cable to the jet drive. Use the existing mounting hardware supplied with the out-board. Adjust shift cable after kit is installed.



- a - Shift Cable
- b - Bolt
- c - Locknut
- d - Flat Washer

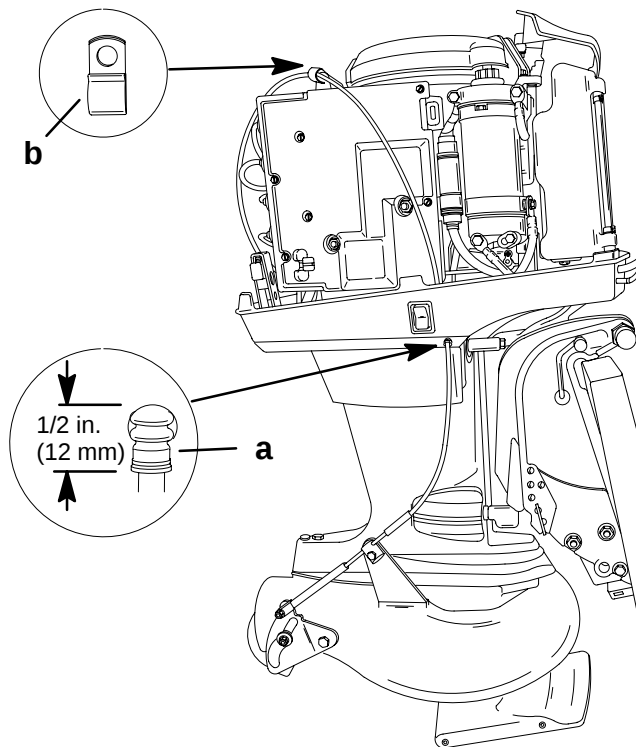
3. Lubricate the shift cable. Slide the cable boot onto the cable.



- a - Cable Boot
- b - Lubricant

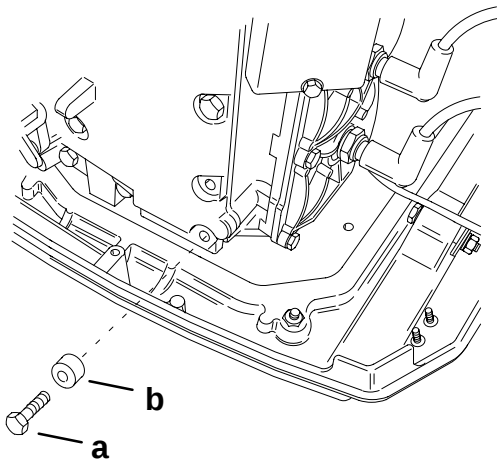


4. Slide the shift cable through the drilled hole.
5. Position the cable boot 1/2 in. (12 mm) out of the drilled hole.
6. Fasten shift cable to the engine with J-clip.



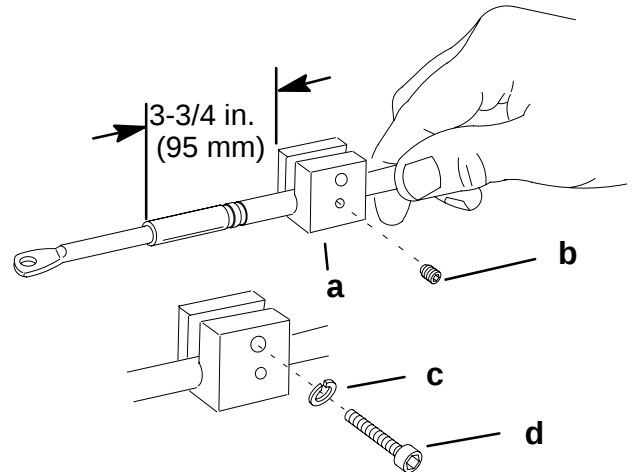
a - Position Cable Boot 1/2 in. (12 mm) Out of Drilled Hole  
b - J-Clip

7. Install bolt and 21/32 in. long spacer into bottom hole on the exhaust cover. Do not tighten bolt at this time.



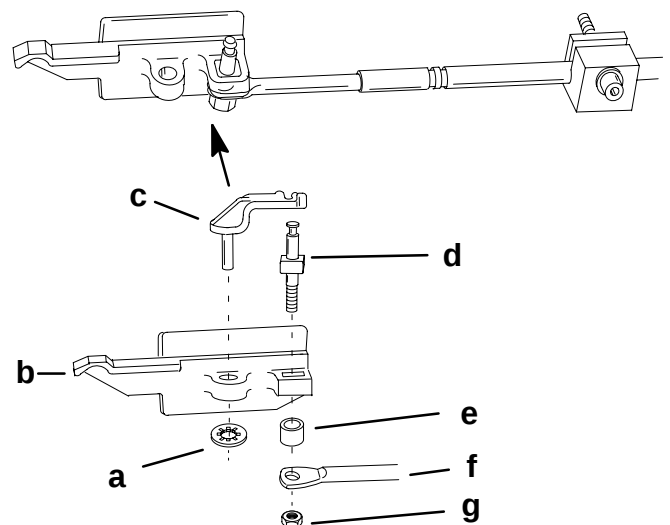
a - Bolt – 1-3/4 in. Long – Do Not Tighten At This Time  
b - Spacer - 21/32 in. Long

8. Rotate the shift cable retainer so that the set screw is facing out and the slot is facing up.
9. Slide shift cable into retainer until brass tube extends out 3-3/4 in. (95 mm). Secure the retainer at this position by tightening the set screw until its snug, then add an additional 1/8 turn.
10. Install the Allen head screw and tighten securely.



a - Shift Cable Retainer  
b - Set Screw  
c - Lock Washer  
d - Allen Head Screw - Tighten Securely

11. Install the shift slider onto the end of the shift cable. Tighten locknut, then back-off 1/4 turn.
12. Fasten the rod end retainer with retaining ring.

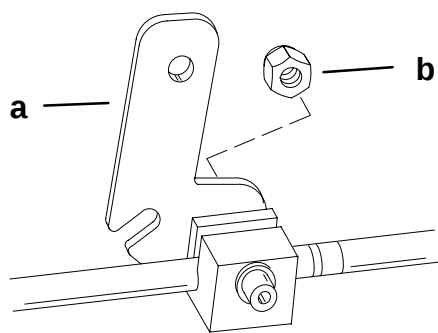


a - Retaining Ring  
b - Shift Slider  
c - Rod End Retainer  
d - Stud  
e - Bushing  
f - Shift Cable  
g - Locknut - Tighten, Then Back-Off The Locknut 1/4 Turn



13. Fasten the anchor plate to the shift cable retainer.

**IMPORTANT: Do not over-tighten. Shift cable retainer must be free to pivot.**

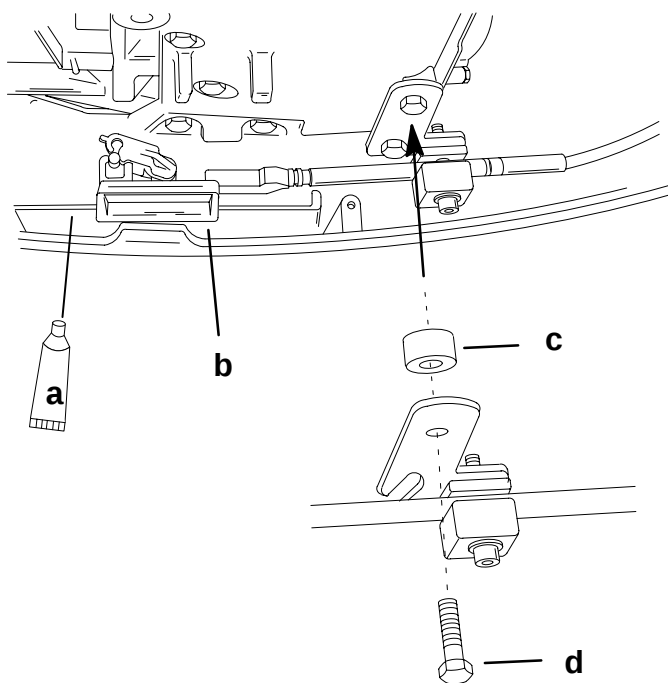


a - Anchor Plate

b - Locknut - Tighten, Then Back-Off The Locknut 1/4 Turn

14. Lubricate the shift slider rail in the bottom cowl with Quicksilver 2-4-C Multipurpose Lubricant with Teflon.

15. Place the shift slider on the rail and fasten the anchor plate to the engine. Torque bolts to 200 lb. in. (22.6 N-m).



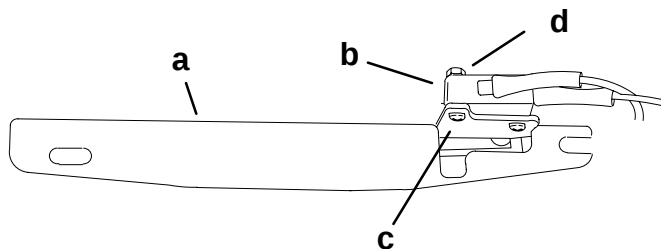
a - Lubricate Shift Slider Rail With Quicksilver 2-4-C Multipurpose Lubricant with Teflon

b - Shift Slider

c - Spacer - 23/32 in. Long

d - Bolt - 1-3/4 in. Long

16. Refer to the parts provided with your tiller handle kit and install the neutral start switch to the retainer. Do not tighten screws at this time.



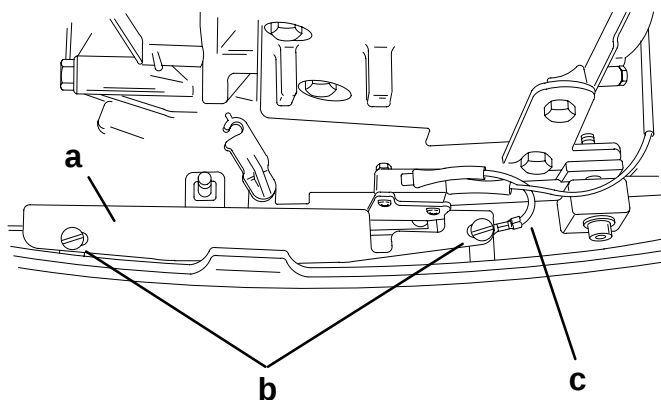
a - Retainer

b - Neutral Start Switch

c - Screw (2) - Do Not Tighten At This Time

d - Locknut (2)

17. Install retainer with two screws.



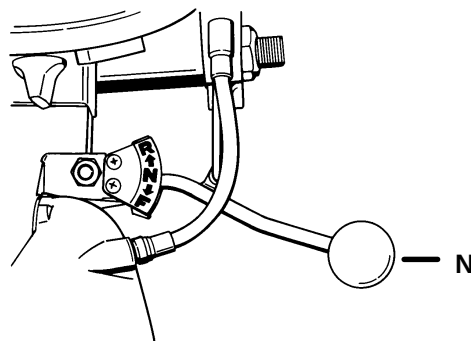
a - Retainer

b - Screw (2) - Provided With This Kit

c - Connect Ground Wire (From Neutral Start Switch) With Screw

18. Adjust the neutral start switch as follows:

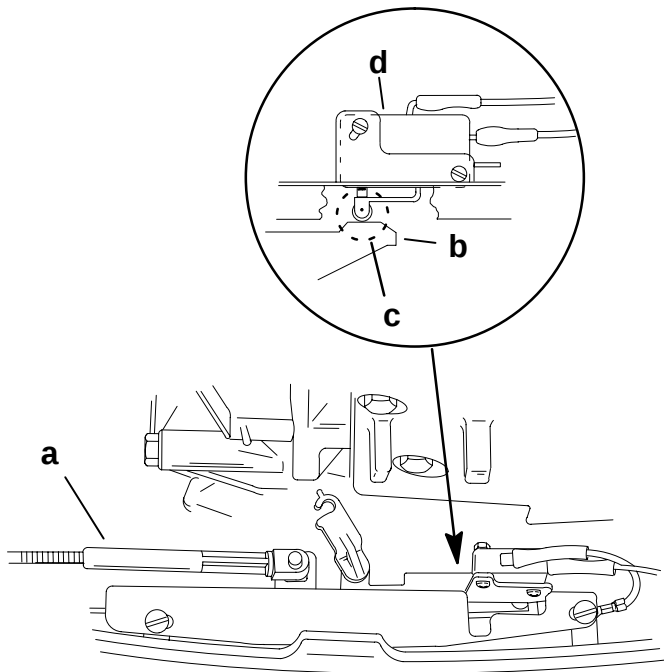
a. Place the outboard shift lever into neutral position.



b. With the shift lever in neutral, adjust the shift rod so that the flat lobe on the shift slider is centered with the roller on the neutral start switch.

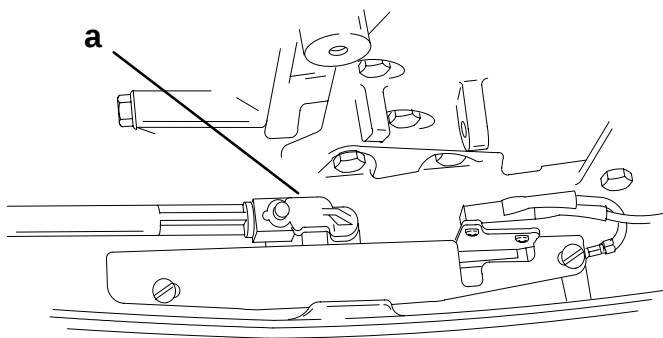


- c. Loosen the upper mounting screw for the neutral start switch. Rotate the neutral start switch up, then lower the switch until the roller activates the switch (clicks). Fasten switch at this position.



- a - Shift Rod  
b - Shift Slider  
c - Center Flat Lobe with Roller  
d - Neutral Start Switch

19. Secure shift rod with rod end retainer.



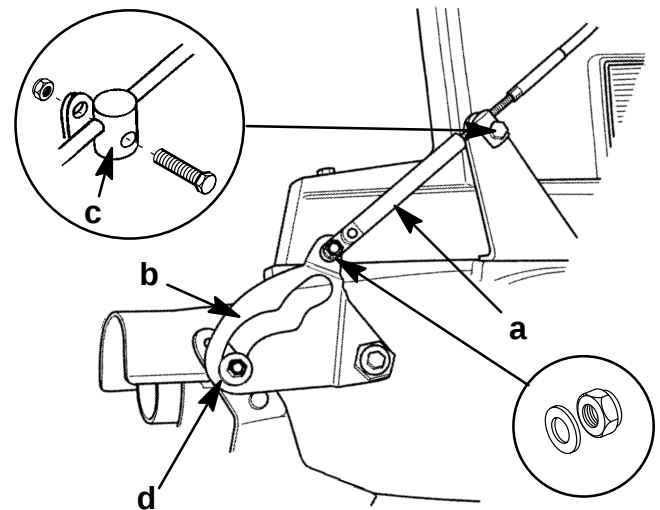
- a - Rod End Retainer

## Shift Cable Adjustment

### ⚠ WARNING

The shift cable must be adjusted to lock the reverse gate against unexpected engagement (caused by water pressure hitting the gate) while operating the boat in forward. Activation of the reverse gate will cause sudden unexpected stopping of the boat. Sudden stopping may cause occupants to be thrown within the boat or even out of the boat. This action may result in serious injury or death.

1. Place shift lever into full forward position.
2. Adjust the brass barrel on the shift cable so that roller is at the full end of travel (bottom) in the shift cam when the shift lever is in forward.
3. Attach the brass barrel to the bracket with bolt and locknut. Tighten the bolt until it seats against the barrel, then back-off the bolt 1/4 turn. Hold bolt from turning, and tighten locknut on bolt. The barrel must be free to pivot.



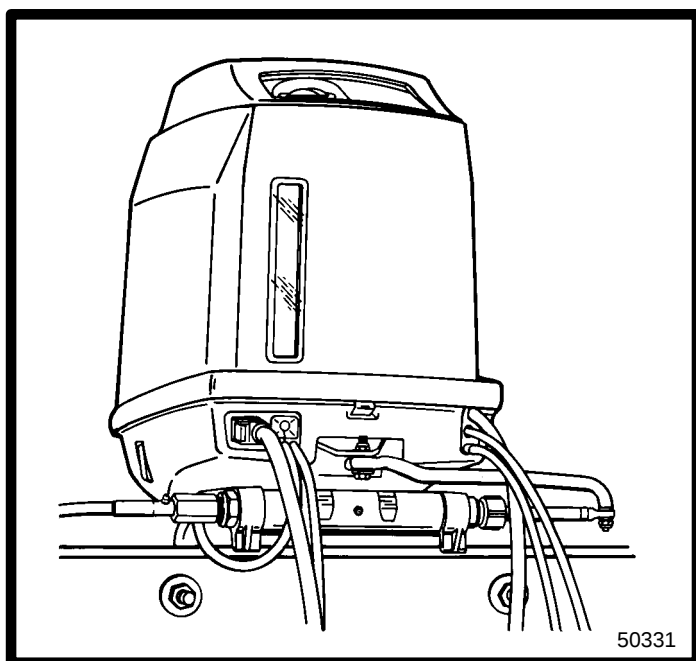
- a - Shift Cable  
b - Shift Cam  
c - Barrel  
d - Roller

4. Recheck the shift cable adjustment in forward shift position. The correct shift adjustment will position the cam far enough on the roller in order to lock the the reverse gate into forward position. You should not be able to forcibly push up the reverse gate toward neutral. Pull on the reverse gate by hand to verify this.

**IMPORTANT:** The forward locking of the reverse gate must be met. If not, readjust the shift cable.



# OUTBOARD MOTOR INSTALLATION/ ATTACHMENTS



7

A

## OUTBOARD MOTOR INSTALLATION/ATTACHMENTS



# Table of Contents

## Page

|                                                                                                                             |       |
|-----------------------------------------------------------------------------------------------------------------------------|-------|
| Installing Outboard Motor on Transom                                                                                        | 7A-1  |
| Determining Recommended Outboard Mounting Height                                                                            | 7A-1  |
| Locate Centerline of Boat Transom                                                                                           | 7A-1  |
| Drilling Outboard Mounting Holes                                                                                            | 7A-2  |
| Lifting Outboard                                                                                                            | 7A-2  |
| Securing Outboard to Boat Transom                                                                                           | 7A-3  |
| Securing Outboard to Boat Transom Using Optional Outboard Mounting Kit (P/N 812432A1)                                       | 7A-3  |
| Single Cable - Single Outboard Ride Guide Steering Attaching Kit (P/N 19608A3 and P/N 19609A2) Installation                 | 7A-4  |
| Component Removal - Tiller Handle Models                                                                                    | 7A-4  |
| Steering Bracket Installation - Tiller Handle Models                                                                        | 7A-4  |
| 19608A-3 Ride Guide Steering Attaching Kit Installation – Steering Cable Routed for Starboard Entry into Outboard Tilt Tube | 7A-4  |
| Installing Ride Guide Cable to Outboard Tilt Tube                                                                           | 7A-4  |
| Installing Steering Link Rod                                                                                                | 7A-5  |
| 19609A-2 Ride Guide Steering Attaching Kit Installation - Steering Cable Routed for Port Entry into Outboard Tilt Tube      | 7A-6  |
| Tilt Tube Reversal                                                                                                          | 7A-6  |
| Installing Ride Guide Cable to Outboard Tilt Tube                                                                           | 7A-6  |
| Installing Steering Link Rod                                                                                                | 7A-7  |
| Maintenance Instructions                                                                                                    | 7A-7  |
| Single Cable - Dual Outboard Ride Guide Steering Kit (P/N 97933A4) Installation                                             | 7A-8  |
| Installation Requirements                                                                                                   | 7A-8  |
| Steering Cable Installation - Cable Routed Down Starboard Side of Boat to Port Outboard                                     | 7A-9  |
| Installing Steering Link Rod                                                                                                | 7A-9  |
| Steering Cable Installation - Cable Routed Down Port Side of Boat to Starboard Outboard                                     | 7A-10 |
| Tilt Tube Reversal                                                                                                          | 7A-10 |
| Installing Steering Cable                                                                                                   | 7A-10 |
| Installing Steering Link Rod                                                                                                | 7A-11 |
| Maintenance Instructions                                                                                                    | 7A-11 |
| Steering Coupler Assembly                                                                                                   | 7A-12 |
| Steering Coupler Installation                                                                                               | 7A-13 |
| Ride-Guide Steering Attachment Extension Couplers                                                                           | 7A-14 |
| Trim Tab Adjustment                                                                                                         | 7A-14 |
| Dual Outboard                                                                                                               | 7A-14 |
| Maintenance Instructions                                                                                                    | 7A-14 |

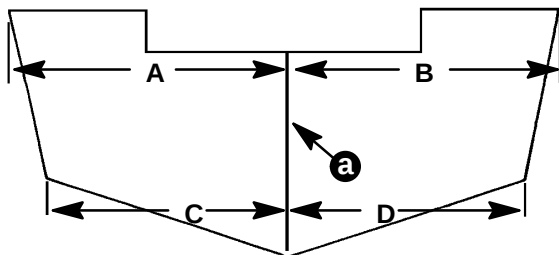
## Page

|                                                                                           |       |
|-------------------------------------------------------------------------------------------|-------|
| Transom Mounted Ride Guide Attaching Kit Installation (73770A1)                           | 7A-15 |
| Attaching Kit Installation                                                                | 7A-15 |
| Clevis Attaching Kit Installation (P/N 70599A4)                                           | 7A-16 |
| Installation Instructions                                                                 | 7A-16 |
| Maintenance Instructions                                                                  | 7A-17 |
| Steering Cable Installation                                                               | 7A-18 |
| Maintenance Instructions                                                                  | 7A-18 |
| Selecting Steering Cable and Remote Control Cables                                        | 7A-19 |
| Remote Control Installation                                                               | 7A-19 |
| Shift Cable Installation and Adjustment to Engine                                         | 7A-19 |
| Throttle Cable Installation and Adjustment to Engine                                      | 7A-20 |
| Connecting Remote Control Wiring Harness to Engine Wiring Harness (Electric Start Models) | 7A-21 |
| Power Trim Wiring Connections (Models So Equipped)                                        | 7A-22 |
| Battery Connections                                                                       | 7A-22 |
| Connecting Remote Control Stop Switch Wiring to Engine Wiring (Manual Start Models)       | 7A-23 |



## Locate Centerline Of The Boat Transom

Locate (and mark with pencil) the vertical centerline of boat transom.



a - Centerline of Transom

**NOTE:** Dimensions "A" & "B" and "C" & "D" are equal length.

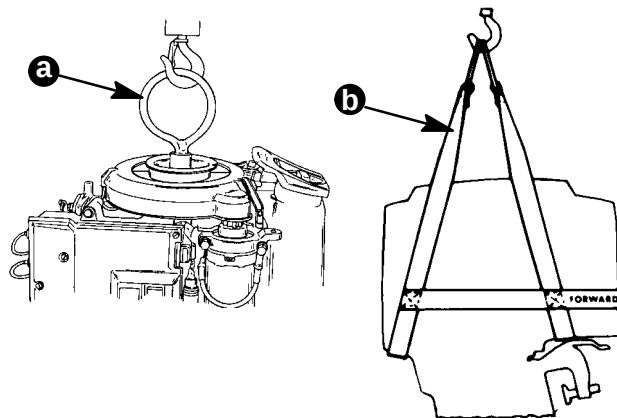
**IMPORTANT:** During installation of dual outboards, the following is recommended. A minimum of 21 inches (533 mm) centerline to centerline width is recommended. This is required to alleviate cowling interference during lock to lock turns if one outboard would be in the full tilt position, while the other outboard(s) are in the vertical running position.

## Lifting Outboard

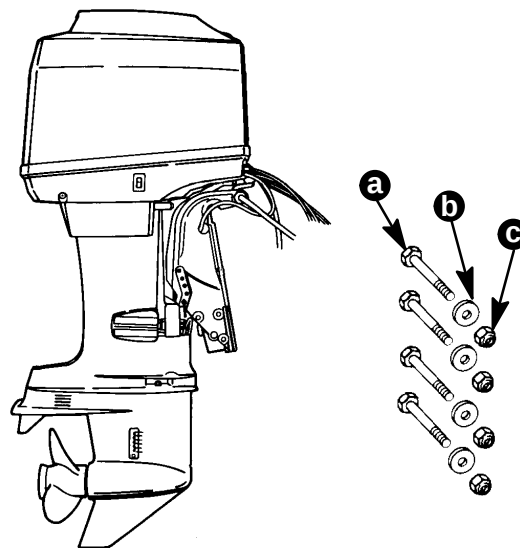
### ⚠ WARNING

Verify that the lifting ring (a) is threaded into the flywheel a minimum of 5 turns and that hoist has a maximum lift capacity over 500 lbs. (227 kg) **BEFORE** lifting outboard.

1. Electric Start Models – Remove plastic cap from center of flywheel. Thread lifting ring ("a" 91-90455) into flywheel hub a minimum of 5 turns. Replace plastic cap after installation.
2. Manual Start Models – Use lifting harness ("b" 91-64400A2).



## Installing Outboard On Boat Transom Models Without Transom Clamp Handles



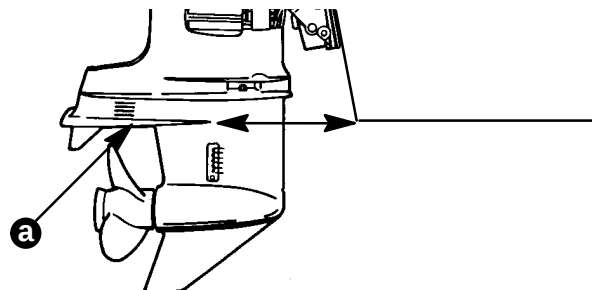
- a - Mounting Bolts (4)
- b - Flat Washers (4)
- c - Locknuts (4)

### ⚠ WARNING

**DO NOT**, under any circumstances, allow upper outboard mounting bolts to be closer than 1 inch (25.4mm) from top of boat transom. Upper mounting bolts must never be installed thru shims.

**NOTE:** When drilling into a fiberglass boat, place masking tape directly onto boat where mounting holes will be drilled to help prevent fiberglass from chipping.

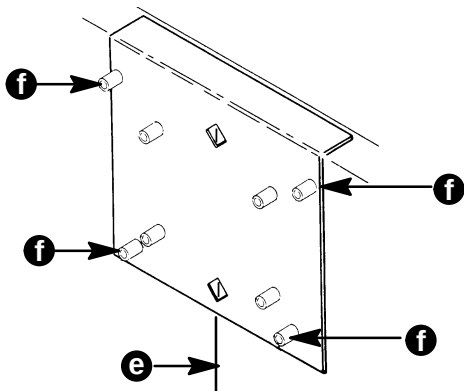
It is recommended for best-all-around boating performance, the outboard should be mounted so the anti-ventilation plate (a) is in-line with the boat bottom.



Use a 17/32 inch (13.5mm) diameter drill bit and drill two mounting holes for the upper set of mounting bolts and two holes for the lower set of mounting bolts.



**NOTE:** If using "Transom Drilling Fixture" (P/N 91-98234A2), use holes (f) when drilling outboard mounting holes.

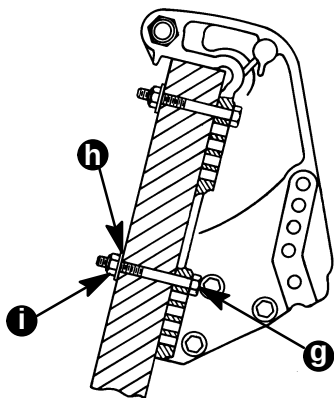


e - Centerline of Transom  
f - Use These Drilling Holes

**NOTE:** On some boats because of transom interference, it may be necessary to install the steering cable before fastening the outboard to the transom.

Position outboard on boat transom. Align the mounting holes in the transom brackets that will place the outboard nearest to the recommended mounting height.

Apply marine sealer to shanks of mounting bolts (not threads) and secure outboard to transom with 4 bolts, flat washers and locknuts, as shown. Be sure that installation is water-tight.

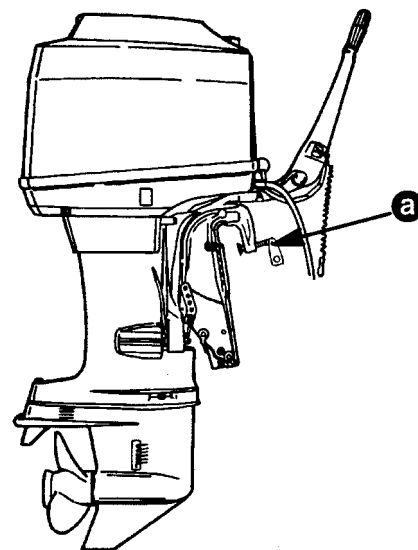


g - 1/2 Inch Diameter Bolts (4)  
h - Flat Washers (4)  
i - Locknuts (4)

### ⚠ CAUTION

Marine sealer must be used on shanks of mounting bolts to make a water-tight installation.

## Installing Outboard On Boat Transom Models With Transom Clamp Handles



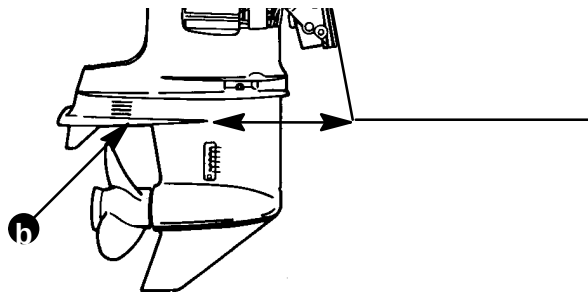
a - Transom Clamp Handles

### ⚠ WARNING

**DO NOT**, under any circumstances, allow the cupped washers on the ends of the transom clamp screws to be closer than 1 inch (25.4mm) from top of (real) boat transom, not shims.

**NOTE:** When drilling into a fiberglass boat, place masking tape directly onto boat where mounting holes will be drilled to help prevent fiberglass from chipping.

It is recommended for best-all-around boating performance, the outboard should be mounted so the anti-ventilation plate (b) is in-line with the boat bottom.

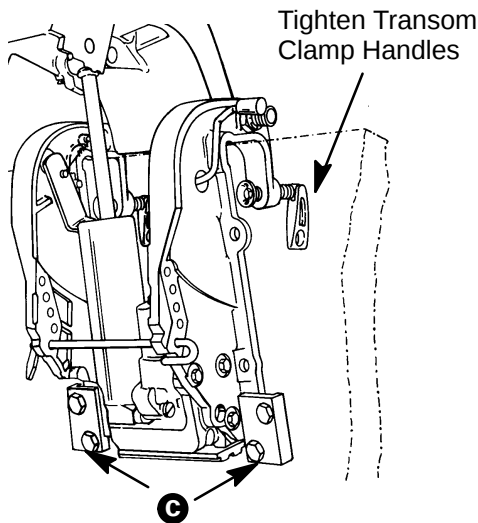


### ⚠ WARNING

Before operation, the outboard must be correctly installed with four mounting bolts shown. Failure to correctly fasten outboard could result in outboard ejecting off boat transom causing serious injury, death, or property damage.



**IMPORTANT:** Outboards with transom clamp handles can be secured to the boat transom, using optional Quicksilver Accessory Outboard Mounting Kit ("C" P/N 812432A4), to allow for quick removal and installation of outboard. Refer to installation instructions supplied with the mounting kit before drilling any mounting holes in the boat transom. Tighten transom clamp handles when using mounting kit.



### **⚠ WARNING**

Outboard must be fastened to boat transom one of two ways, permanently fastened to transom with transom clamp handles, and mounting bolts (provided), or secured to the transom using the optional outboard mounting kit (P/N 812432A4) should the outboard strike an underwater object or be steered into a sharp turn. Failure to fasten outboard correctly to the boat transom with mounting bolts or optional mounting kit could result in outboard ejecting suddenly off boat transom causing serious injury, death, boat damage or loss of outboard.

### **FASTENING OUTBOARD TO THE BOAT TRANSOM**

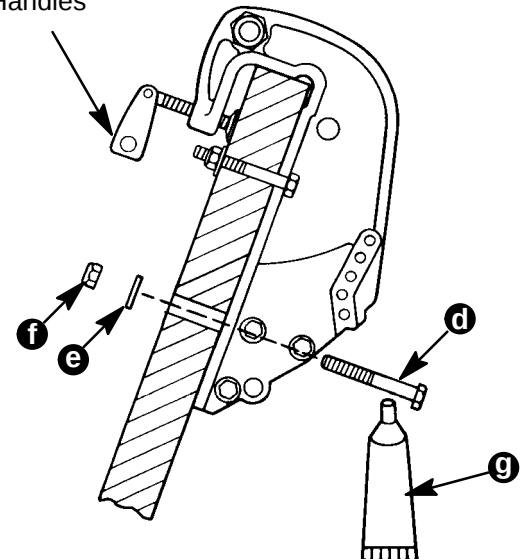
**IMPORTANT:** Read the preceding WARNING before installing outboard.

Use a 17/32 inch (13.5mm) diameter drill bit and drill two upper mounting holes and two lower mounting holes.

Position outboard on boat transom. Align the mounting holes in the transom brackets that will place the outboard nearest to the recommended mounting height.

Apply marine sealer to shanks of mounting bolts (not threads) and secure outboard to transom with 4 bolts, flat washers and locknuts, as shown. Be sure that installation is water-tight.

Tighten Transom Clamp Handles



d - 1/2 Inch Diameter Bolts (4)

e - Flat Washers (4)

f - Locknuts (4)

g - Marine Sealer

### **⚠ CAUTION**

Marine sealer must be used on shanks of mounting bolts to make a water-tight installation.



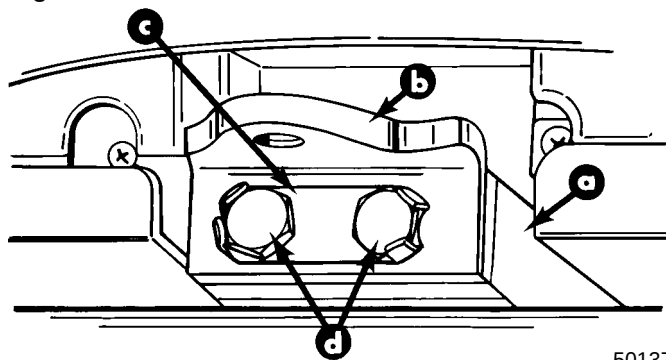
# Single Cable - Single Outboard Ride Guide Steering Attaching Kit (P/N 19608A3 and P/N 19609A2) Installation

## Component Removal - Tiller Handle Models

Remove (and discard) tiller handle assembly, spacer and mounting studs from outboard steering arm as outlined in appropriate outboard service manual.

## Steering Bracket Installation - Tiller Handle Models

Secure (supplied) steering bracket to outboard steering arm.



50137

- a - Outboard Steering Arm
- b - Steering Bracket
- c - Locking Retainer
- d - Bolt (2) 7/8 in. (22mm) Long - Torque to 40 lb. ft. (54 N·m). Then bend corner tabs of locking retainer up against flats on each bolt.

### WARNING

Locking retainer corner tabs, **MUST BE bent up and against flats on each bolt that secures steering bracket to outboard steering arm, to prevent bolts from turning out.**

## 19608A-3 Ride Guide Steering Attaching Kit Installation – Steering Cable Routed for Starboard Entry into Outboard Tilt Tube

Refer to “Quicksilver Accessories Guide” to determine correct length of steering cable and remote control cables.

**IMPORTANT:** Steering cable and remote control cables must be the correct length, sharp bends on too-short cables result in “kinks”; too-long cable require unnecessary bends and/or loops. Both conditions place extra stress on the cables.

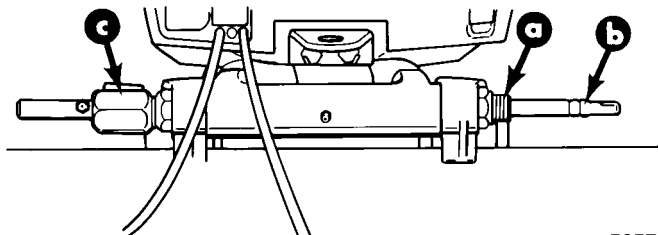
Install steering mount and steering wheel in accordance with installation instructions that accompany each.

## Installing Ride Guide Cable to Outboard Tilt Tube

**IMPORTANT:** Before installing steering cable into tilt tube, lubricate entire cable end with Quicksilver 2-4-C Marine Lubricant.

**NOTE:** Ride Guide Steering cable is lubricated at the factory and requires no additional lubrication at initial installation.

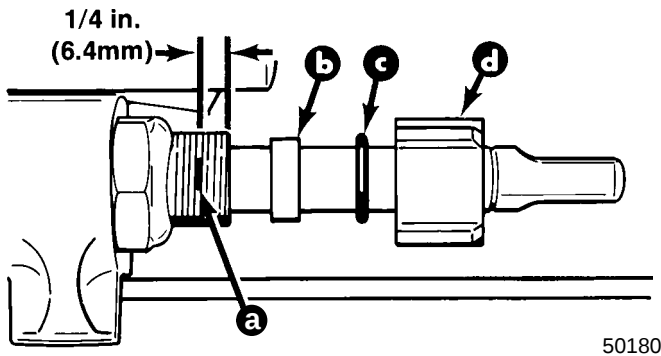
1. Lubricate inside of outboard tilt tube (a) and entire steering cable end (b) with Quicksilver 2-4-C Marine Lubricant.
2. Insert steering cable end thru outboard tilt tube and secure steering cable to tilt tube with steering cable attaching nut (c) as shown. Torque nut to 35 lb. ft. (41 N·m).



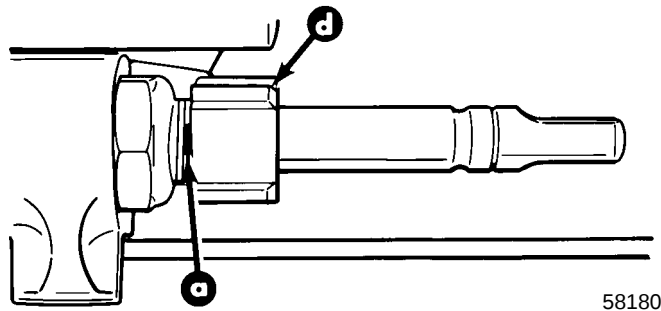
50579



3. Place a mark (a) on tilt tube 1/4 in. (6.4mm) from port end of tube. Slide plastic spacer (b), O-ring (c) and cap (d) over steering cable end, to tilt tube on outboard.



4. Thread cap (d) onto tilt tube, up to mark (a).



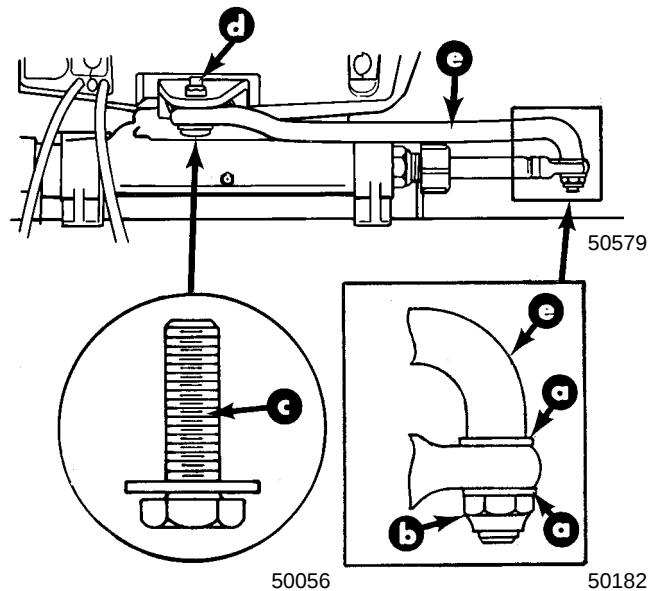
## Installing Steering Link Rod

### ⚠ WARNING

Steering link rod **MUST BE** secured between outboard steering arm/bracket and steering cable end, using special washer head bolt (P/N 10-14000) and two nylon insert locknuts (P/N 11-34863), as shown. Both special washer head bolt and nylon insert locknuts **MUST BE** tightened as specified.

Lubricate hole in end of steering cable, with Quicksilver 2-4-C Marine Lubricant. Assemble steering link rod to steering cable end, using 2 flat washers and nylon insert locknut. Tighten locknut until it seats [DO NOT exceed 120 lb. in. (14 N·m) of torque], then back nut off 1/4 turn.

Lubricate ball joint in steering link rod with SAE 30W Motor Oil. Secure link rod to outboard steering arm, using special washer head bolt (P/N 10-14000) provided and nylon insert locknut as shown. Torque special bolt 20 lb. ft. (27 N·m), then torque locknut to 20 lb. ft. (27 N·m).



- a - Flat Washer (2)
- b - Nylon Insert Locknut - Torque Until It Seats [DO NOT Exceed 120 lb. in. (14 N·m) of Torque], Then Back Nut Off 1/4 Turn
- c - Special Washer Head Bolt (P/N 10-14000) - Torque to 20 lb. ft. (27.1 N·m)
- d - Nylon Insert Locknut - Torque to 20 lb. ft. (27 N·m)
- e - Steering Link Rod

### ⚠ WARNING

After installation is complete (and before operating outboard), check that boat will turn to right when steering wheel is turned right and that boat will turn left when steering wheel is turned left. Check steering thru full range (left and right) at all tilt angles to assure interference-free movement.



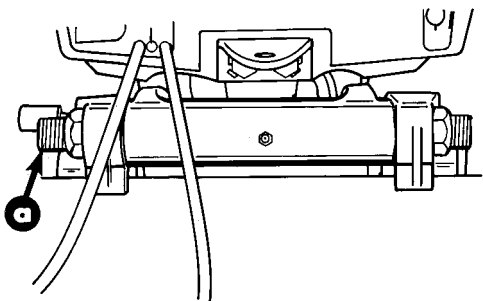
## 19609A-2 Ride Guide Steering Attaching Kit Installation - Steering Cable Routed for Port Entry into Outboard Tilt Tube

### TILT TUBE REVERSAL

#### ⚠ CAUTION

Outboard tilt tube **MUST BE** removed and reinstalled in the opposite direction (turned end for end), so that when reassembled, longer threaded end of tilt tube extends out port side of outboard approximately 3/4 in. (19mm). Failure to reposition outboard tilt tube as described, could interfere with steering system operation.

Remove outboard tilt tube and reinstall in opposite direction (turn end for end), so that when reassembled, longer threaded end (a) of tilt tube extends out port side of outboard approximately 3/4 in. (19mm). Refer to Section 5A "Midsection".



50579

Refer to "Quicksilver Accessories Guide" to determine correct length of steering cable and remote control cables.

**IMPORTANT:** Steering cable and remote control cables must be the correct length, sharp bends on too-short cables result in "kinks"; too-long cables require unnecessary bends and/or loops. Both conditions place extra stress on the cables.

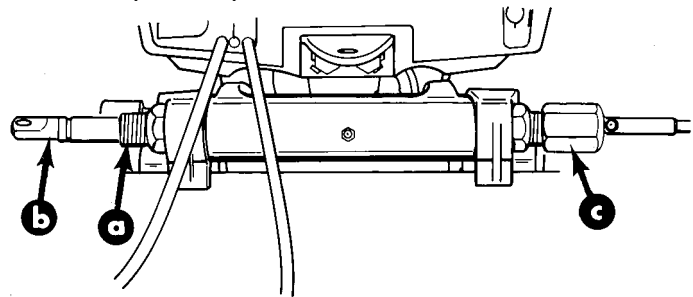
Install steering mount and steering wheel in accordance with installation instructions that accompany each.

## Installing Ride Guide Cable to Outboard Tilt Tube

**IMPORTANT:** Before installing steering cable into tilt tube, lubricate entire cable end with Quicksilver 2-4-C Marine Lubricant.

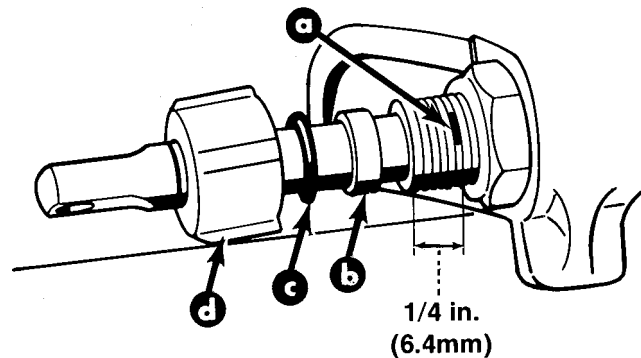
**NOTE:** Ride Guide Steering Cable is lubricated at the factory and requires no additional lubrication at initial installation.

1. Lubricate inside of outboard tilt tube (a) and entire steering cable end (b) with Quicksilver 2-4-C Marine Lubricant.
2. Insert steering cable end thru outboard tilt tube and secure steering cable to tilt tube with steering cable attaching nut (c) as shown. Torque nut to 35 lb. ft. (41 N·m).



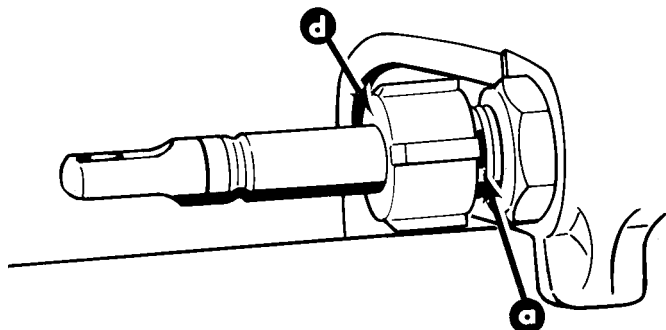
50579

3. Place a mark (a) on tilt tube 1/4 in. (6.4mm) from starboard end of tube. Slide plastic spacer (b), O-ring (c) and cap (d) over steering cable end, to tilt tube on outboard.



50325

4. Thread cap (d) onto tilt tube, up to mark (a).



50325



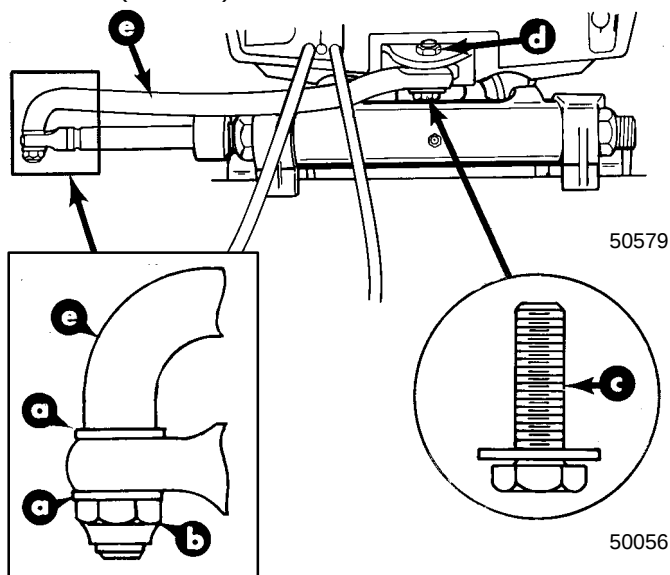
## Installing Steering Link Rod

### **⚠ WARNING**

Steering link rod **MUST BE** secured between outboard steering arm/bracket and steering cable end, using special washer head bolt (P/N 10-14000) and two nylon insert locknuts (P/N 11-34863), as shown. Both special washer head bolt and nylon insert locknuts **MUST BE** tightened as specified.

Lubricate hole in end of steering cable, with Quicksilver 2-4-C Marine Lubricant. Assemble steering link rod to steering cable end, using 2 flat washers and nylon insert locknut. Tighten locknut until it seats [DO NOT exceed 120 lb. in. (14 N·m) of torque], then back nut off 1/4 turn.

Lubricate ball joint in steering link rod with SAE 30W Motor Oil. Secure link rod to outboard steering arm, using special washer head bolt (P/N 10-14000) provided and nylon insert locknut as shown. Torque special bolt to 20 lb. ft. (27 N·m), then torque locknut to 20 lb. ft. (27 N·m).



- a - Flat Washer (2)
- b - Nylon Insert Locknut - Torque Until It Seats [DO NOT Exceed 120 lb. in. (14 N·m) of Torque], Then Back Nut Off 1/4 Turn
- c - Special Washer Head Bolt (P/N 10-14000) - Torque to 20 lb. ft. (27.1 N·m)
- d - Nylon Insert Locknut - Torque to 20 lb. ft. (27 N·m)
- e - Steering Link Rod

### **⚠ WARNING**

After installation is complete (and before operating outboard), check that boat will turn to right when steering wheel is turned right and that boat will turn left when steering wheel is turned left. Check steering thru full range (left and right) at all tilt angles to assure interference-free movement.

## Maintenance Instructions

Maintenance inspection is the owner's responsibility and must be performed at intervals specified.

**Normal Service** – Every 50 hours of operation or 60 days (whichever comes first)

**\*Severe Service** – Every 25 hours of operation or 30 days (whichever comes first)

\*Operation in salt water is considered "Severe Service".

1. Carefully check steering system components for wear. Replace worn parts.
2. Check steering system fasteners to be sure that they are torqued to correct specifications.

**NOTE:** Ride-Guide Steering cable is lubricated at the factory and requires no additional lubrication at initial installation.

### **⚠ WARNING**

**Core of steering cable (transom end) must be fully retracted into cable housing before lubricating cable. If cable is lubricated while extended, hydraulic lock of cable could occur.**

3. With core of Ride-Guide Steering cable (transom end) fully retracted, lubricate transom end of steering cable thru grease fitting and exposed portion of cable end with 2-4-C Marine Lubricant. Lubricate all pivot points with SAE 30W engine oil.



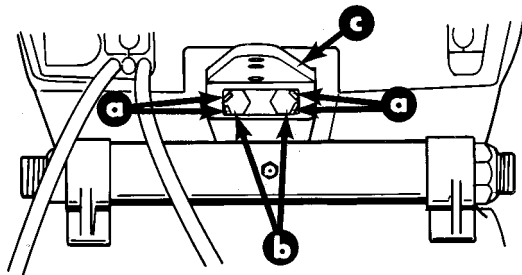
# Single Cable - Dual Outboard Ride Guide Steering Kit (P/N 97933A4) Installation

Dual outboard installation requires steering bracket replacement P/N 19617 from kit.

## ⚠ WARNING

**Upon completion of steering bracket replacement, locking retainer corner tabs must be bent up and against flats on each bolt that secures steering bracket to outboard, to prevent bolts from turning out.**

1. Remove (and retain) steering bracket bolts and locking retainer. Discard original steering bracket.
2. Attach steering bracket from kit to outboard steering arm with retained bolts and locking retainer.
3. Torque bolts to 40 lb. ft. (54 N·m) and bend tabs of locking retainer up against flats of bolts.



50579

- a - Locking Tabs Bent Into Place  
b - Bolts, Torque to 40 lb. ft. (54 N·m)  
c - Steering Bracket

## Installation Requirements

**IMPORTANT:** The distance from each outboard's centerline to the side of transom opening or gunnel **MUST BE** a minimum of 16 in. (406mm).

This kit contains all necessary parts to connect both outboards to Ride-Guide Steering Cable for 21 in. (533mm) MINIMUM thru 22-1/2 in. (572mm). If outboard centerline distance is other than specified, refer to "Ride-Guide Steering Attachment Extension Couplers" following.

Ride-Guide steering cable can be routed on either side of boat. If steering cable is routed on starboard side of boat, install steering cable to outboard mounted on port side of boat or, if steering cable is routed on port side of boat, install steering cable to outboard mounted on starboard side of boat. (Refer to "Steering Cable Installation Starboard Outboard" following).

Refer to "Quicksilver Accessories Guide" to determine correct length of steering cable and remote control cables.

**IMPORTANT:** Steering cable and remote control cables **MUST BE THE CORRECT LENGTH**, sharp bends on too-short cables result in "kinks"; too-long cables require unnecessary bends and/or loops. Both conditions place extra stress on the cables.

Install steering mount and steering wheel in accordance with installation instructions that accompany each.

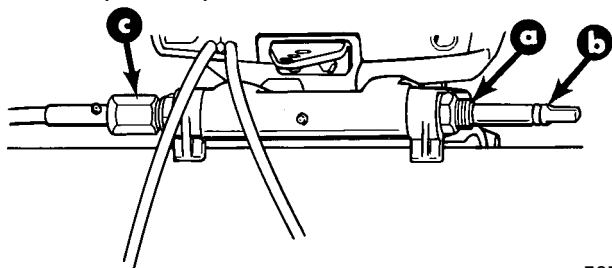


## Steering Cable Installation - Cable Routed Down Starboard Side of Boat to Port Outboard

**IMPORTANT:** Before installing steering cable into tilt tube, lubricate entire cable end with Quicksilver 2-4-C Marine Lubricant.

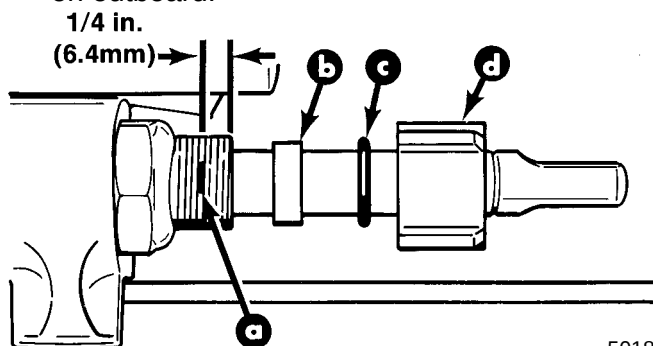
**NOTE:** Ride-Guide Steering cable is lubricated at the factory and requires no additional lubrication at initial installation.

1. Lubricate inside of outboard tilt tube (a) and entire steering cable end (b) with Quicksilver 2-4-C Marine Lubricant.
2. Insert steering cable end thru outboard tilt tube and secure steering cable to tilt tube with steering cable attaching nut (c) as shown. Torque nut to 35 lb. ft. (41 N·m).



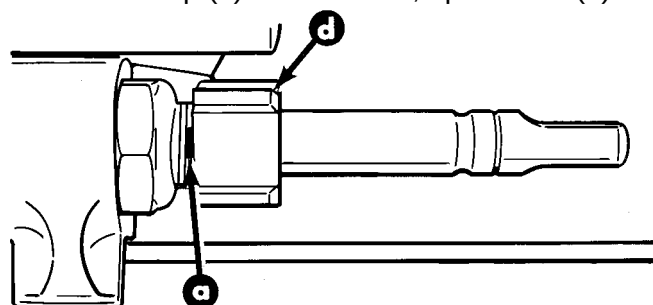
50579

3. Place a mark (a) on tilt tube 1/4 in. (6.4mm) for port end of tube. Slide plastic spacer (b), O-ring (c) and cap (d) over steering cable end, to tilt tube on outboard.



50180

4. Thread cap (d) onto tilt tube, up to mark (a).



58180

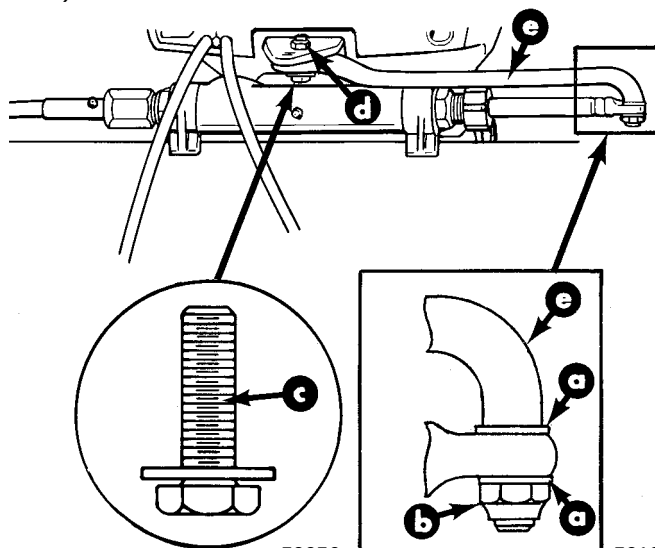
## Installing Steering Link Rod

### ⚠ WARNING

Steering link rod **MUST BE** secured between outboard steering arm/bracket and steering cable end, using special washer head bolt (P/N 10-14000) and two nylon insert locknuts (P/N 11-34863), as shown. Both special washer head bolt and nylon insert locknuts **MUST BE** tightened as specified.

Lubricate hole in end of steering cable, with Quicksilver 2-4-C Marine Lubricant. Assemble steering link rod to steering cable end, using 2 flat washers and nylon insert locknut. Tighten locknut until it seats [DO NOT exceed 120 lb. in. (14 N·m) of torque], then back nut off 1/4 turn.

Lubricate ball joint in steering link rod with SAE 30W motor oil. Secure link rod to outboard steering arm inner hole (closest to outboard), using special washer head bolt (P/N 10-14000) provided and nylon insert locknut as shown. Torque special bolt to 20 lb. ft. (27 N·m).



50056

50182

- a - Flat Washer (2)
- b - Nylon Insert Locknut - Torque Until It Seats [DO NOT Exceed 120 lb. in. (14 N·m) of Torque], Then Back Nut Off 1/4 Turn
- c - Special Washer Head Bolt (P/N 10-14000) - Torque to 20 lb. ft. (27.1 N·m)
- d - Nylon Insert Locknut - Torque to 20 lb. ft. (27 N·m)
- e - Steering Link Rod

### ⚠ WARNING

After installation is complete (and before operating outboard), check that boat will turn to right when steering wheel is turned right and that boat will turn left when steering wheel is turned left. Check steering thru full range (left and right) at all tilt angles to assure interference-free movement.



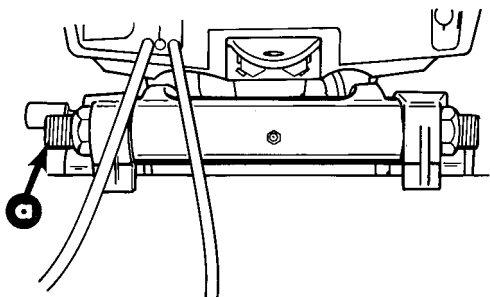
## Steering Cable Installation - Cable Routed Down Port Side of Boat to Starboard Outboard

### TILT TUBE REVERSAL

#### ⚠ CAUTION

Outboard tilt tube **MUST BE** removed and reinstalled in the opposite direction (turned end for end), so that when reassembled, longer threaded end of tilt tube extends out port side of outboard approximately 3/4 in. (19mm). Failure to reposition outboard tilt tube as described, could interfere with steering system operation.

Remove outboard tilt tube and reinstall in opposite direction (turn end for end), so that when reassembled, longer threaded end (a) of tilt tube extends out port side of outboard approximately 3/4 in. (19mm). Refer to Section 5A "Midsection".



50579

Refer to "Quicksilver Accessories Guide" to determine correct length of steering cable and remote control cables.

**IMPORTANT:** Steering cable and remote control cables must be the correct length, sharp bends on too-short cables result in "kinks"; too-long cables require unnecessary bends and/or loops. Both conditions place extra stress on the cables.

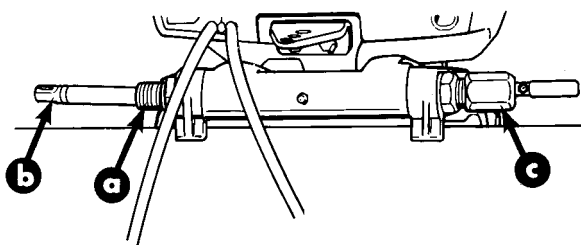
Install steering mount and steering wheel in accordance with installation instructions that accompany each.

## Installing Steering Cable

**IMPORTANT:** Before installing steering cable into tilt tube, lubricate entire cable end with Quicksilver 2-4-C Marine Lubricant.

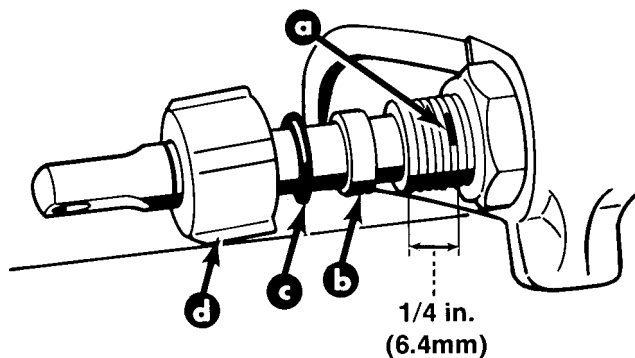
**NOTE:** Ride Guide Steering Cable is lubricated at the factory and requires no additional lubrication at initial installation.

1. Lubricate inside of outboard tilt tube (a) and entire steering cable end (b) with Quicksilver 2-4-C Marine Lubricant.
2. Insert steering cable end thru outboard tilt tube and secure steering cable to tilt tube with steering cable attaching nut (c) as shown. Torque nut to 35 lb. ft. (41 N·m).



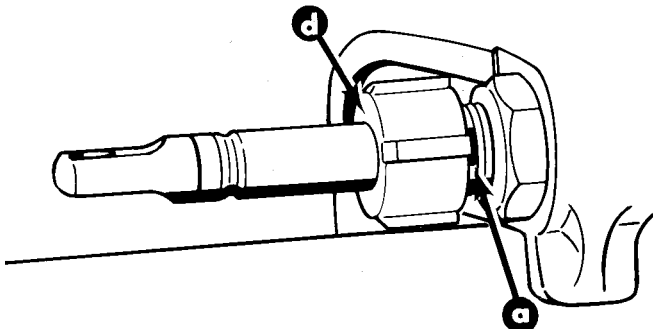
50579

3. Place a mark (a) on tilt tube 1/4 in. (6.4mm) from starboard end of tube. Slide plastic spacer (b), O-ring (c) and cap (d) over steering cable end, to tilt tube on outboard.



50325

4. Thread cap (d) onto tilt tube, up to mark (a).



50325



## Installing Steering Link Rod

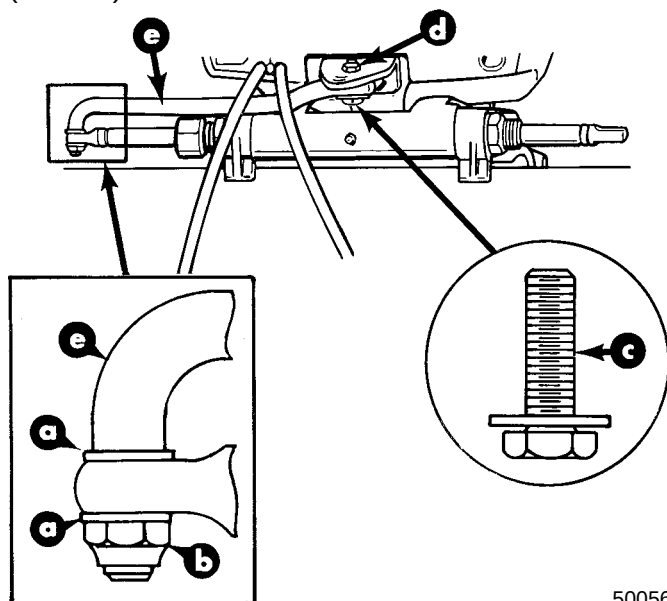
**NOTE:** Steering link rod and components from Ride-Guide Attaching Kit (P/N 17432A6) must be used when steering cable is routed down starboard side of boat to port outboard.

### ⚠ WARNING

Steering link rod **MUST BE** secured between outboard steering arm/bracket and steering cable end, using special washer head bolt (P/N 10-14000) and two nylon insert locknuts (P/N 11-34863), as shown. Both special washer head bolt and nylon insert locknuts **MUST BE** tightened as specified.

Lubricate hole in end of steering cable, with Quicksilver 2-4-C Marine Lubricant. Assemble steering link rod to steering cable end, using 2 flat washers and nylon insert locknut. Tighten locknut until it seats [DO NOT exceed 120 lb. in. (14 N·m) of torque], then back nut off 1/4 turn.

Lubricate ball joint in steering link rod with SAE 30W Motor Oil. Secure link rod to outboard steering arm inner hole (closest to outboard), using special washer head bolt (P/N 10-14000) provided and nylon insert locknut as shown. Torque special bolt to 20 lb. ft. (27 N·m).



50056

- a - Flat Washer (2)
- b - Nylon Insert Locknut - Torque Until It Seats [DO NOT Exceed 120 lb. in. (14 N·m) of Torque], Then Back Nut Off 1/4 Turn
- c - Special Washer Head Bolt (P/N 10-14000) - Torque to 20 lb. ft. (27.1 N·m)
- d - Nylon Insert Locknut - Torque to 20 lb. ft. (27 N·m)
- e - Steering Link Rod

### ⚠ WARNING

After installation is complete (and before operating outboard), check that boat will turn to right when steering wheel is turned right and that boat will turn left when steering wheel is turned left. Check steering thru full range (left and right) at all tilt angles to assure interference-free movement.

## Maintenance Instructions

Maintenance inspection is the owner's responsibility and must be performed at intervals specified.

**Normal Service** – Every 50 hours of operation or 60 days (whichever comes first)

**\*Severe Service** – Every 25 hours of operation or 30 days (whichever comes first)

\*Operation in salt water is considered "Severe Service".

1. Carefully check steering system components for wear. Replace worn parts.
2. Check steering system fasteners to be sure that they are torqued to correct specifications.

**NOTE:** Ride-Guide Steering cable is lubricated at the factory and requires no additional lubrication at initial installation.

### ⚠ WARNING

Core of steering cable (transom end) must be fully retracted into cable housing before lubricating cable. If cable is lubricated while extended, hydraulic lock of cable could occur.

3. With core of Ride-Guide Steering cable (transom end) fully retracted, lubricate transom end of steering cable thru grease fitting and exposed portion of cable end with 2-4-C Marine Lubricant. Lubricate all pivot points with SAE 30W engine oil.



## Steering Coupler Assembly

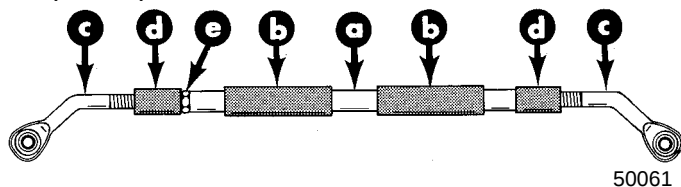
Position outboards so that they are facing straight forward. (Distance between threaded hole centers of steering arms/brackets **MUST BE** equal to distance between propeller shaft center lines.)

Lubricate inside of rubber sleeves with Quicksilver 2-4-C Marine Lubricant and slide sleeves on steering coupler.

Work rubber bushings onto threaded ends of steering eyes.

Thread jam nut on starboard steering eye.

Thread steering eyes equally into coupler, so that distance between hole centers of steering eye ball joints is equal to distance between threaded hole centers of steering arms/brackets. Exposed threads of steering eyes **MUST BE** of equal length and threads **MUST NOT** extend out from coupler more than 2-3/4 in. (70mm).



- a - Coupler
- b - Rubber Sleeve
- c - Steering Eye
- d - Rubber Bushing
- e - Jam Nut

### WARNING

Both steering eyes must be threaded into coupler 3/4 in. (19mm) minimum. Thread length of steering eye is 3-1/2 in. (89mm), so exposed thread must not extend out of coupler more than 2-3/4 in. (70mm). Failure to adhere to this requirement could result in steering system failure.

Assemble steering coupler between outboard steering brackets, as shown on the following pages.

**IMPORTANT:** With assembled steering coupler installed and before tightening special washer head bolts/locknuts, check outboard alignment. Distance between hole centers of steering eye ball joints **MUST BE** equal to distance between propeller shaft center lines, for proper steering. If adjustment is necessary, temporarily remove special washer head bolt/locknut from one steering eye and turn eye in or out to correct alignment.

### WARNING

Both steering eyes **MUST BE** threaded into coupler 3/4 in. (19mm) minimum, and jam nut must be tightened against coupler to prevent coupler from turning. Torque "jam" nut to 20 lb. ft. (27 N·m).

Tighten "jam" nut against coupler. Torque "jam" nut to 20 lb. ft. (27 N·m).

Spray Quicksilver Corrosion Guard on exposed threads of steering eyes and position rubber bushings and rubber sleeves to cover exposed threads of steering eyes.

### WARNING

After installation is complete (and before operating outboards), check that boat will turn right when steering wheel is turned right and that boat will turn left when steering wheel is turned left. Check steering thru full range (left and right) at all tilt angles to assure interference-free movement.

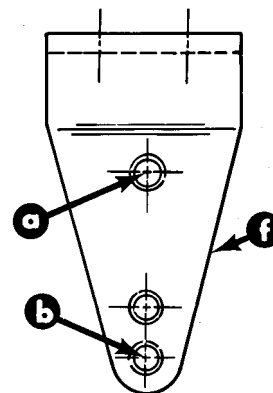
Adjust trim tabs of both outboards, as outlined in "Trim Tab Adjustment", following.



## Steering Coupler Installation

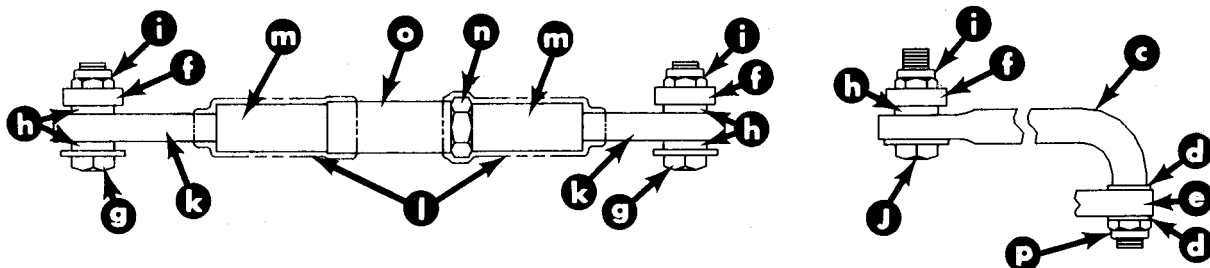
**IMPORTANT:** Dual outboard installation requires a minimum outboard centerline distance of 21 in. (533mm) to assure interference-free movement.

**IMPORTANT:** Lubricate all moving parts with Quicksilver 2-4-C Multi-Purpose Lubricant.

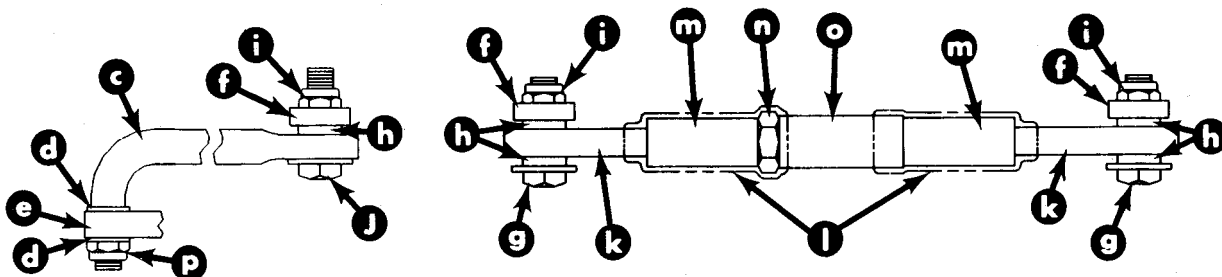


50137

**Steering cable routed on starboard side of boat connected to port outboard.**



**Steering cable routed on port side of boat connected to starboard outboard.**

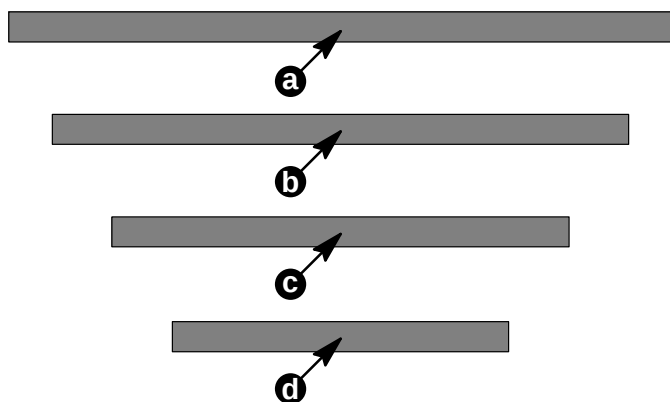


- a - Steering Link Connecting Hole
- b - Coupler Assembly Connection Hole 40 Model
- c - Steering Link (Supplied on Outboard)
- d - Washer (Supplied with Steering Link)
- e - Ride Guide Cable
- f - Steering Bracket (Supplied in Kit)
- g - Special (Washer Head) Bolt (Supplied in Kit 3/8" x 1-5/8" P/N 10-90041), Torque to 20 lb. ft. (27.1 N·m)
- h - Special Washer (P/N 12-71970)
- i - Lock Nut (Two Supplied in Kit and with Steering Link) P/N 11-34863, Torque to 20 lb. ft. (27.1 N·m)
- j - Special (Washer Head) Bolt (P/N 10-14000) Torque to 20 lb. ft. (27 N·m) (Supplied with Steering Link)
- k - Steering Eye
- l - Rubber Sleeve
- m - Rubber Bushing
- n - Jam Nut, Torque to 20 lb. ft. (27.1 N·m)
- o - Dual Steering Coupler (9")
- p - Lock Nut (Supplied with Steering Link) P/N 11-34863, Torque Until it Seats [Do Not Exceed 120 lb. in. (13.6 N·m) of Torque], then Back Off 1/4 Turn



## Ride-Guide Steering Attachment Extension Couplers

| Outboard Center Line Distance                 | Required Coupler(s) Between Steering Eyes (Shown Below) |
|-----------------------------------------------|---------------------------------------------------------|
| 21 in. thru 22-1/2 in. (533mm thru 572mm)     | 9 in. (229mm) Coupler                                   |
| 22-1/2 in. thru 24-1/2 in. (572mm thru 622mm) | 12 in. (305mm) Coupler                                  |
| 23-1/2 in. thru 27-1/2 in. (597mm thru 699mm) | 15 in. (381mm) Coupler (Supplied with this Kit)         |
| 26-1/2 in. thru 30-1/2 in. (673mm thru 755mm) | 18 in. (457mm) Coupler                                  |



- a - 18 in. (457mm) Coupler (P/N 814951--4)  
b - 15 in. (381mm) Coupler (P/N 814951--3)  
c - 12 in. (305mm) Coupler (P/N 814951--2)  
d - 9 in. (229mm) Coupler (P/N 814951--1)

## Trim Tab Adjustment

### DUAL OUTBOARD

1. Check trim tab position as follows:

**IMPORTANT:** Initial trim tab setting for both outboards should be straight to rear of outboard, so that tabs are aligned with gear housing center line. Refer to "If Necessary, Adjust Trim Tab as Follows," following.

- a. Operate boat at normal cruise throttle setting and adjust trim to optimum setting.
  - b. If boat pulls to the right (starboard), trailing edge of trim tab must be moved to the right (when viewing outboard from behind). If boat pulls to the left (port), trailing edge of trim tab must be moved to the left.
2. If necessary, adjust trim tab as follows:
    - a. Shift outboard into neutral and make sure ignition key is at "OFF" position.
    - b. Remove plastic cap from rear of drive shaft housing and loosen bolt and trim tab.

**IMPORTANT:** Trim tabs **MUST BE** set in the same position on both outboards.

- c. If boat pulls to the right, adjust trailing edges of both trim tabs to the right. If boat pulls to the left, adjust trailing edges of both trim tabs to the left.
- d. Tighten both trim tab bolts securely and replace plastic caps.
- e. Operate boat per "Check Trim Tab Position as Follows," preceding, to check trim tab setting. Readjust trim tabs, if necessary.

## Maintenance Instructions

Maintenance inspection is the owner's responsibility and must be performed at intervals specified.

**Normal Service** – Every 50 hours of operation or 60 days (whichever comes first)

**\*Severe Service** – Every 25 hours of operation or 30 days (whichever comes first)

\*Operation in salt water area is considered "Severe Service".

1. Carefully check steering system components for wear. Replace worn parts.
2. Check steering system fasteners to be sure that they are torqued to correct specifications.

**NOTE:** Ride-Guide Steering cables are lubricated at the factory and requires no additional lubrication at initial installation.

### WARNING

**Core of each steering cable (transom end) must be fully retracted into cable housing before lubricating cable. If cable is lubricated while extended, hydraulic lock of cable could occur.**

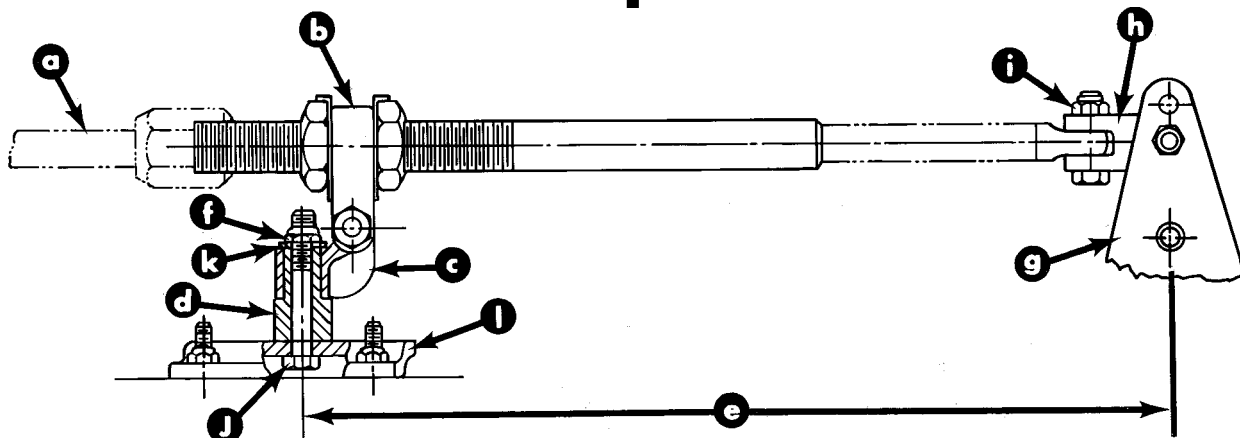
3. With core of Ride-Guide Steering cable (transom end) fully retracted, lubricate transom end of steering cable thru grease fittings (a) with 2-4-C Marine Lubricant. Lubricate exposed portions of cable ends (b) with 2-4-C Marine Lubricant.
4. Lubricate pivot points of steering link rods and ball joints of link rods/steering coupler with Quick-silver 2-4-C Lubricant.
5. Inspection and lubrication of steering head assembly (rotary or straight rack) should be performed once each year (by your Authorized Dealer) or whenever steering mount and/or steering head are disassembled, or if steering effort has increased. Lubricate with 2-4-C Marine Lubricant.



# Transom Mounted Ride Guide Attaching Kit Installation (73770A1)

## Attaching Kit Installation

1. Lubricate both holes in pivot block (Figure 1) with Quicksilver 2-4-C Marine Lubricant.



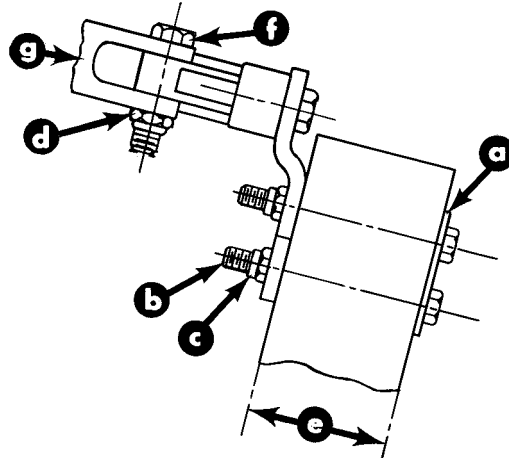
- a - Ride-Guide Cable
- b - Ride-Guide Yoke
- c - Pivot Block
- d - Pivot Spacer
- e - 15 in. (Centerline of Attaching Kit Pivot to Centerline of Outboard)
- f - Pivot Attaching Locknut [Torque to 20 lb. ft. (27.1 N·m)]
- g - Outboard Steering Arm
- h - "Clevis Kit"
- i - Ride-Guide Cable Attaching Locknut [Torque to 10 lb. ft. (13.6 N·m)]
- j - Bolt (3/8 in. x 2-1/2 in.)
- k - Flat Washer
- l - Transom Bracket

**Figure 1. Installing Attaching Kit**

3. Place Ride-Guide yoke on pivot block and secure with 7/16 in. x 1-3/4 in. bolt and locknut, as shown in Figures 1 and 2. Torque locknut to 10 lb. ft. (13.6 N·m), **then back off 1/4 turn.**
4. Install one cable tube jam nut onto steering cable tube. Place tab washer over Ride-Guide yoke, then insert cable tube thru tab washer and yoke. Install second cable tube jam nut onto cable tube but do not tighten at this time. (Figure 3)
5. Position transom attaching kit on transom as follows:
  - a. Determine centerline of outboard, then measure 15 in. (38.1cm) over from this centerline and draw a vertical line on transom. (Figure 1)

2. Place pivot block on pivot spacer and secure to transom bracket with 3/8 in. x 2-1/2 in. bolt, flat washer and locknut, as shown in Figure 1. Torque locknut to 20 lb. ft. (27 N·m).

- b. Position attaching kit on transom so that **transom bracket is centered on the 15 in. line** (Figure 1) at a height where the **center of Ride-Guide yoke is even with, or not more than 1/2 in. (12.8mm) above, top edge of transom.** (Figure 3)



- a - Transom Backing Plate
- b - Bolt (5/16 in. x 3-1/4 in.)
- c - Locknut (Torque to 10 lb. ft.)
- d - Ride-Guide Yoke Attaching Locknut (Torque to 10 lb. ft. **Then Back Off 1/4 Turn**)
- e - 2-3/8 in. Maximum Transom Thickness
- f - Bolt (7/16 in. x 1-3/4 in.)
- g - Ride-Guide Yoke

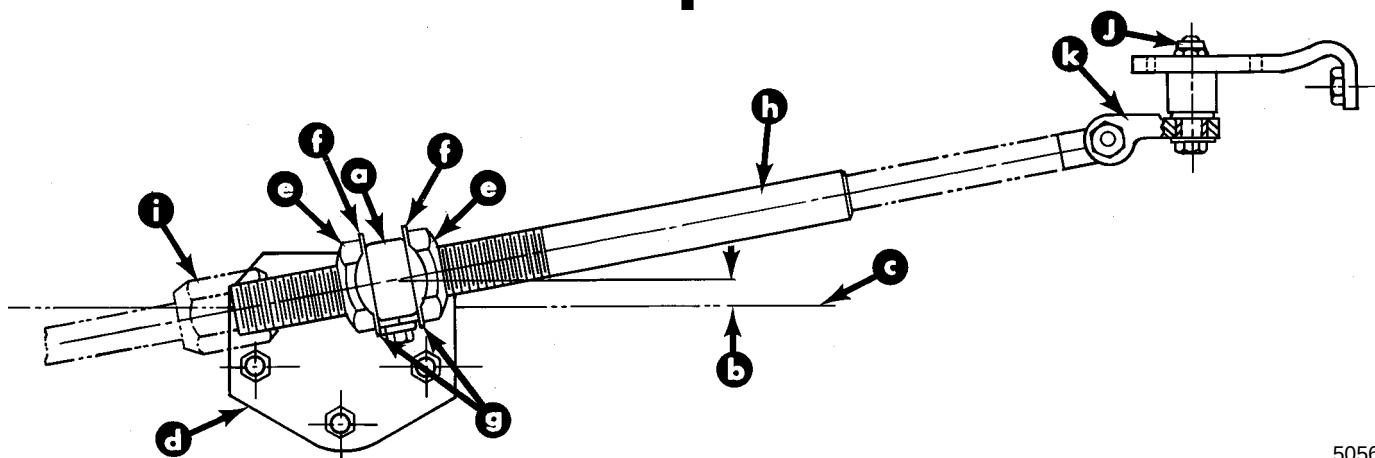
**Figure 2. Installing Attaching Kit**



**NOTE:** When drilling thru transom, be sure that holes are drilled perpendicular to transom.

- With attaching kit positioned as outlined preceding, use 3 holes in transom bracket as a guide and drill three 11/32 in. (8.7mm) holes thru transom.

- Use a marine-type sealer on three 5/16 in. x 3-1/4 in. bolts. Secure attaching kit to transom, using transom backing plate, 3 bolts (with sealer) and 3 locknuts, installed as shown in Figure 2. Torque locknuts to 10 lb. ft. (13.6 N·m).



- a - Ride-Guide Yoke
- b - 0 in. to 1/2 in. (Center of Ride-Guide Yoke to Top of Transom)
- c - Top of Transom
- d - Transom Bracket
- e - Cable Tube Jam Nuts [Torque to 35 lb. ft. (41.5 N·m)]
- f - Tab Washer
- g - After Jam Nuts are Torqued to Specification, Bend Locking Tabs Against Nuts
- h - Cable Guide Tube
- i - Ride-Guide Cable Attaching Nut [Torque to 35 lb. ft. (41.5 N·m)]
- j - "Clevis Kit"
- k - Clevis Attaching Locknut [Torque to 20 lb. ft. (27.1 N·m)]

**Figure 3. Installing Attaching Kit**

## Clevis Attaching Kit Installation (P/N 70599A4)

**NOTE:** This kit is used to attach Ride-Guide cable to outboard steering arm **ONLY** when "Transom Mounted Ride-Guide Attaching Kit" is being used. If Ride-Guide cable is installed thru outboard tilt tube, then "Steering Link Rod" must be used.

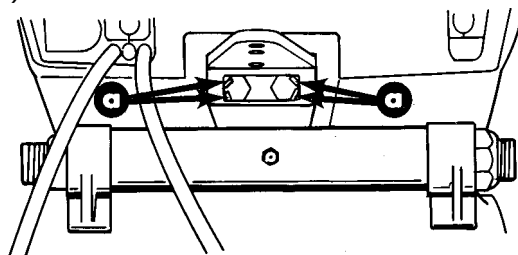
### Installation Instructions

- Remove (and discard) existing steering bracket. Two bolts and locking plate will be reused to install new steering bracket (supplied in kit).

### **⚠ WARNING**

Locking retainer corner tabs, **MUST BE bent up and against flats on each bolt that secures steering bracket to outboard**, to prevent bolts from turning out.

- Install (supplied) steering bracket to outboard steering arm with two retained bolts and locking plate as shown below. Torque bolts to 35-45 lb. ft. (47-61 N·m) and bend tabs against flats of bolts (a).

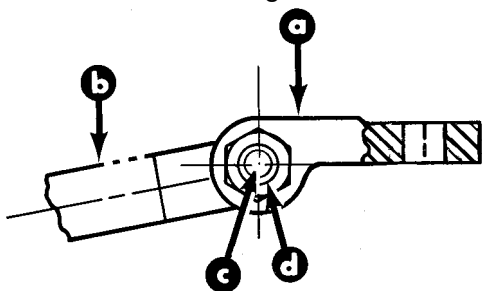


a - Locking Tabs Bent into Place

**IMPORTANT:** Lubricate all moving parts of clevis kit with Quicksilver 2-4-C Lubricant.



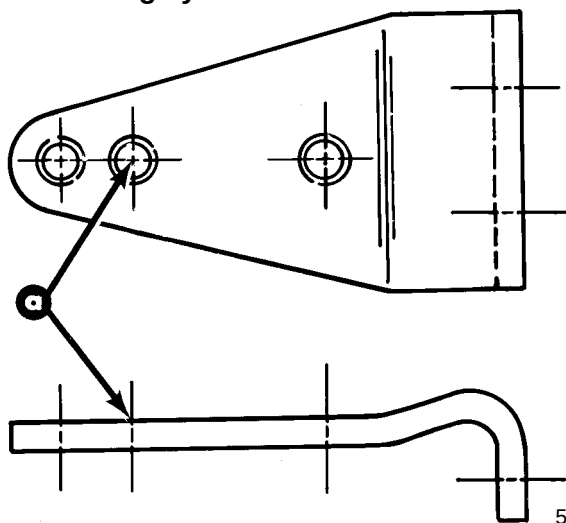
3. Install clevis to steering cable as shown.



- a - Clevis
- b - Steering Cable
- c - Bolt, 3/8" - 24 x 1-3/8" (Lubricate Unthreaded Area)
- d - Locknut [Clevis to Steering Cable; Torque to 120 lb. (14 N·m)]

### ⚠ CAUTION

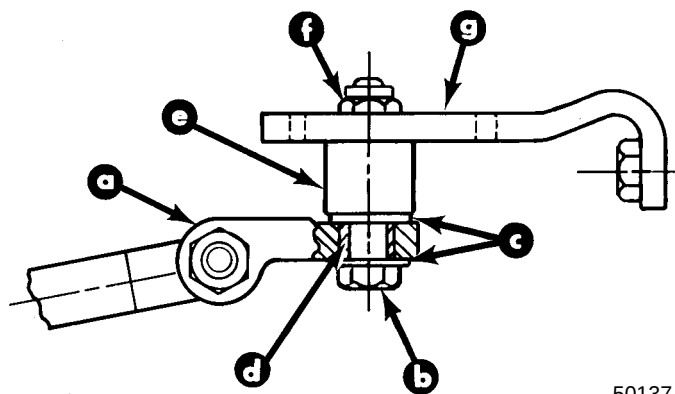
**Clevis must be connected to the middle hole in the steering bracket (below) to ensure proper engine clearances. Failure to use middle hole could cause steering system to bind.**



- a - Proper Hole to be Used

50137

4. Install clevis to middle hole in steering bracket as shown.



50137

- a - Clevis
- b - Bolt, 3/8 in. - 24 x 1-7/8 in. [Torque to 240 lb. in. (27 N·m)] (Lubricate Unthreaded Area)
- c - Washers (1/16 in. Thick)
- d - Spacer (Small) (Lubricate Spacer)
- e - Spacer (Large)
- f - Locknut [Clevis to Engine Steering Bracket; Torque to 240 lb. in. (27 N·m)]
- g - Steering Bracket

## Maintenance Instructions

Lubrication and maintenance inspection is owner's responsibility and must be performed at intervals as specified following:

**Normal Service** – Every 50 hours of operation or 60 days (whichever comes first)

**\*Severe Service** – Every 25 hours of operation or 30 days (whichever comes first)

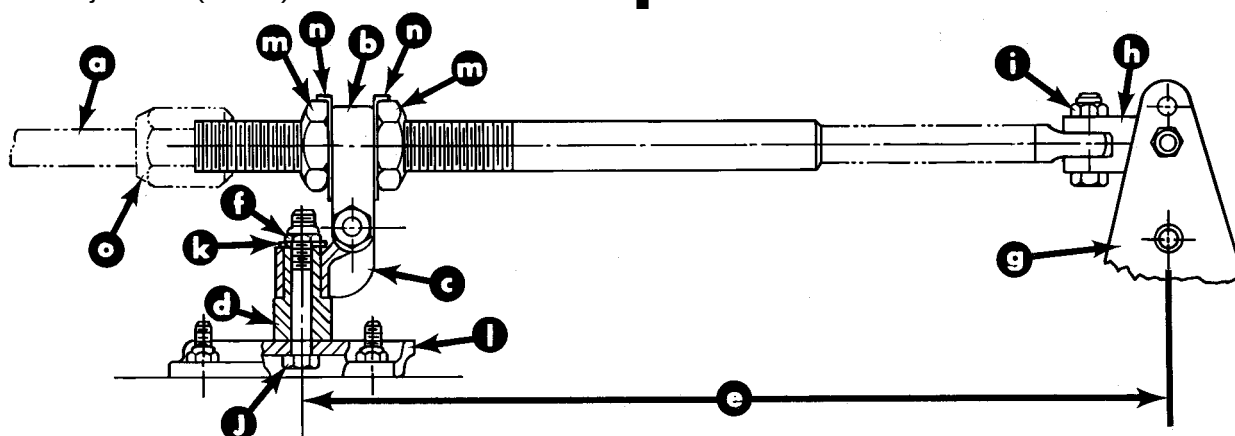
\*Operation in salt water area is considered "Severe Service".

1. Carefully check steering components for wear. If worn, take your local Authorized Dealer.
2. Check steering system fasteners to be sure that they are torqued to correct specifications.
3. Lubricate clevis pivot points with a drop of light oil.
4. Inspection and lubrication of steering system should be performed once each year (by your Authorized Dealer) or whenever steering components are disassembled, steering effort has increased or steering seems loose.



## Steering Cable Installation

1. Lubricate steering cable end with Quicksilver 2-4-C Marine Lubricant.
2. Install steering cable thru steering cable tube and secure to cable tube with cable attaching nut. (See below) Do not tighten cable attaching nut at this time.
3. Attach Ride-Guide cable to outboard steering bracket (middle hole) using Clevis Kit (P/N 70599A4).
4. Adjust 2 large jam nuts on cable tube of attaching kit, so that **steering wheel** is in normal straight-driving position with outboard in straight-running position. Torque each jam nut to 35 lb. ft. (41.5 N·m), then bend a side of tab washer against flat of each jam nut (below).



- a - Ride-Guide Cable
- b - Ride-Guide Yoke
- c - Pivot Block
- d - Pivot Spacer
- e - 15 in. (Centerline of Attaching Kit Pivot to Centerline of Engine)
- f - Pivot Attaching Locknut [Torque to 20 lb. ft. (27.1 N·m)]
- g - Engine Steering Arm
- h - Clevis Kit
- i - Ride-Guide Cable Attaching Locknut [Torque to 10 lb. ft. (13.6 N·m)]
- j - Bolt (3/8 in. x 2-1/2 in.)
- k - Flat Washer
- l - Transom Bracket
- m - Cable Tube Jam Nut; Torque to 35 lb. ft. (47 N·m)
- n - Tab Washers (Bend Over Flat of Jam Nuts)
- o - Cable Attaching Nut

5. Torque Ride-Guide cable attaching nut (which secures cable to guide tube) to 35 lb. ft. (41.5 N·m) (below). Install locking sleeve over cable attaching nut and secure with cotter pin. Spread ends of cotter pin.

**NOTE:** Some Ride-Guide steering cables may not be equipped with locking sleeve and cotter pin. If cable being installed does not have these parts, disregard instructions to install them.

### ⚠ WARNING

After installation is completed (and before operating outboard), check that boat will turn right when steering wheel is turned right and that boat will turn left when steering wheel is turned left. Check steering thru full range (left and right) at all tilt angles to assure interference-free movement.

50568

## Maintenance Instructions

Lubrication and maintenance inspection is owner's responsibility and must be performed at intervals as specified following:

**Normal Service** – Every 50 hours of operation or 60 days (whichever comes first)

**\*Severe Service** – Every 25 hours of operation or 30 days (whichever comes first)

\*Operation in salt water area is considered "Severe Service".

### ⚠ CAUTION

**Core of steering cable must be fully retracted into cable housing before lubricating cable. If cable is lubricated while extended, hydraulic lock of cable could occur.**

1. Lubricate outboard end of Ride-Guide steering cable (thru grease fitting next to cable attaching nut) with Quicksilver 2-4-C Marine Lubricant.

**NOTE:** Ride-Guide Steering cable is lubricated at the factory and requires no additional lubrication at initial installation.



2. Lubricate all steering system pivot points (and exposed portion of steering cable core) with Quicksilver 2-4-C Marine Lubricant. Lubricate at intervals specified preceding.
3. Check steering system components for wear (at intervals specified, preceding). Replace worn parts.
4. Check steering system fasteners (at intervals specified, preceding) to be sure that they are torqued to correct specifications. (Figures 1, 2, and 3)

## Selecting Steering Cable and Remote Control Cables

Refer to "Quicksilver Accessories Guide" to determine correct length of steering cables and remote control cables.

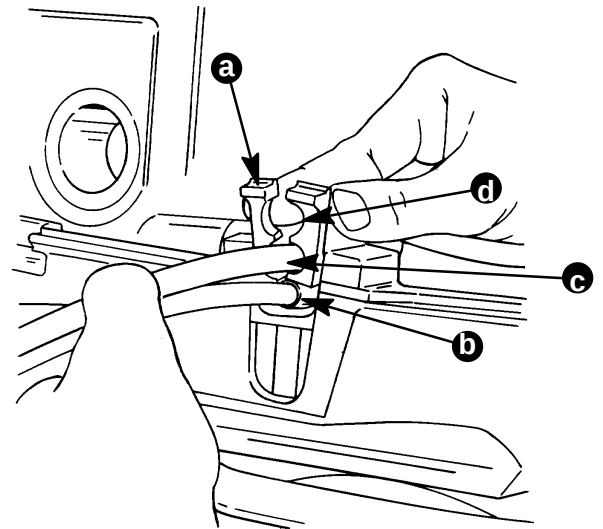
**IMPORTANT:** Steering cable and remote control cables must be the correct length, sharp bends on too-short cables result in "kinks"; too-long cables require unnecessary bends and/or loops. Both conditions place extra stress on the cables.

### Remote Control Installation

**IMPORTANT:** Install control cables to remote control and mount remote control **BEFORE** attaching control cables to engine.

Install throttle and shift cables to remote control and mount remote control as outlined in the installation instructions which accompany the remote control.

**NOTE:** It will be necessary to lift control cable rubber grommet out of opening in bottom cowl, so that control cables can be routed thru grommet and into bottom cowl.



50566

- a - Control Cable Rubber Grommet
- b - Shift Cable Opening
- c - Throttle Cable Opening
- d - Remote Control Wiring Harness/Key Switch Wiring Harness Opening

### Shift Cable Installation and Adjustment to Engine

**NOTE:** Attach shift cable to engine first. Shift cable is the first cable to move when remote control handle is advanced from neutral position toward in-gear position.

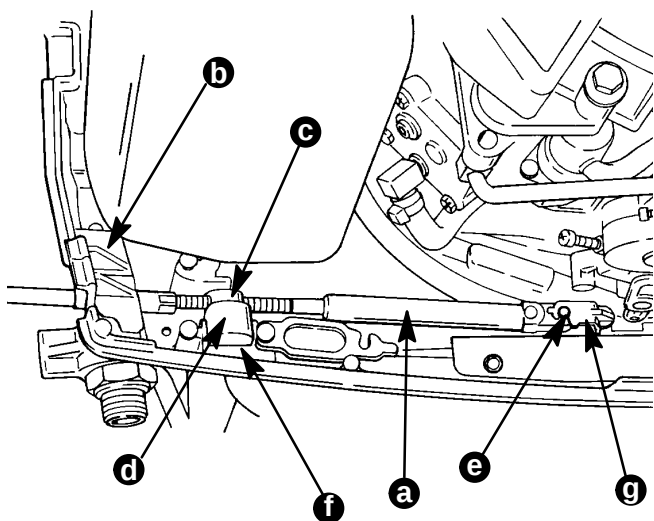
If remote control has a neutral lock release, secure the release in the depressed position using a piece of tape. Now you can locate the true neutral detent.

**NOTE:** Rotate remote control handle back and forth. You will feel three detent positions; center detent is neutral.

1. Position remote control handle into neutral detent.
2. Manually shift outboard into neutral (propeller will rotate freely).



3. Route shift cable (a) thru control cable grommet (b).
4. Adjust barrel (c) of shift cable to attain the same distance between barrel and hole in end of shift cable guide as exists between barrel receptacle (d) and peg (e) of shift actuator, with a slight preload adjustment toward reverse.
5. Lift barrel receptacle out of recess (f) in bottom cowl, insert shift cable barrel into lower hole of barrel receptacle and position receptacle back down into recess.
6. Place hole in end of shift cable guide over peg of shift actuator and secure with cable retainer (g).

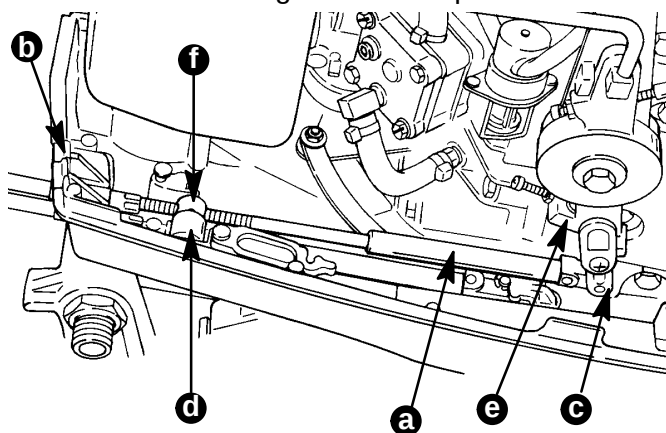


53121

7. Check shift cable adjustment as follows:
  - a. **Shift remote control into forward gear.** Now, check prop shaft, the shaft should not be able to turn counterclockwise. If it does, adjust cable barrel closer to cable end guide.
  - b. **Shift remote control into neutral.** The prop shaft now should turn freely without drag. If not, adjust cable barrel away from cable end guide. Repeat steps a and b.
  - c. **Shift remote control into reverse as the prop shaft is rotated by hand.** The prop shaft should not be able to turn clockwise. If it does, adjust cable barrel away from cable end guide. Repeat steps a thru c.
  - d. **Shift remote control into neutral.** The prop shaft should turn freely without drag. If not, adjust cable barrel closer to cable end guide. Repeat steps a thru d.

## Throttle Cable Installation and Adjustment to Engine

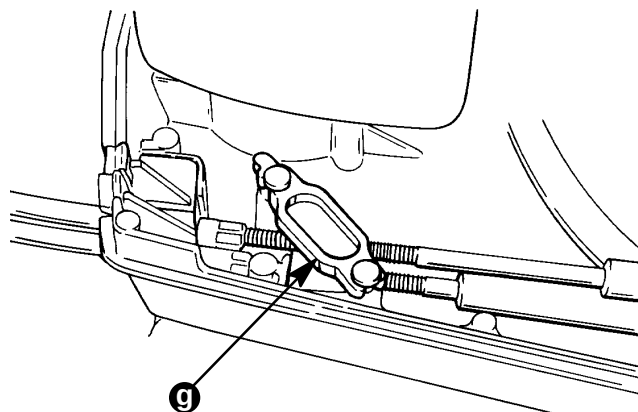
1. Shift remote control into neutral.
2. Route throttle cable (a) thru control cable grommet (b).
3. Place hole in end of throttle cable end guide, over peg of throttle lever and secure with cable retainer (c).
4. Lift barrel receptacle (d) out of recess in bottom cowl, to allow installation of throttle cable barrel into upper hole of receptacle.
5. Holding engine throttle lever (e) against idle stop, adjust throttle cable barrel (f) to slip into upper hole of barrel receptacle, with a very light preload of throttle lever against idle stop.



50564D

50564D

6. Position barrel receptacle back down into recess of bottom cowl and lock receptacle in place with barrel retainer (g).
7. Check preload on throttle cable by placing a thin piece of paper between idle stop screw and idle stop. Preload is correct when paper can be removed without tearing, but has some drag on it. Readjust cable barrel, if necessary.



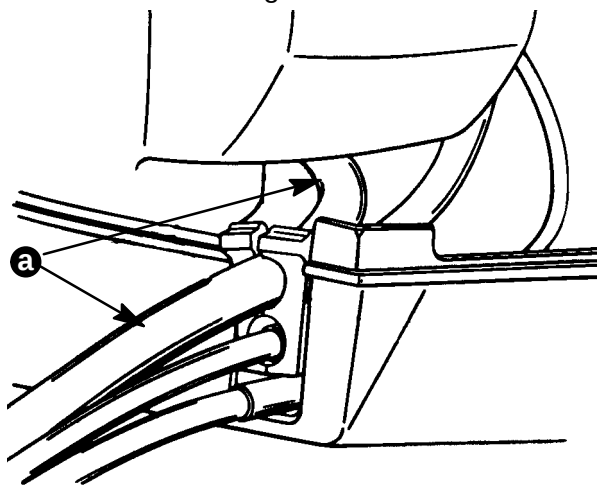
53120



## Connecting Remote Control Wiring Harness to Engine Wiring Harness (Electric Start Models)

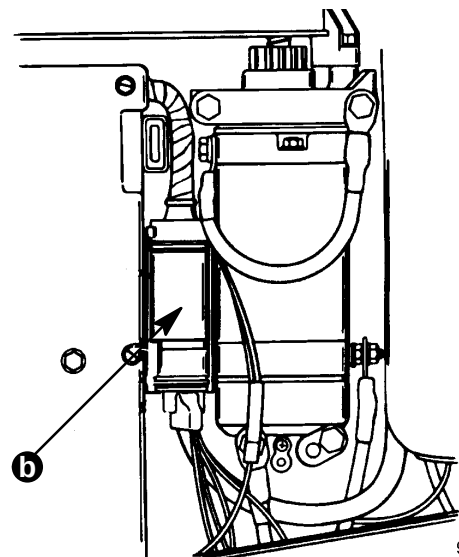
Route remote control harness or key switch harness down side of boat to engine, fastening harness to boat. Be sure that harness does not rub, get pinched or come in contact with bilge water.

Route the remote control wiring harness (a) into bottom cowl thru control cable grommet. Route harness behind oil tank to engine harness connector, located on starboard side of engine.



919-H

Plug remote control wiring harness into engine harness connector (b) and push connection into retainer.



50566

### **⚠ CAUTION**

Remote control wiring harness or key switch wiring harness must be routed between control cable rubber grommet and engine attachment points, so that harness will not interfere with engine throttle and shift operation.



## Power Trim Wiring Connections (Models So Equipped)

Make bullet connector wiring connection, between remote control wiring harness/key switch wiring harness and engine wiring.

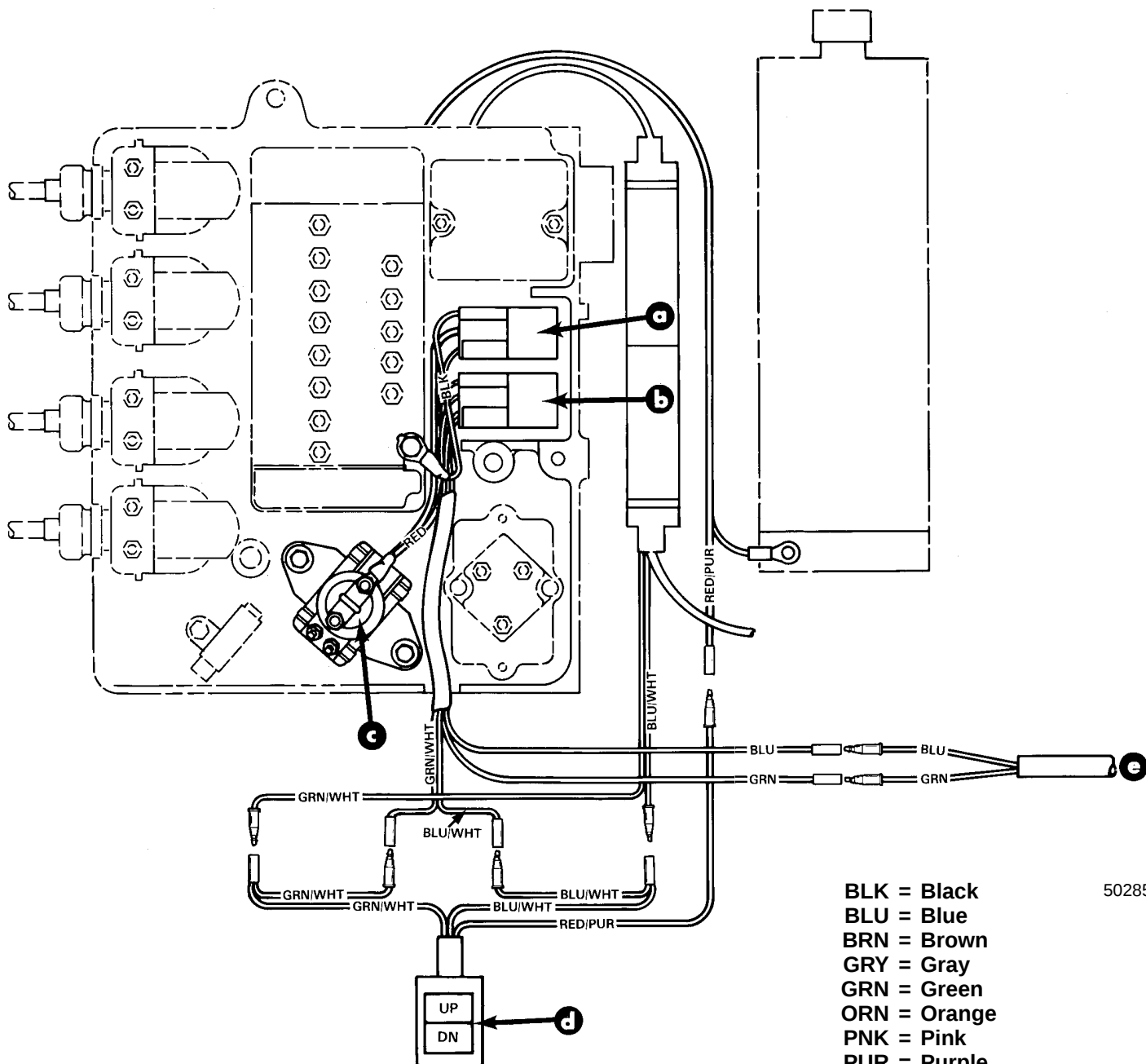
**IMPORTANT:** Tape back and isolate any unused wiring harness leads.

## Battery Connections

### ⚠ CAUTION

Failure to observe correct polarity when connecting battery cables to battery, will result in damage to the charging system.

1. Connect battery cables (from engine) to battery. Connect red battery cable to positive (+) battery terminal and black battery cable to negative (-) battery terminal.



- a - "Up" Relay Switch
- b - "Down" Relay Switch
- c - Starter Solenoid
- d - Trim Switch
- e - From Control Harness

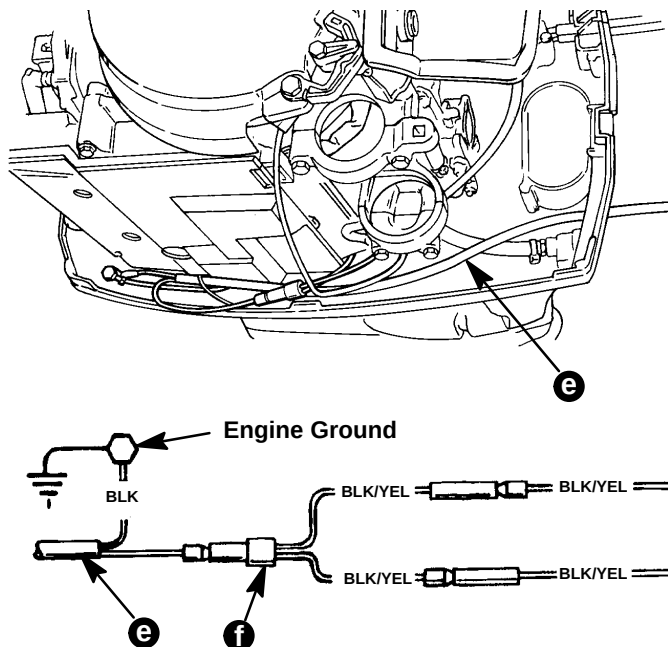
BLK = Black  
BLU = Blue  
BRN = Brown  
GRY = Gray  
GRN = Green  
ORN = Orange  
PNK = Pink  
PUR = Purple  
RED = Red  
TAN = Tan  
WHT = White  
YEL = Yellow  
LIT = Light  
DRK = Dark

50285



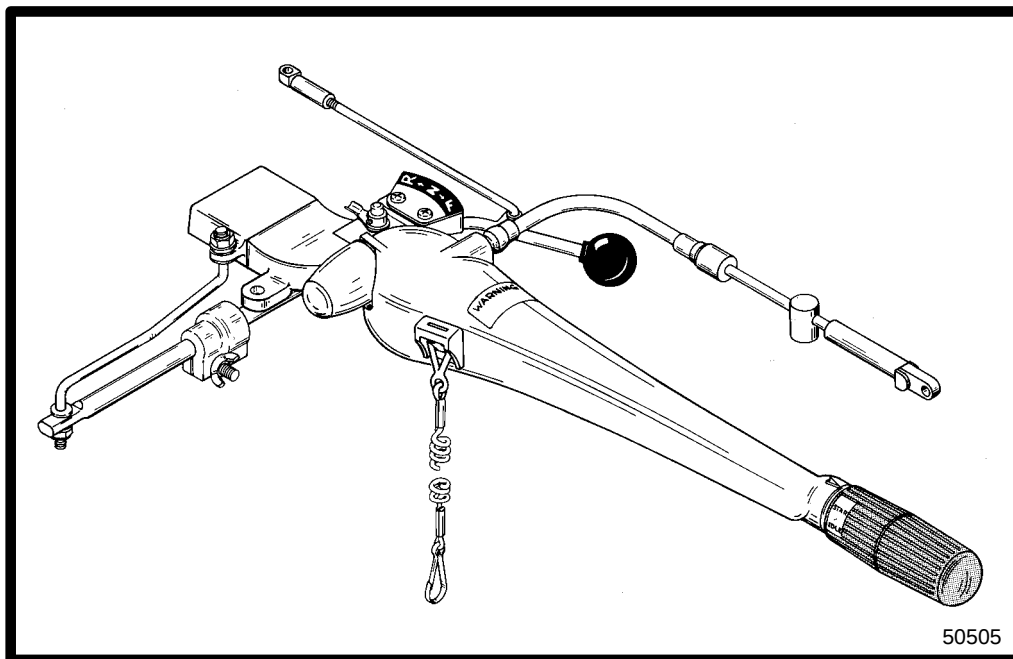
## Connecting Remote Control Stop Switch Wiring to Engine Wiring (Manual Start Models)

1. Locate the engine mounted stop switch wiring harness in the bottom cowl and disconnect the black/yellow wire that goes to the switch box.
2. Route the remote control wiring harness (e) into the bottom cowl thru the wiring grommet . Connect the "Y" harness (f) P/N 84-11149A1 (supplied with remote control) between the remote control wiring harness and the disconnected black/yellow wire connections as shown.





# OUTBOARD MOTOR INSTALLATION/ ATTACHMENTS



7

B

## TILLER HANDLE AND CO-PILOT



# Table of Contents

|                                              | Page  |
|----------------------------------------------|-------|
| Tiller Handle Components .....               | 7B-1  |
| Torque Specifications .....                  | 7B-1  |
| Quicksilver Lubricants and Service Aids ..   | 7B-1  |
| Tiller Handle Throttle Cable Replacement ... | 7B-2  |
| Tiller Handle Installation .....             | 7B-5  |
| Shift Link Rod Installation .....            | 7B-6  |
| Throttle Cable Installation .....            | 7B-6  |
| Lanyard Stop Switch Wiring .....             | 7B-8  |
| Neutral Start Switch Wiring .....            | 7B-9  |
| Battery Connections .....                    | 7B-10 |
| Co-Pilot Installation Instructions .....     | 7B-11 |
| Shift Interlock Adjustment .....             | 7B-12 |



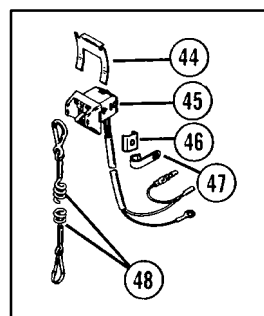
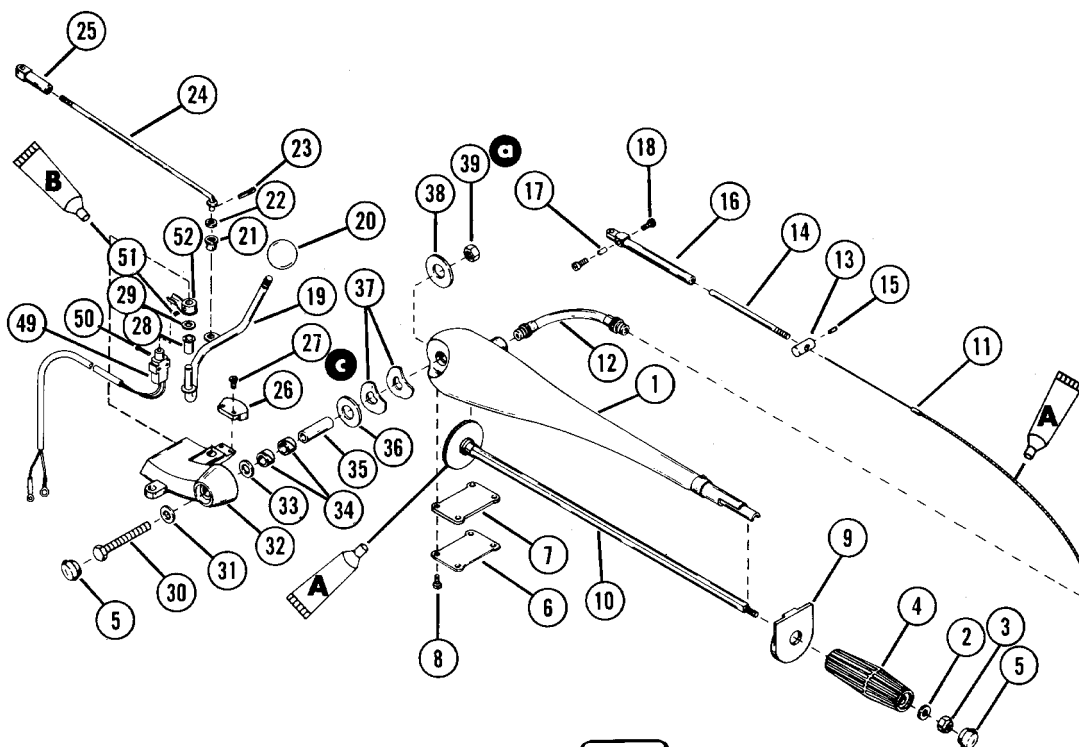
# Tiller Handle Components

- 1 - Steering Arm
- 2 - Washer
- 3 - Nut
- 4 - Grip
- 5 - Cap
- 6 - Plate
- 7 - Gasket
- 8 - Screw (4)
- 9 - Housing
- 10- Drive Rod
- 11- Throttle Cable
- 12- Conduit
- 13- Throttle Barrel
- 14- Tube
- 15- Screw

- 16- Guide
- 17- Anchor
- 18- Screw (2)
- 19- Shift Lever
- 20- Knob
- 21- Bushing
- 22- Washer
- 23- Cotter Pin
- 24- Shift Rod
- 25- Rod End
- 26- Detent
- 27- Screw (2)
- 28- Bushing
- 29- Washer
- 30- Screw
- 31- Washer
- 32- Bracket
- 33- Washer
- 34- Bushing (2)
- 35- Spacer
- 36- Washer
- 37- Wave Washer (2)
- 38- Washer
- 39- Locknut
- 40- Spacer
- 41- Stud (2)
- 42- Tab Washer (2)
- 43- Nut (2)
- 44- Retainer
- 45- Stop Switch
- 46- "C" Washer
- 47- Clamp
- 48- Lanyard

## Electric Start Models

- 49- Switch Assembly
- 50- Screw (2)
- 51- Set Screw (2)
- 52- Actuator

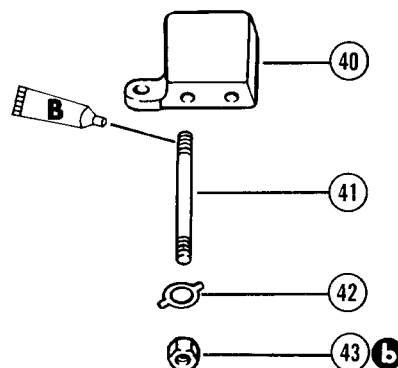


## Quicksilver Lubricants and Service Aids

**A** 2-4-C Marine Lubricant\*

**B** Loctite Grade "A" (271)\*

\*See Quicksilver Accessories Guide for part numbers.



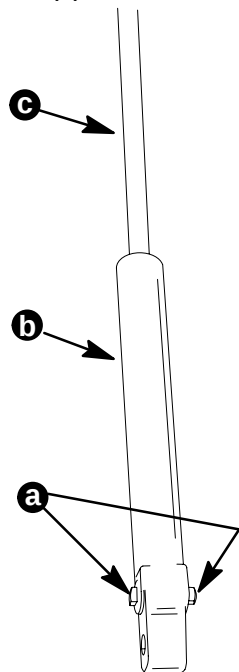
## Torque Specifications

- a** 30 lb. in. (3.3 N·m)
- b** 33 lb. ft. (45 N·m)
- c** 40 lb. in. (4.4 N·m)



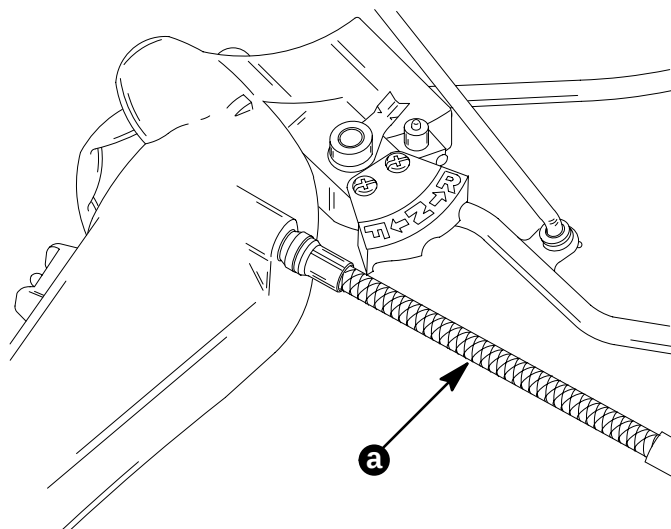
# Tiller Handle Throttle Cable Replacement

1. Remove tiller handle from outboard.
2. Remove throttle twist grip.
3. Loosen screws (a) securing cable guide (b) to throttle cable (c).



54819

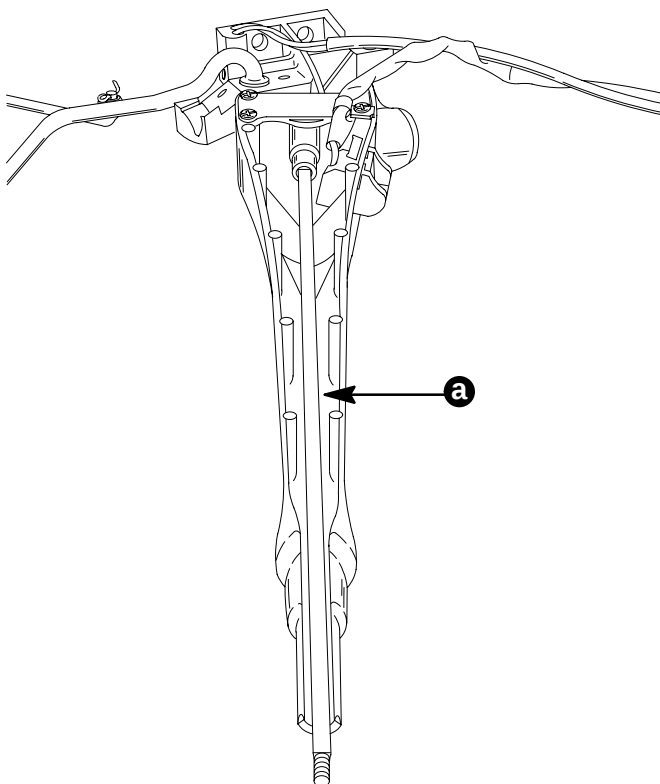
4. Remove conduit (a) and throttle cable from tiller handle.



54820

5. Install throttle cable.

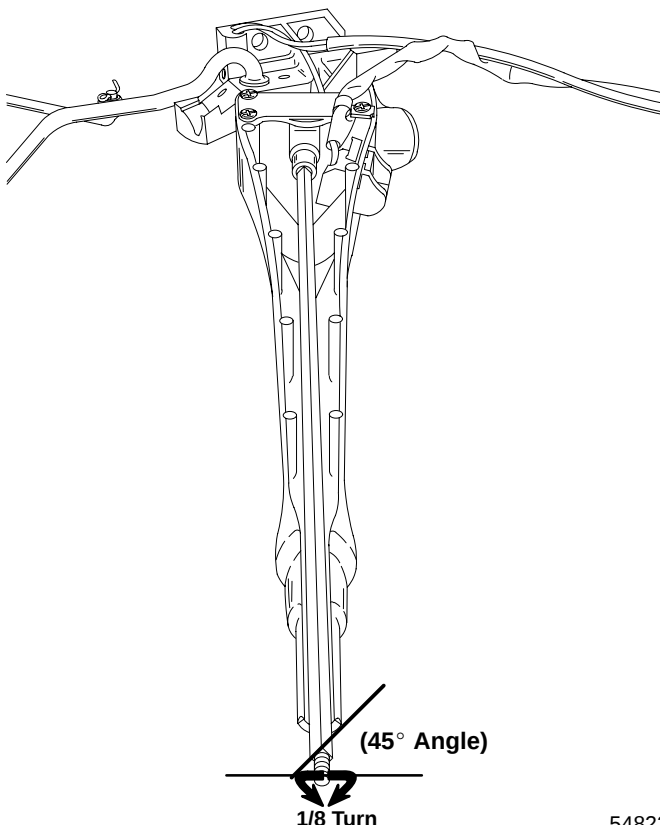
- a. Position drive rod flat surface parallel to work surface.



54821

a - Drive Rod

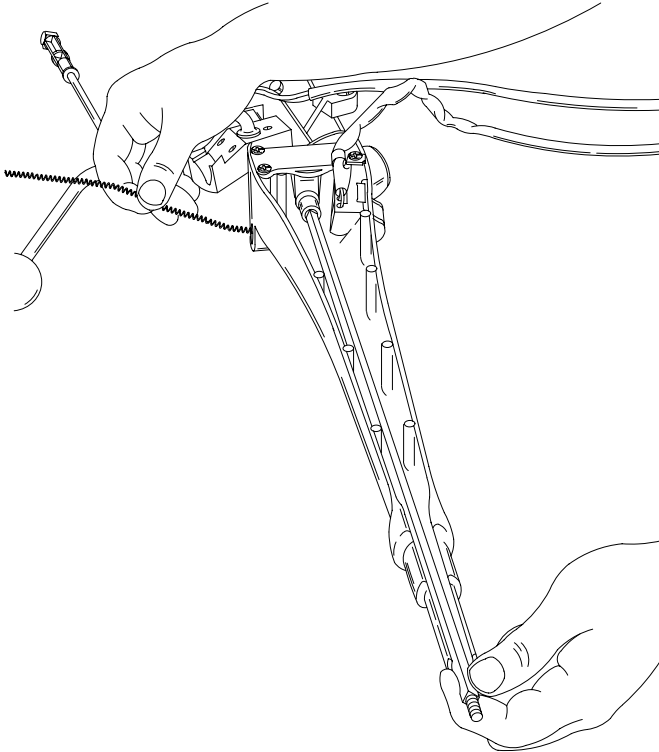
- b. Rotate drive rod (either direction) 1/8 turn to attain drive rod flat surface of 45°.



54822

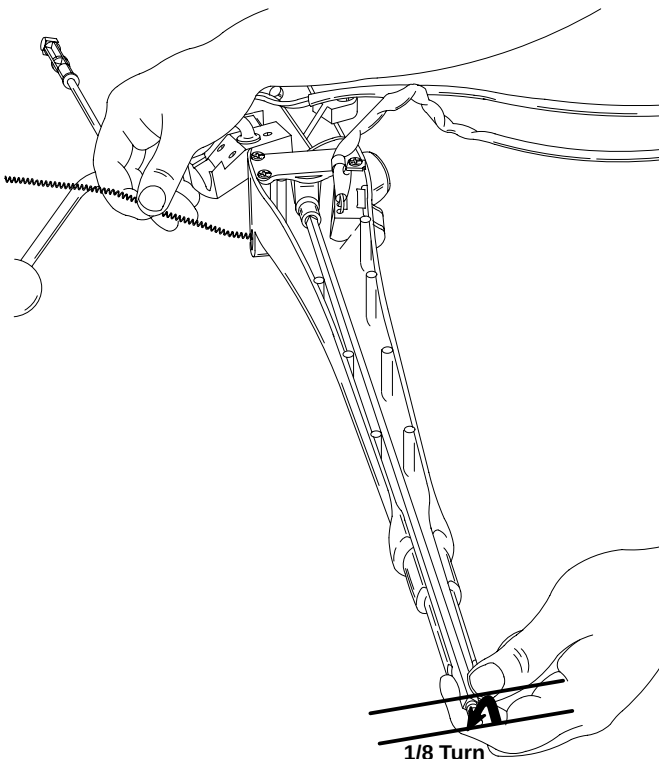


- c. Install throttle cable into tiller handle port until movement is felt in drive rod.



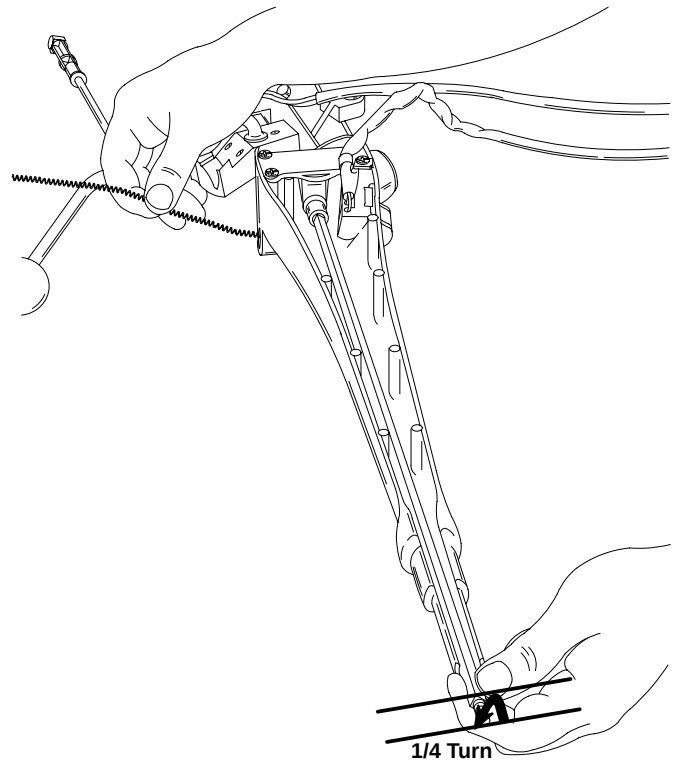
54823

- d. Rotate drive rod counterclockwise 1/8 turn (45°) until flat surface becomes parallel with work surface.



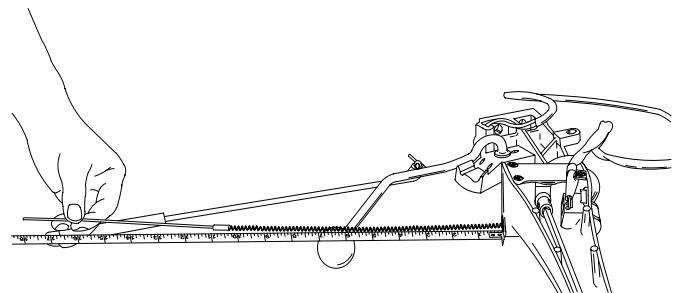
54823

- e. Rotate drive rod counterclockwise 1/4 turn (90°) until flat surface becomes parallel with work surface.



54823

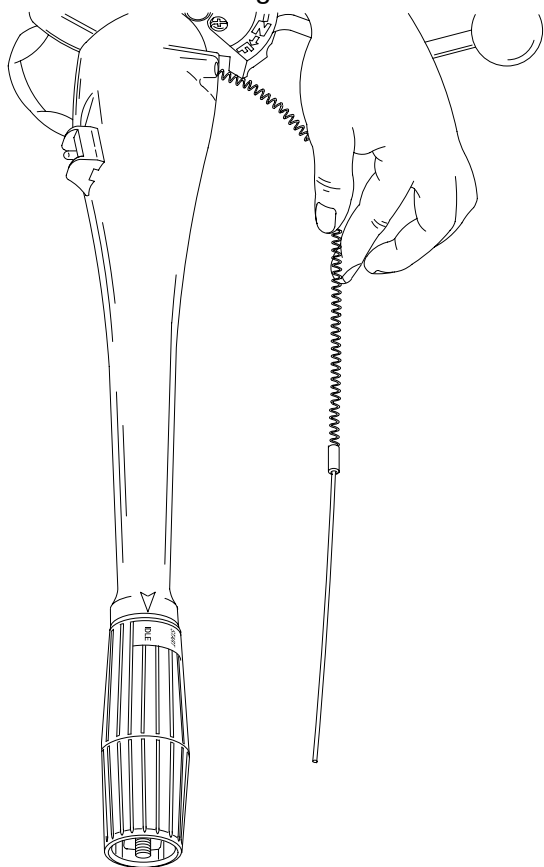
- f. Measure distance between tiller handle port and end of throttle cable. A measurement of 18 in. (457mm) must be attained for throttle shutter plates to open and close properly.



54824

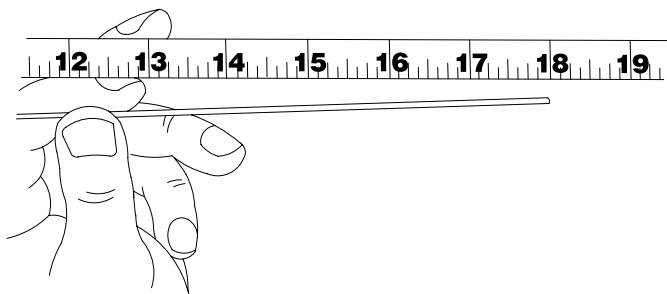


- g. Install throttle handle to tiller handle. Align "IDLE" on throttle handle with arrow on tiller handle without moving drive rod. Recheck throttle cable length.



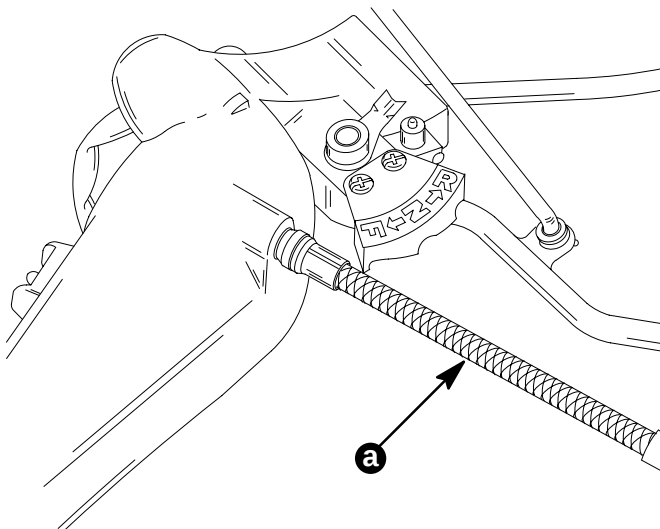
54825

**IMPORTANT:** If 18 in. (457mm) measurement is not attained following throttle cable installation, repeat steps a-g.



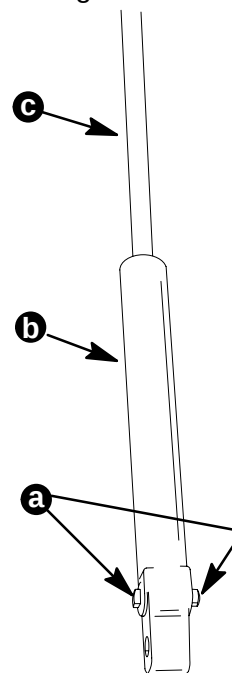
54826

6. Install washer, nut and end cap to throttle grip. Tighten nut snugly allowing grip to turn freely.
7. Install conduit (a) to tiller handle. Turn conduit in until bottomed out on tiller handle, then back off one turn.



54820

8. Reinstall cable guide to throttle cable.



54819

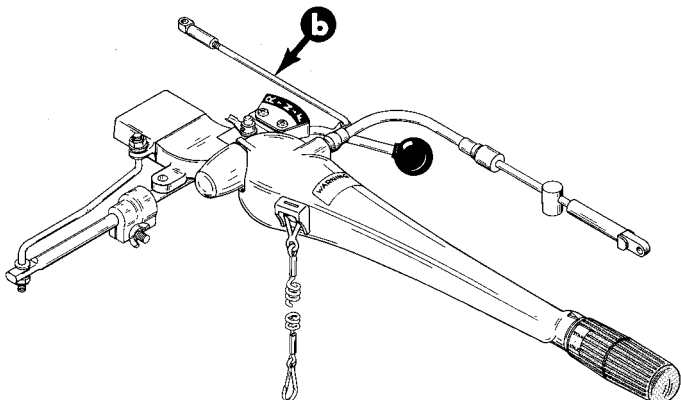
- a - Screws  
b - Cable Guide  
c - Throttle Cable



# Tiller Handle Installation

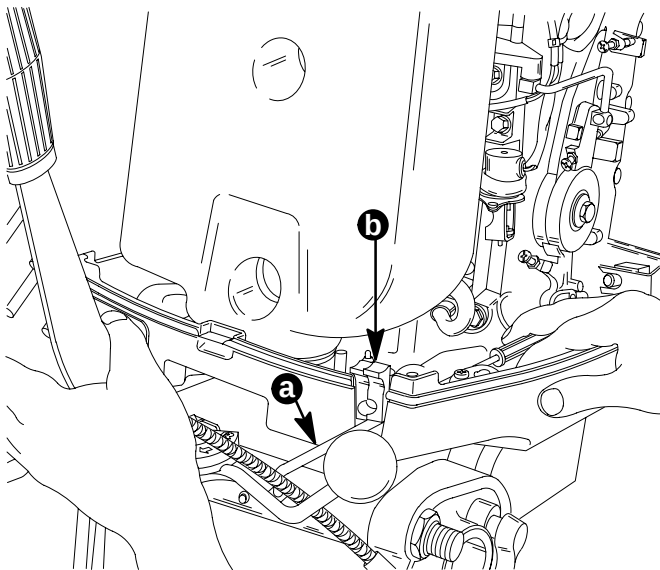
(ELECTRIC START MODEL SHOWN)

1. Insert shift link rod (b) thru opening in the bottom cowl.



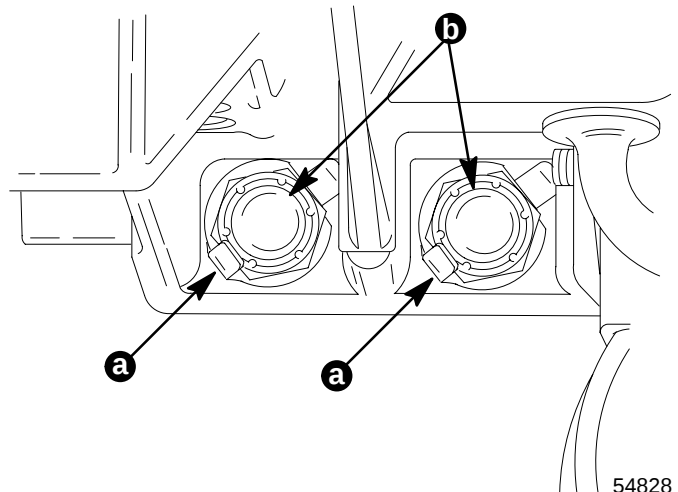
50505

2. Route shift link rod (a) around port side of outboard and position through lower opening in rubber grommet (b).



54827

3. Secure tiller handle assembly to studs of outboard steering arm using tab washers (a) and locknuts (b). Torque locknuts to 33 lb. ft. (45 N·m) and bend tab washers against hex of locknuts.



54828



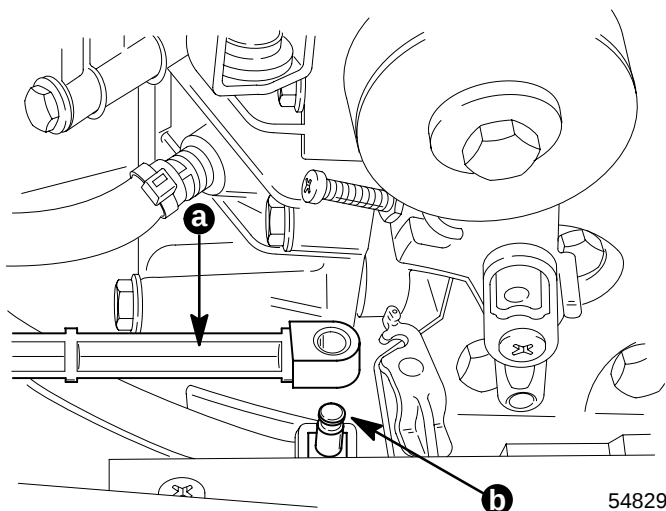
## Shift Link Rod Installation

1. Place shift lever (located on tiller handle) in "N" (Neutral) position.

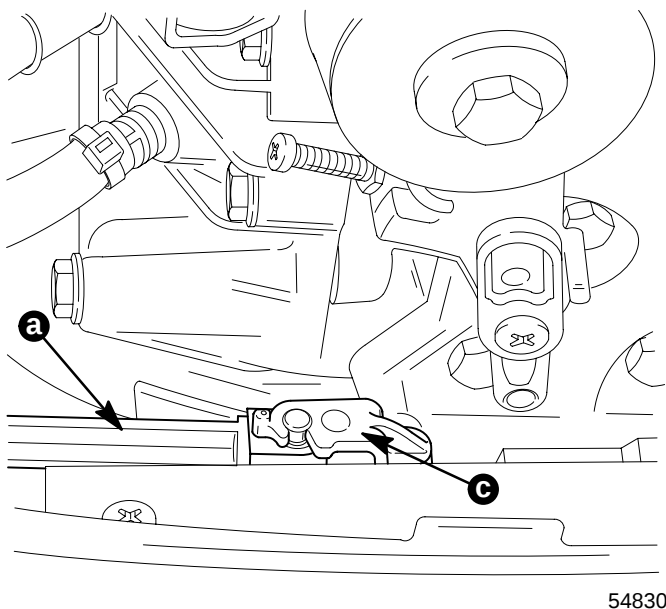
### **⚠ CAUTION**

To avoid accidental starting, which could result in personal injury, remove and isolate high tension spark plug leads from spark plugs before working near propeller.

2. Place engine shift actuating slide to neutral position (propeller turns freely in both directions).
3. Adjust shift link rod (a) to fit over peg (b) of shift actuating slide without moving shift lever or actuating slide.



4. Secure shift link rod end (a) onto shift peg, using rod end retainer (c).

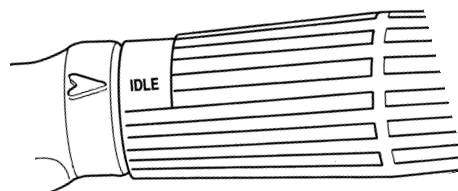


5. Check shift link rod adjustment as follows:

- a. Place outboard shift lever in "F" (Forward) position. Propeller should not rotate in a COUNTERCLOCKWISE direction. If propeller does rotate COUNTERCLOCKWISE, length of shift link rod must be reduced and Step "a" repeated.
- b. Place outboard shift lever in "N" (Neutral) position. Propeller should rotate freely without drag. If not, length of shift link rod must be increased and Steps "a" and "b" repeated.
- c. While rotating propeller, place outboard shift lever in "R" (reverse) position. If propeller can be rotated in either direction, length of shift link rod must be increased and Steps "a" thru "c" repeated.
- d. Place outboard shift lever in "N" (Neutral) position. Propeller should turn freely without drag. If not, length of shift link rod must be decreased and Steps "a" thru "d" repeated.

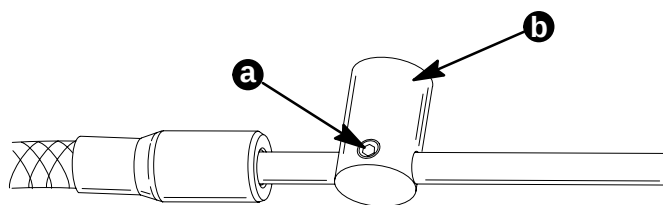
## Throttle Cable Installation

1. Rotate throttle twist grip fully clockwise to stop "IDLE" position.



20888

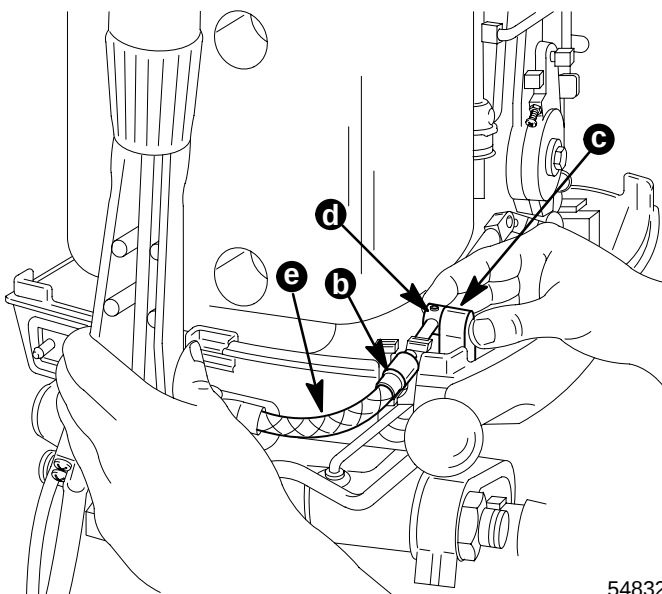
2. Back out set screw (a) from throttle cable barrel (b) until 2 or 3 threads of set screw are exposed.



54831

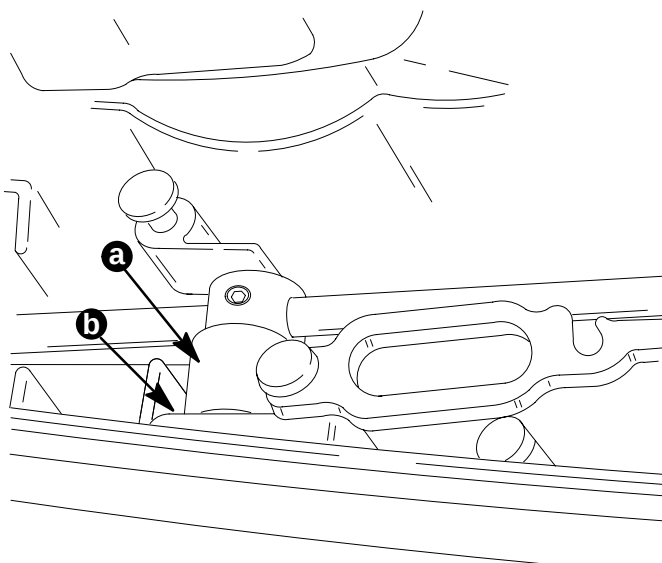


3. Place barrel receptacle (c) onto throttle barrel (d). Route throttle cable (e) around port side of outboard and position throttle cable through center opening in rubber grommet (b).



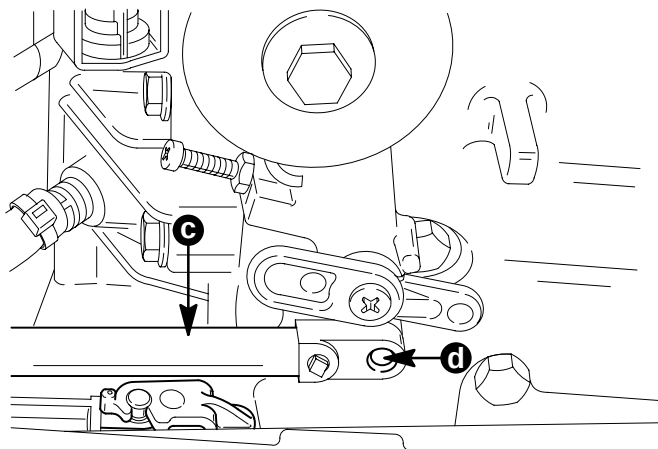
54832

4. Position barrel receptacle (a) into receptacle guide (b).



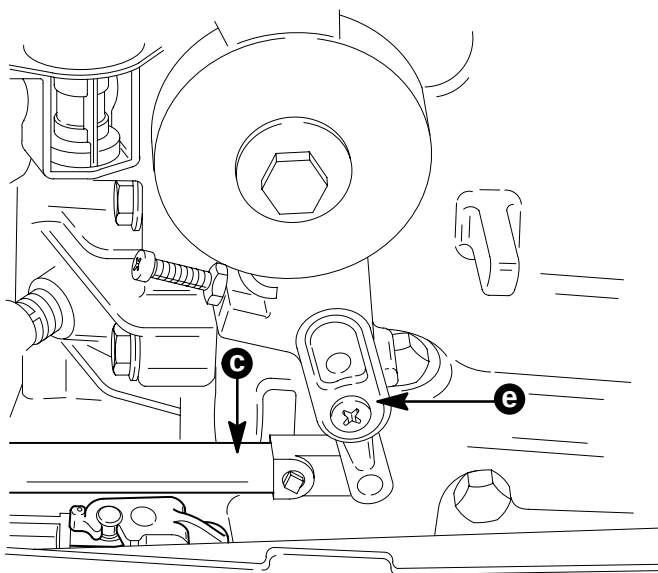
54833

5. Place end of throttle cable (c) on peg of throttle lever (d).



54834

6. Secure throttle cable (c) with latch (e).



54835

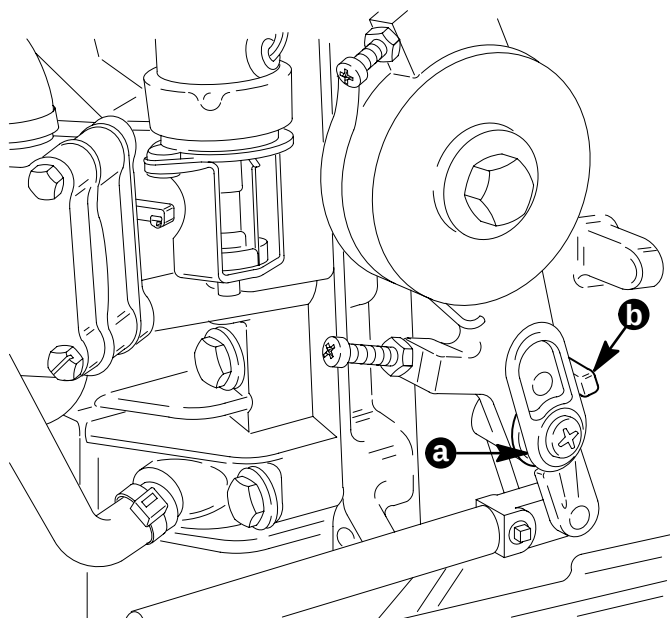
7. Apply a drop of Loctite 271 onto exposed threads of throttle cable barrel set screw. (DO NOT tighten set screw at this time.)

### **⚠ CAUTION**

**DO NOT** exceed 1/4-turn on set screw after it has bottomed-out.

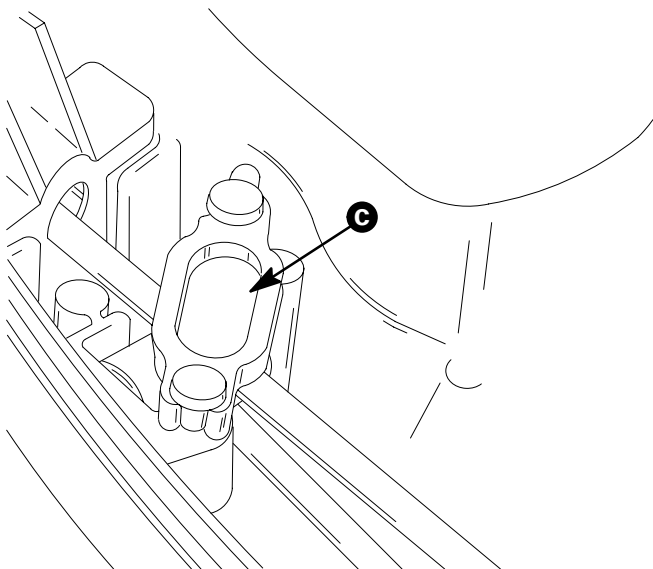


8. With throttle lever (a) held **lightly against** stop (b) and throttle twist grip at "IDLE", turn set screw of throttle cable barrel in until it bottoms-out on tube, then tighten screw an additional 1/8 turn.



54836

9. Secure barrel receptacle using barrel retainer (c).

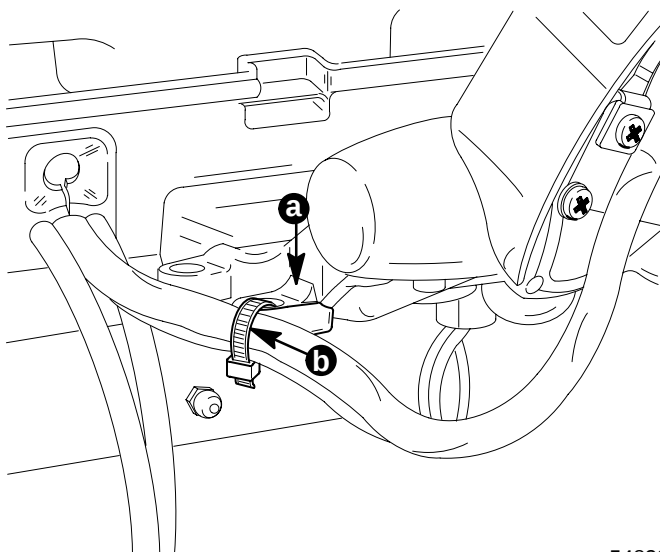


54837

10. Check preload on throttle cable, by placing a thin piece of paper between idle stop screw and idle stop. Preload is correct when paper can be removed without tearing, but has some drag on it. Readjust throttle cable barrel, if necessary.

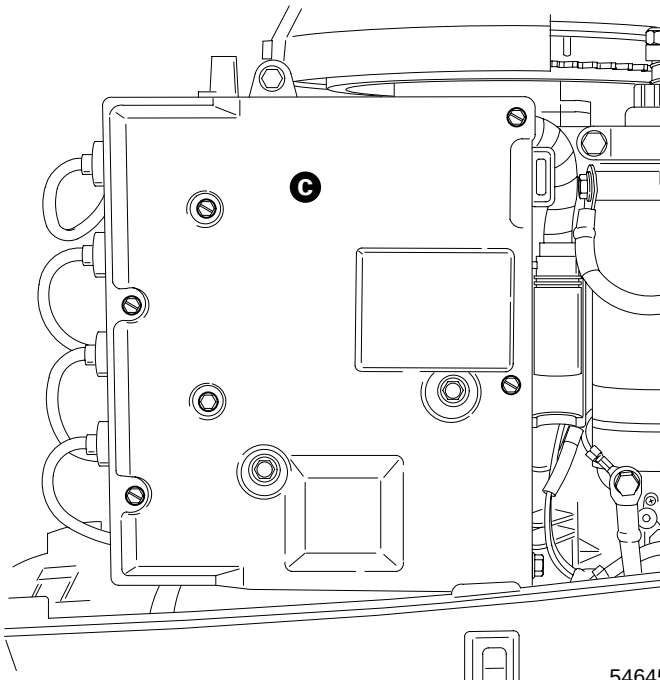
## Lanyard Stop Switch Wiring

1. Route Lanyard Stop Switch and Neutral Start Switch wiring through bushing as shown. Secure wiring to tiller bracket (a) using sta-strap (b).



54838

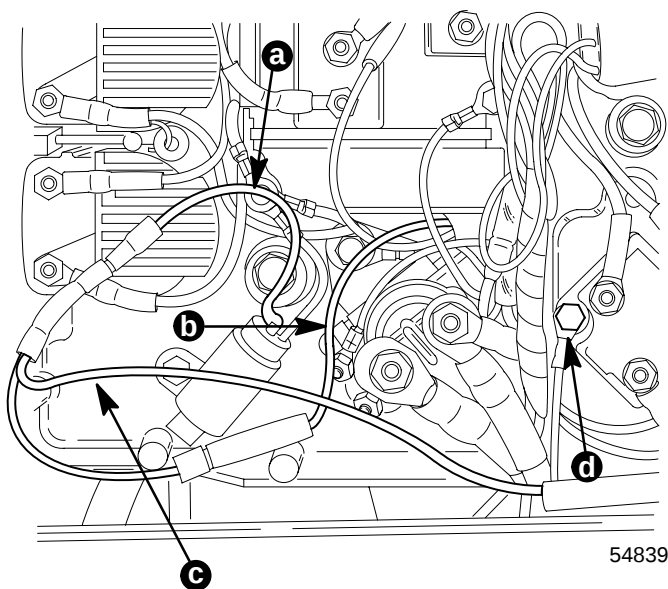
2. Remove electrical box side cover (c).



54645

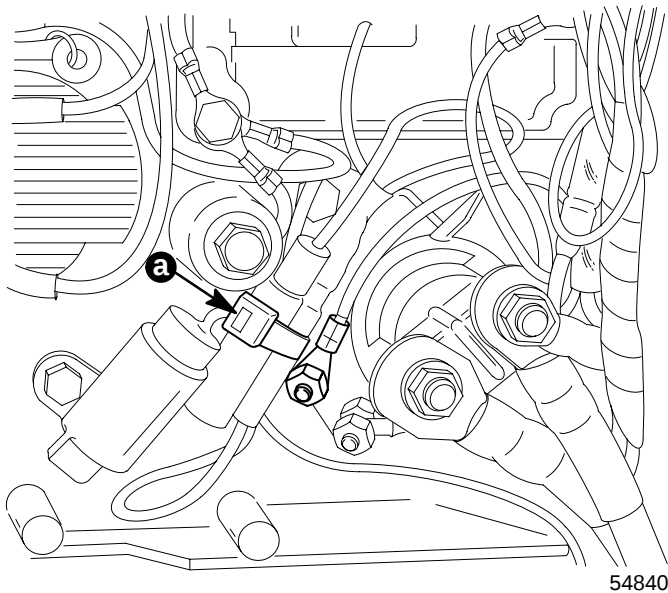


3. Connect lanyard stop switch wiring harness as shown.



- a - Black/Yellow Lead from Mercury Stop Switch
- b - Black/Yellow Lead from Outboard Wiring Harness
- c - Black/Yellow Leads from Lanyard Stop Switch
- d - Black Lead (to Outboard Ground)

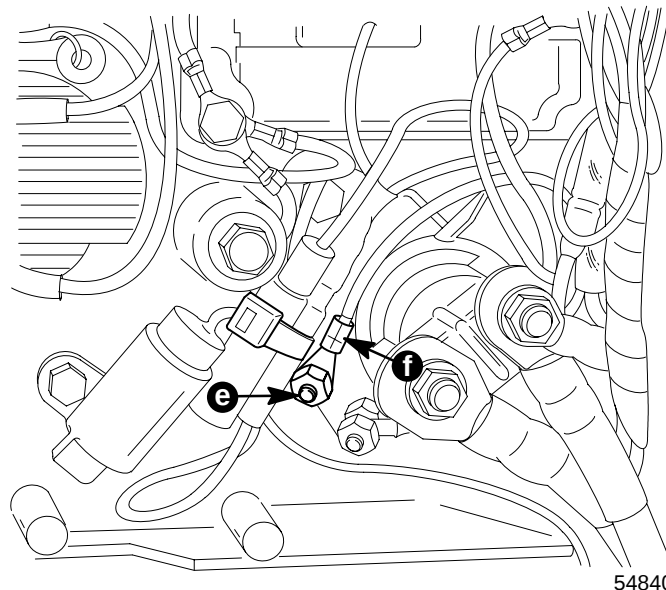
4. Secure lanyard stop switch leads with sta-strap (a).



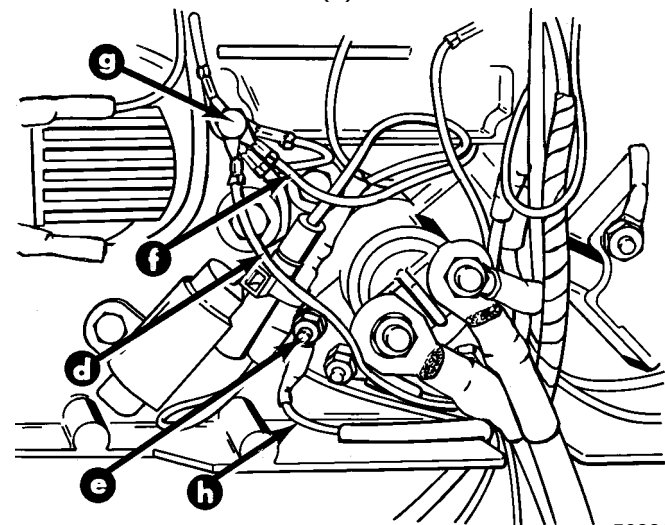
## Neutral Start Switch Wiring

**NOTE:** Electric Start Models

1. Remove ground lead (f) from solenoid terminal (e).



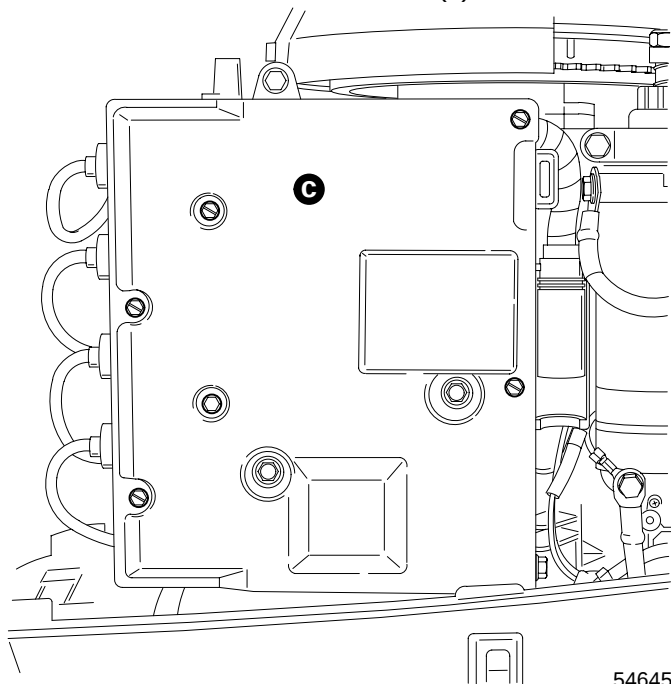
2. Connect ground lead (f) and ground lead (d) from Neutral Start Switch to switch box ground (g). Connect remaining Neutral Start Switch wire (h) to solenoid terminal (e).



- d - Ground Lead (Large Ring Terminal) from Neutral Start Switch
- e - Solenoid terminal
- f - Ground Lead (Removed from Solenoid)
- g - Engine Ground
- h - Ground Lead (Small Ring Terminal) from Neutral Start Switch



3. Reinstall electrical box cover (c).



## Battery Connections

### ⚠ CAUTION

**Failure to observe correct polarity when connecting battery cable to battery, will result in damage to the charging system.**

1. A battery with a minimum reserve capacity rating of 100 minutes (minimum cold cranking rating of 350 amperes) is recommended.
2. House battery in a battery box and secure in a favorable position in boat.
3. Connect battery cables to battery by connecting BLACK lead to negative (–) terminal and connecting RED lead to positive (+) terminal on battery.



## Co-Pilot Installation Instructions

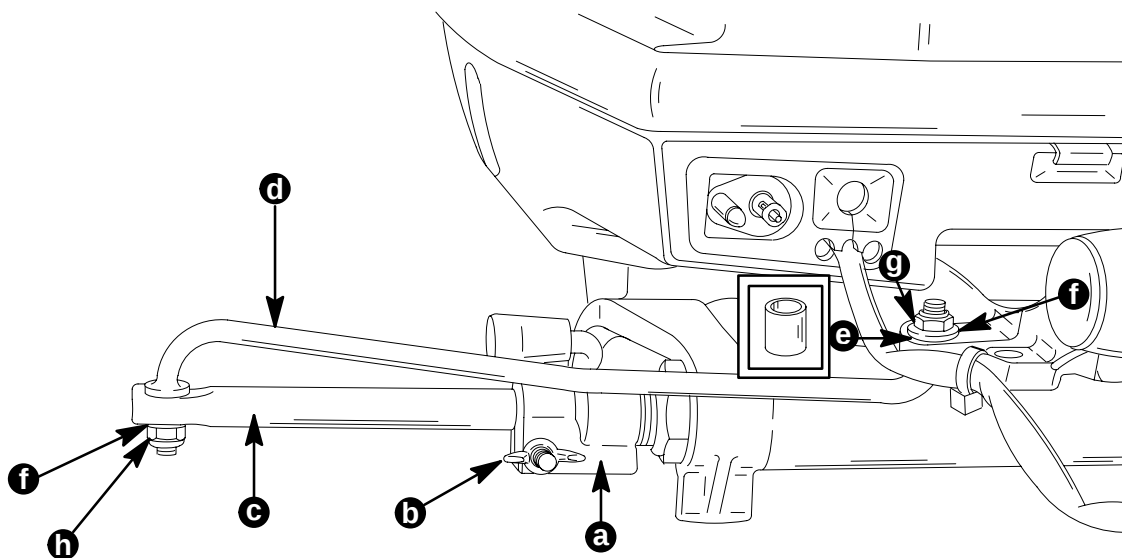
1. Thread friction device (a) onto starboard end of tilt tube until securely tightened and wind nut will be positioned toward front of outboard.
2. Loosen wing nut on friction device and insert pilot rod (c) into friction device and tilt tube.
3. Lubricate each end of link rod with Quicksilver 2-4-C Marine Lubricant.
4. Install link rod ("d" longer end) into hole in steering handle bracket and other end of link rod into hole in pivot rod, as shown.
5. Secure link rod to steering handle spacer bracket with spacer, flat washer and locknut. Torque locknut to 120 lb. in. (13.6 N·m).

6. Secure link rod to pilot rod with flat washer and locknut. Tighten locknut until it seats. DO NOT exceed 120 lb. in. (13.6 N·m), then back off 1/4-turn.
7. Adjust wing nut on friction device to provide desired steering control.

**IMPORTANT: Tighten wing nut (b) to increase friction; loosen to decrease friction.**

### WARNING

**If the wing nut (b) is overtightened it may not be possible to steer the outboard in an emergency.**



- a - Friction Device [Position so Wing Nut (b) will be Positioned Toward Front of Outboard]
- b - Wing Nut
- c - Pivot Rod
- d - Link Rod
- e - Spacer (Hidden); Place in Hole
- f - Flat Washer
- g - Locknut; Torque to 120 lb. in. (13.6 N·m)
- h - Locknut; Tighten Until it Seats; DO NOT Exceed 120 lb. in. (13.6 N·m), then Back Off 1/4-Turn

26381



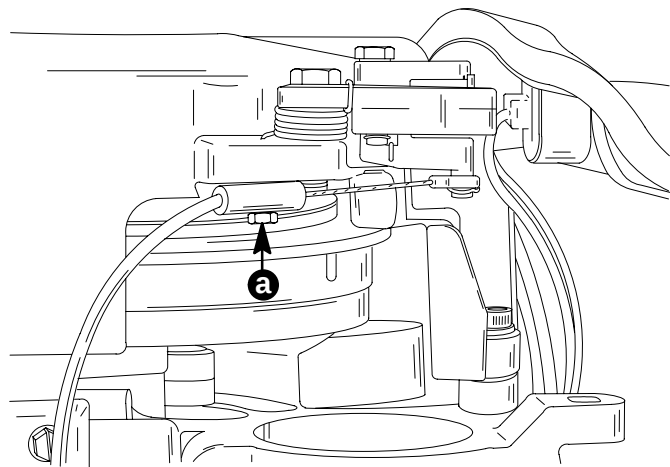
# Shift Interlock Adjustment

(MANUAL START MODEL)

## ⚠ CAUTION

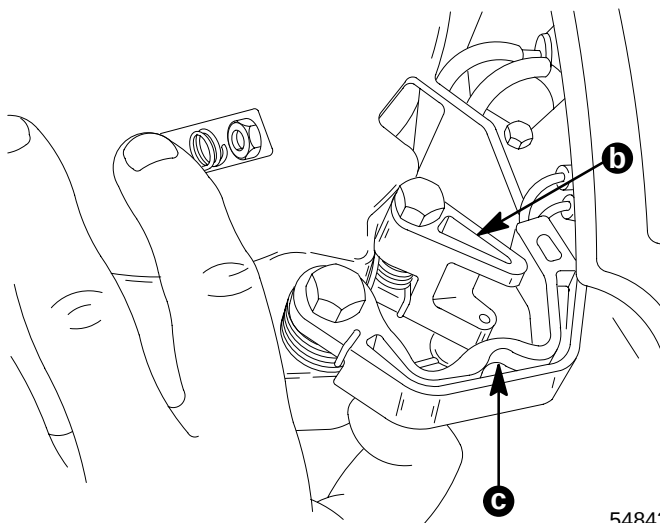
**DO NOT** shift into “R” (reverse gear) position when engine is not running, as shifting mechanism could be damaged.

1. Shift outboard into neutral position.
2. Loosen cable attaching screw (a) to allow cable movement.

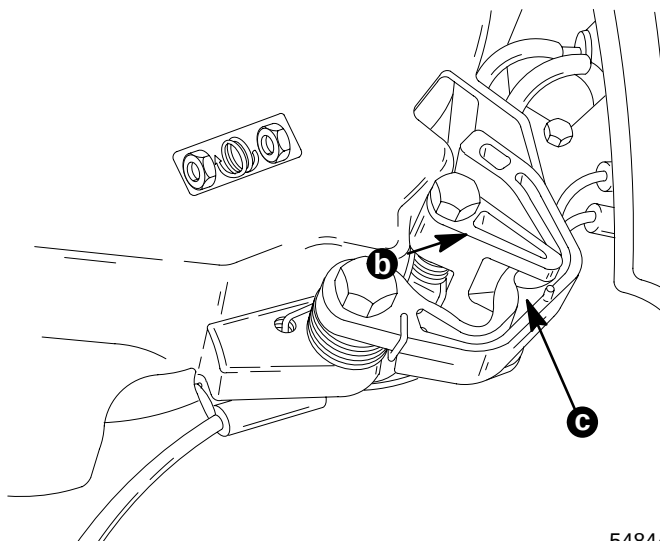


54842

3. Interlock actuator (b) must align with rise of interlock cam (c) while shift lever is in the neutral position.
4. Tighten cable attaching screw securely.



54843

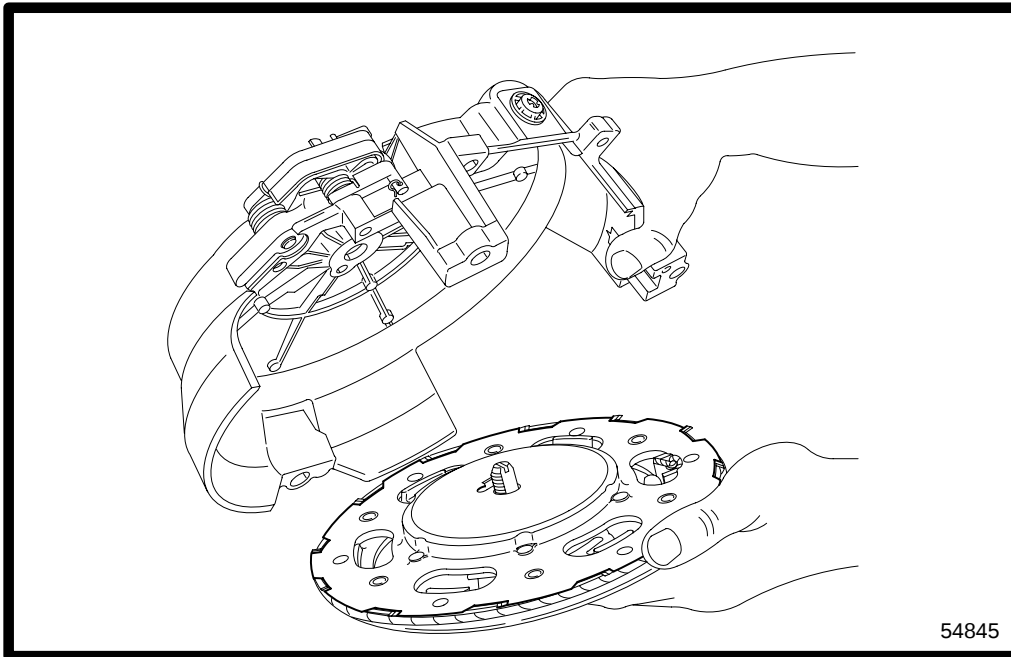


54844

b - Interlock Actuator  
c - Interlock Cam



# OUTBOARD MOTOR INSTALLATION/ ATTACHMENTS



7  
C

## REWIND STARTER



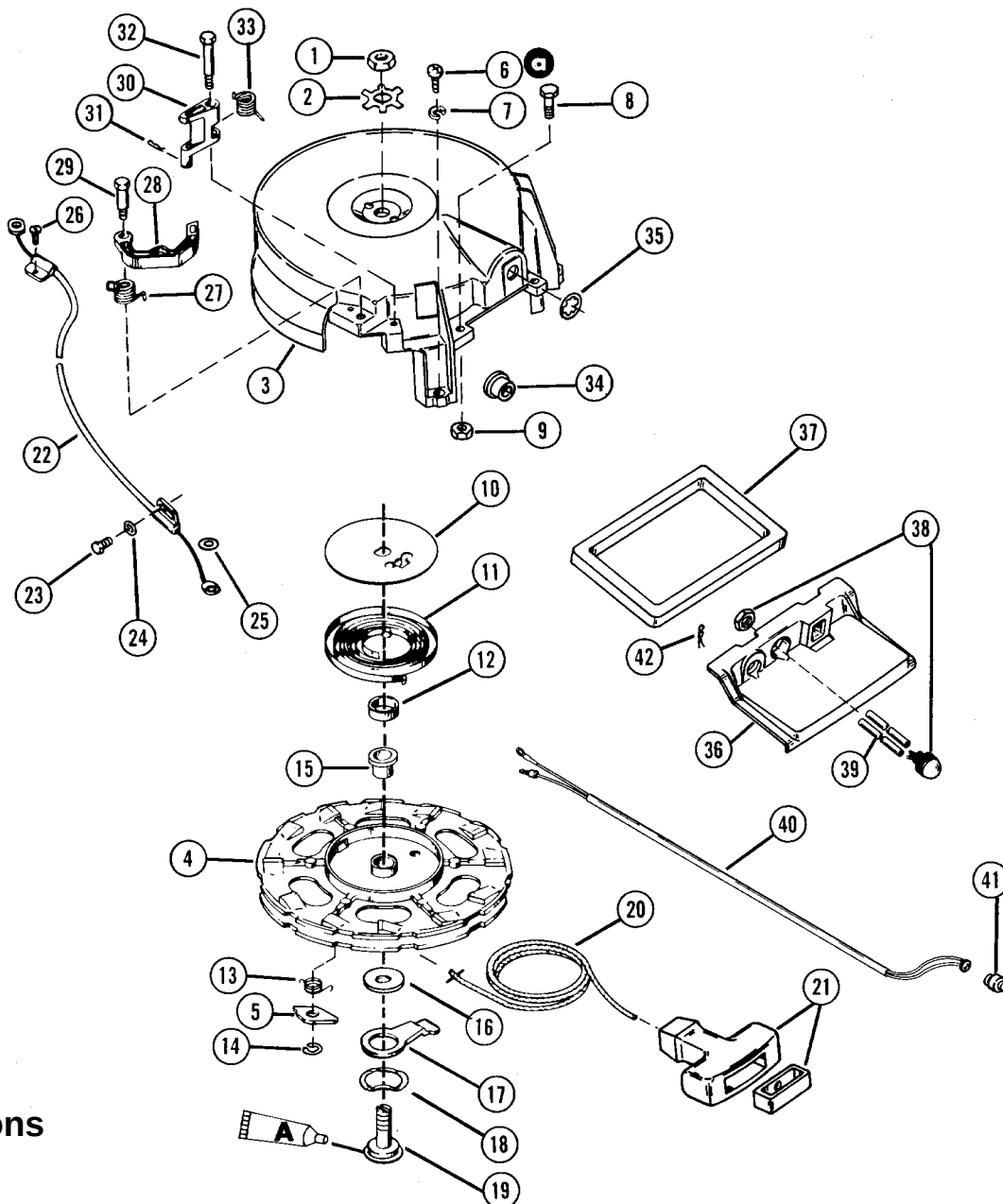
# Table of Contents

|                                            | Page |
|--------------------------------------------|------|
| Rewind Starter Components .....            | 7C-1 |
| Torque Specifications .....                | 7C-1 |
| Quicksilver Lubricants and Service Aids .. | 7C-1 |
| Rewind Starter Disassembly .....           | 7C-2 |
| Cleaning and Inspection .....              | 7C-3 |
| Rewind Starter Reassembly .....            | 7C-4 |
| Installing Used Rewind Spring .....        | 7C-4 |
| Installing New Rewind Spring .....         | 7C-4 |
| Rope Installation .....                    | 7C-5 |
| Adjusting Rewind Spring Tension .....      | 7C-7 |



# Rewind Starter Components

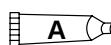
- 1 - Nut (Left Hand Thread)
- 2 - Tab Washer
- 3 - Starter Housing
- 4 - Starter Sheave
- 5 - Starter Pawl
- 6 - Screw (3)
- 7 - Lockwasher (3)
- 8 - Screw (2)
- 9 - Nut (2)
- 10- Plate
- 11- Spring
- 12- Bushing
- 13- Spring
- 14- "E" Ring
- 15- Spacer
- 16- Washer
- 17- Lever
- 18- Wave Washer
- 19- Sheave Shaft
- 20- Starter Rope
- 21- Handle and Retainer
- 22- Cable
- 23- Screw
- 24- Washer
- 25- Washer
- 26- Screw
- 27- Spring
- 28- Cam
- 29- Screw
- 30- Actuator
- 31- Cotter Pin
- 32- Screw
- 33- Spring
- 34- Bushing
- 35- Retaining Ring
- 36- Rest Assembly
- 37- Seal
- 38- Primer Bulb
- 39- Tubing
- 40- Stop Switch Assembly
- 41- Boot Assembly
- 42- Cotter Pin (2)



## Torque Specifications

- a** 100 lb. in. (11 N·m)

## Quicksilver Lubricants and Service Aids

 2-4-C Marine Lubricant\*

\*See Quicksilver Accessories Guide for part numbers.

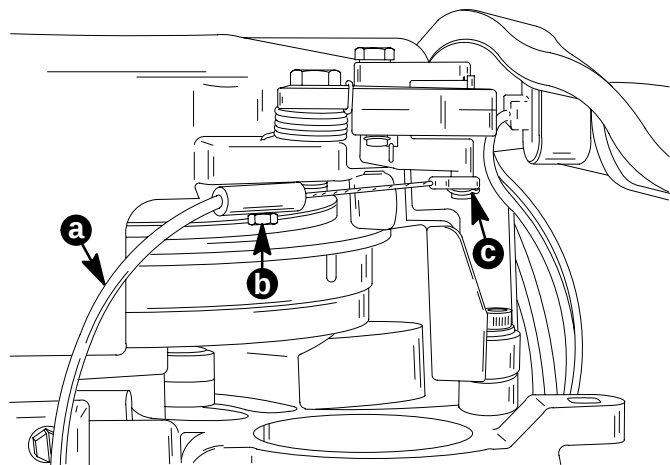


# Rewind Starter Disassembly

## ⚠ WARNING

When disassembling and reassembling rewind starter, **SAFETY GLASSES** must be worn in case rewind spring uncoils out of the housing.

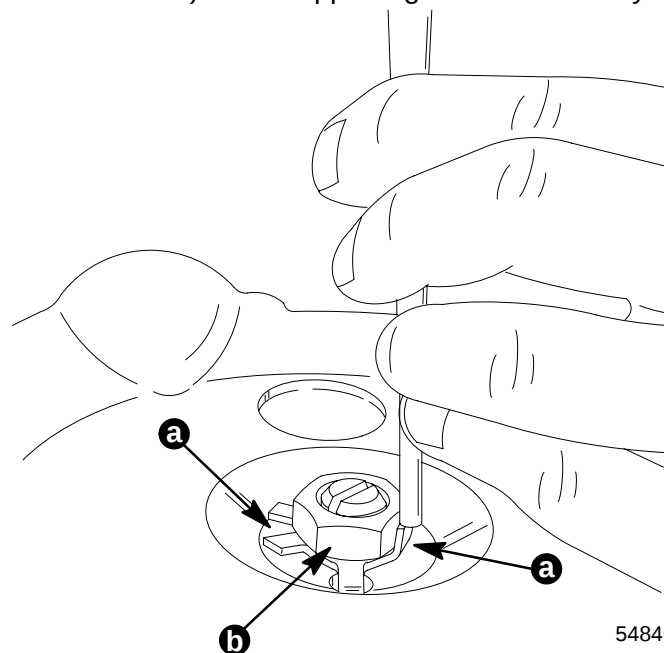
1. Untie knot in starter rope and release starter rope to allow rewind spring to unwind.
2. Remove retaining clip and attaching screw which secures shift interlock cable to starter housing.
3. Remove rewind starter from engine.



54842

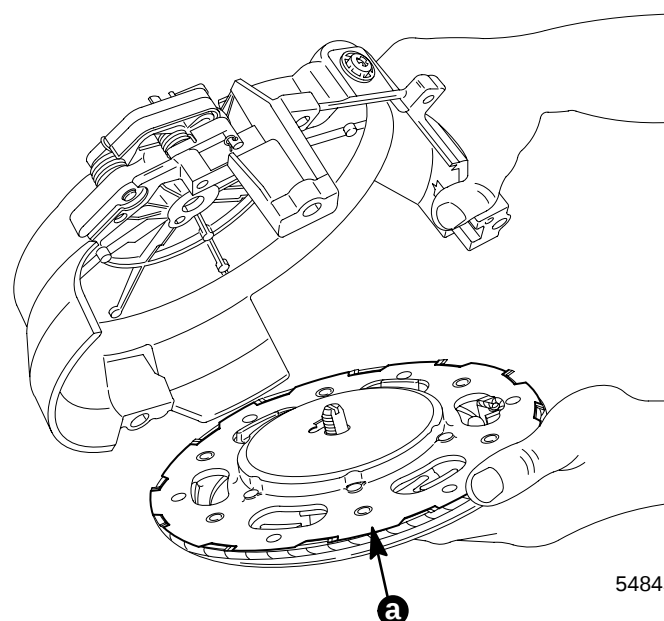
- a - Shift Interlock Cable
- b - Cable Attaching Screw
- c - Retaining Clip

4. Bend lock tabs (a) away from nut (b).
5. Remove nut ("b" left hand thread-turn clockwise to remove) while supporting rewind assembly.



54846

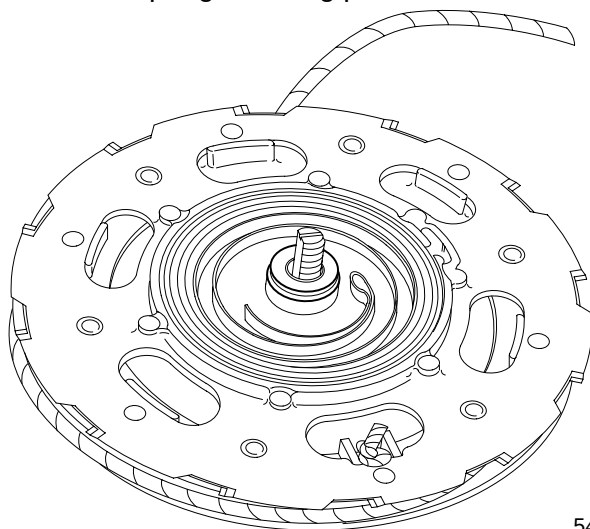
6. Remove sheave assembly (a) from housing.



54845

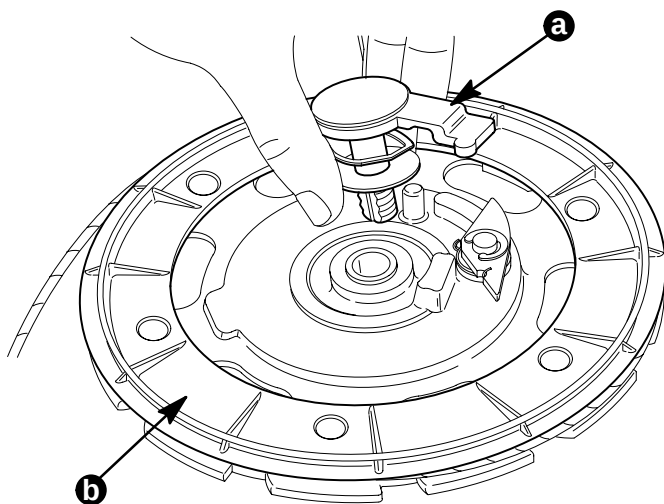


7. Remove spring retaining plate.



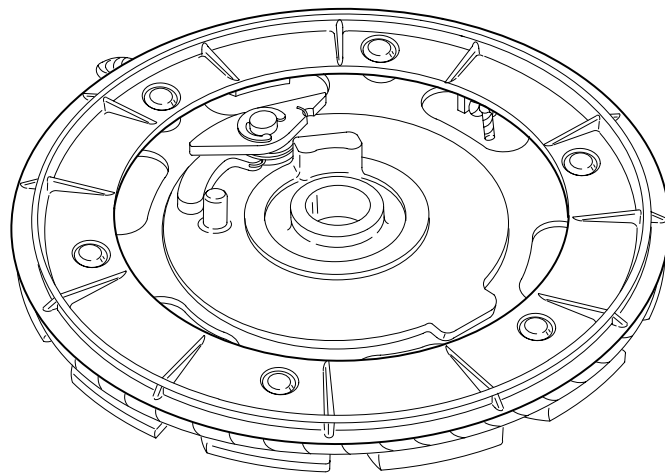
54847

8. Remove lever components (a) from sheave (b).



54848

9. Remove rewind spring by placing sheave over 2 pieces of wood (2 x 4's) with spring facing down. Tap top of sheave with a mallet. This will cause rewind spring to drop out of sheave.



54849

## Cleaning and Inspection

1. Clean components in solvent and dry with compressed air.
2. Inspect rewind spring for kinks, burrs, corrosion or breakage.
3. Inspect starter sheave, rope guide and starter housing for nicks, grooves, cracks, wear or distortion, especially area of rope travel.
4. Inspect bushing, starter drive pawl and spring for wear or damage.
5. Inspect starter rope for wear.
6. Replace components as necessary.



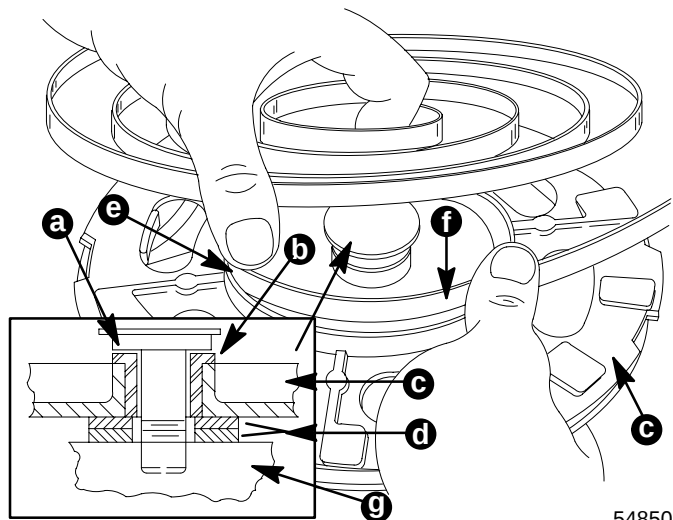
# Rewind Starter Reassembly

## ⚠ WARNING

When reassembling rewind starter, **SAFETY GLASSES** must be worn in case rewind spring uncoils out of the housing.

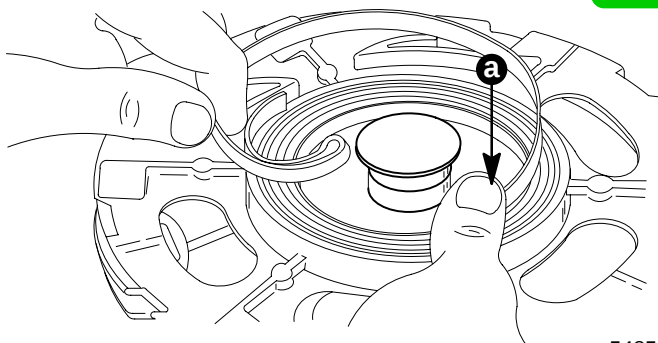
## Installing Used Rewind Spring

1. Lubricate rewind spring with low temperature grease.
2. To enable sheave to rotate when installing rewind spring, place bushing and sheave shaft into sheave. Add flat washers, below sheave to raise sheave above vise. Secure sheave shaft in vise that is equipped with soft jaw protectors.
3. Engage hook (on end of spring) into sheave.
4. Turn sheave clockwise, while feeding spring into recess, and use thumbs to guide rewind spring into recess. Proceed cautiously; do not allow spring to get out-of-control.
5. Remove sheave from vise and remove sheave shaft and bushing.



54850

- a - Sheave Shaft
- b - Bushing
- c - Sheave
- d - Flat Washers (Allowing Enough Clearance for Sheave to Rotate Above Vise)
- e - Hook Spring in Notch
- f - Turn Sheave Clockwise while Feeding Spring into recess
- g - Vise (with Soft Jaw Protectors)

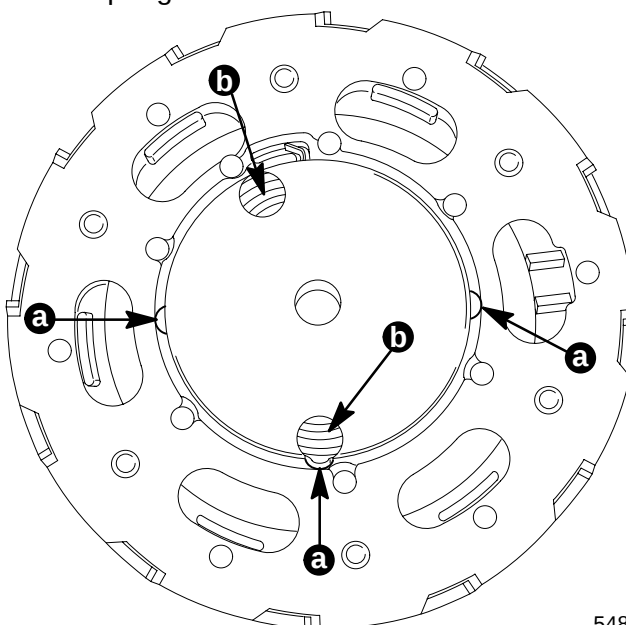


54851

- a - Push Rewind Spring into Recess while Turning Sheave Clockwise

## Installing New Rewind Spring

1. Remove retainers (used to keep spring from accidentally coming out of shipping container).
2. Place hook (on end of spring) into sheave anchor and place support tabs (a) on container above spring recess, as shown.
3. Insert 2 large bit screwdrivers thru openings (b) and push spring out of shipping container and into spring recess in sheave.

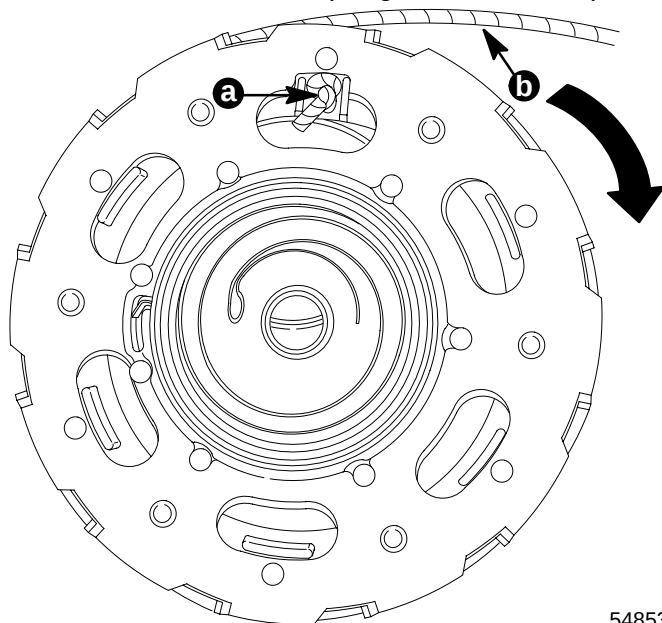


54852

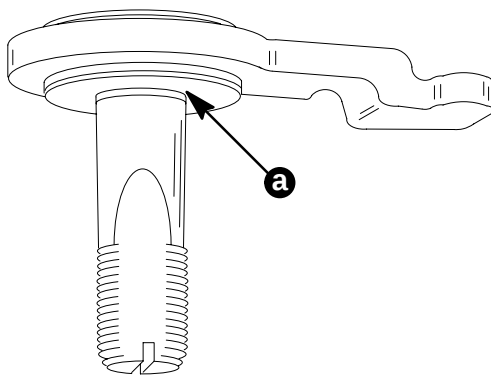


## Rope Installation

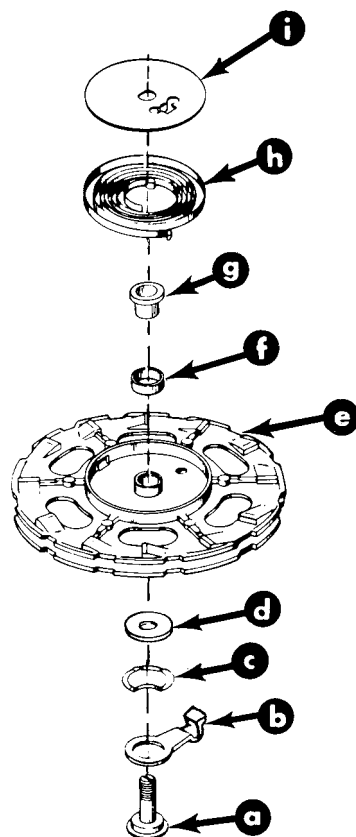
1. Route rope thru hole in sheave.
2. Tie a knot in end of rope and place knot in recess (a).
3. Wind rope (b) clockwise onto sheave (when viewed from rewind spring side of sheave).



4. Lubricate shoulder on sheave shaft (a) with low temperature grease and install lever as shown.

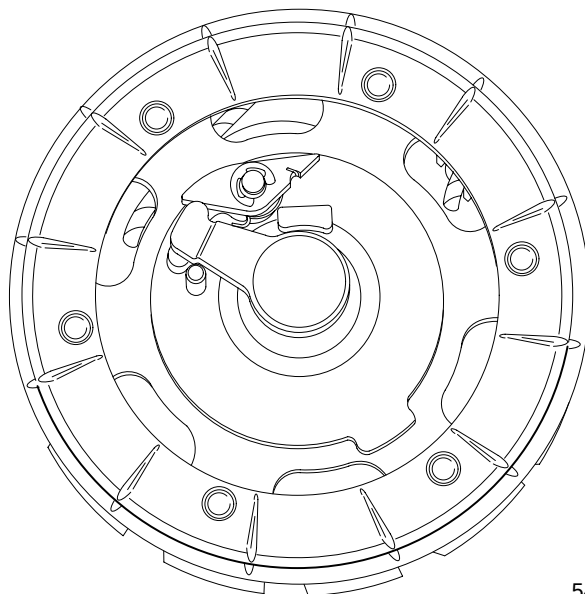


5. Lubricate all components with low temperature grease.



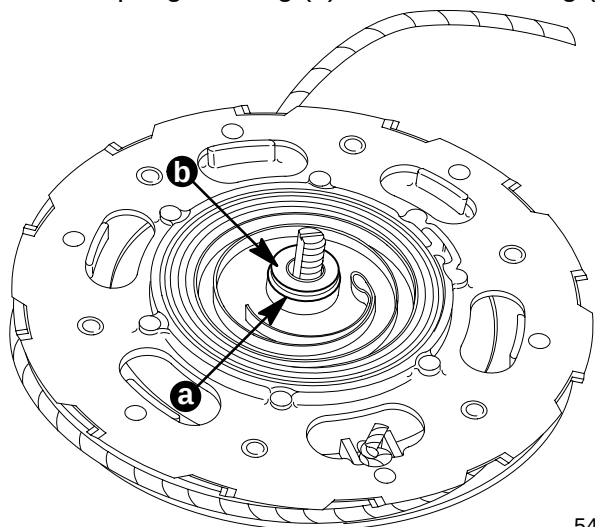
- a - Sheave Shaft
- b - Lever
- c - Wave Washer
- d - Flat Washer
- e - Sheave
- f - Spring Bushing
- g - Shaft Bushing
- h - Rewind Spring
- i - Spring Retainer Plate

6. Assemble sheave components as shown.



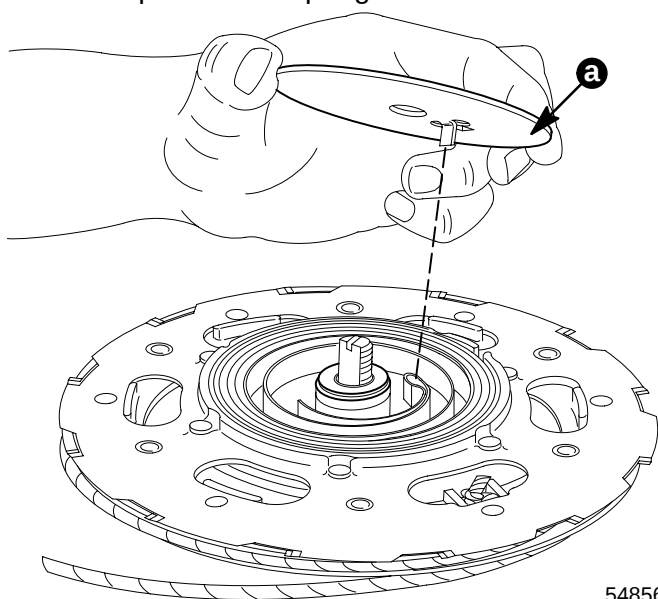


7. Install spring bushing (a) and shaft bushing (b).



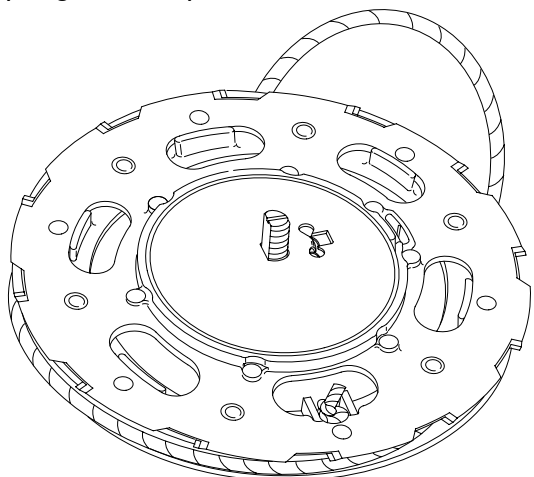
54847

8. Install spring retainer plate (a) over sheave shaft. Use a thin shaft screwdriver to engage tab into inner loop of rewind spring.



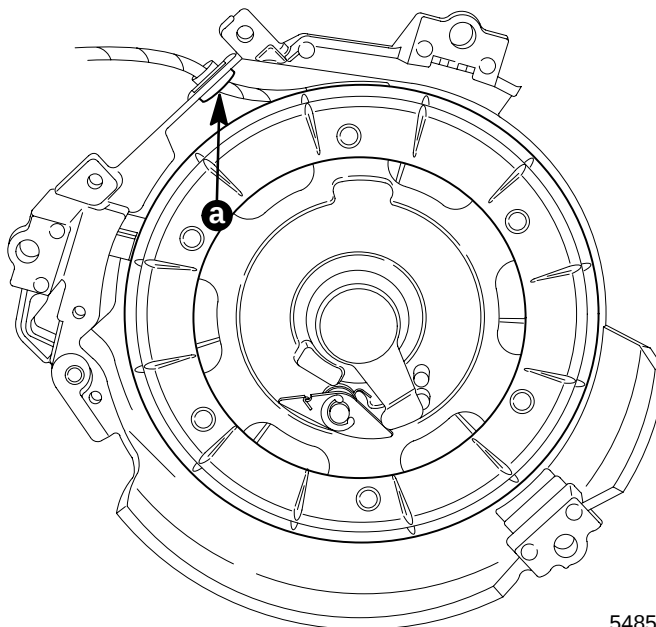
54856

9. Spring retainer plate installed.



54857

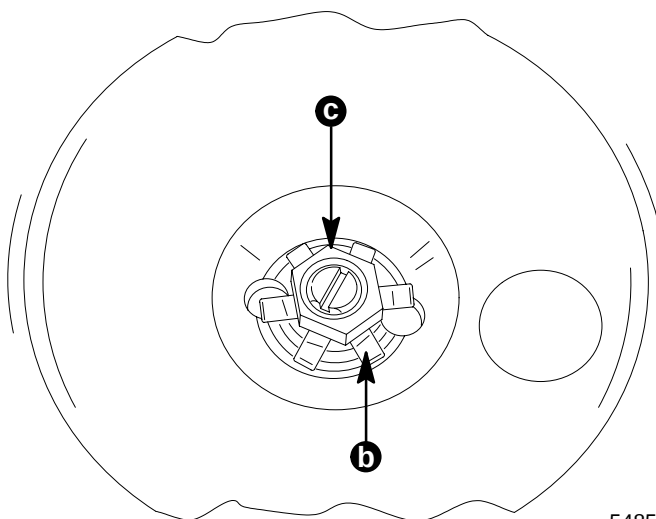
10. Push starter rope thru rope guide (a) then place sheave assembly into rewind housing.



54858

11. Place new locking tab washer ("b" cupped side facing down on sheave shaft).

12. Thread nut ("c" left hand thread) finger tight on shaft.

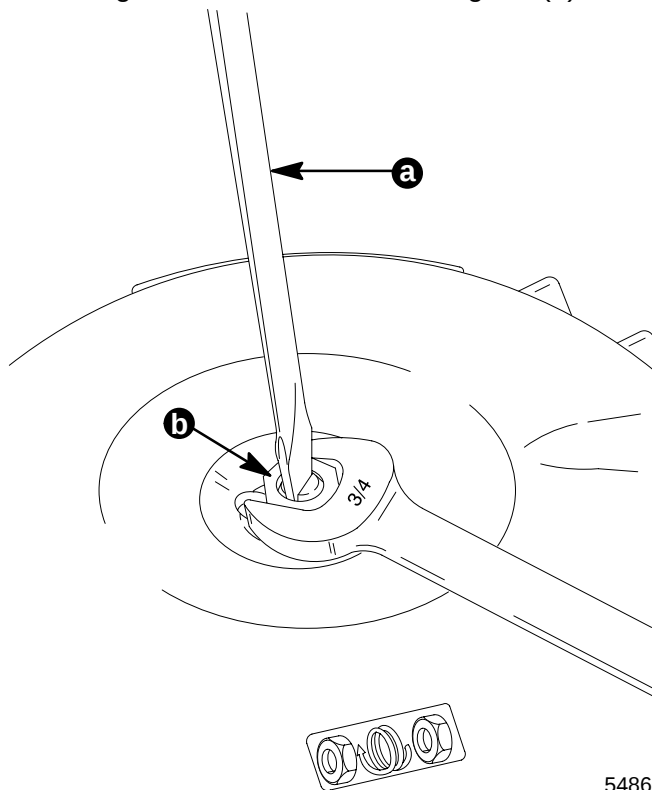


54859



## Adjusting Rewind Spring Tension

1. Tie a slip knot in starter rope approximately 12 in. (305mm) from end of rope.
2. Using a screwdriver (a) turn sheave shaft counterclockwise to pull knot in rope against rope guide.
3. With rope knot against rope guide, turn sheave shaft 2 full turns counterclockwise to add proper tension to rewind spring.
4. Position tab of tab washer over holes in rewind assembly.
5. While holding sheave shaft as described in step "2", tighten sheave shaft retaining nut (b).

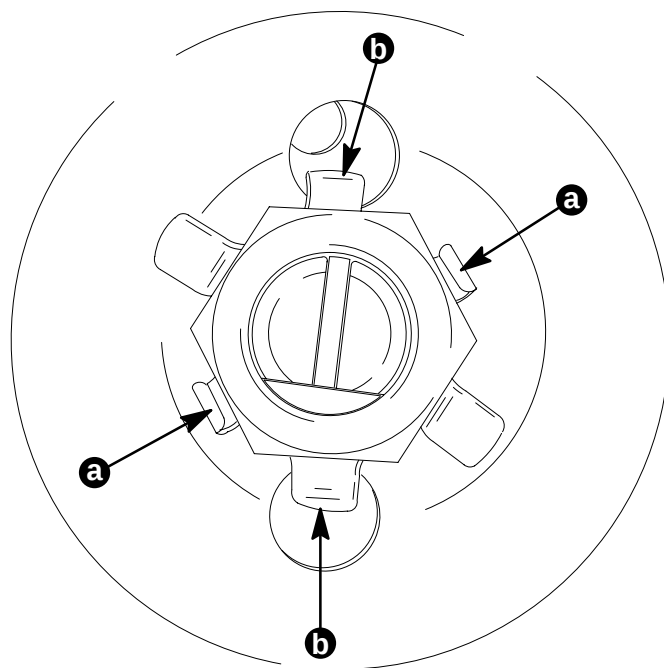


54860

- a - Hold Retainer Nut and Turn Sheave Shaft 2 Full Turns to Add Proper Tension to Rewind Spring  
b - Sheave Shaft Retaining Nut (Left hand Thread - Turn Counterclockwise to Tighten)

**NOTE:** Check operation of rewind starter before bending tabs against nut.

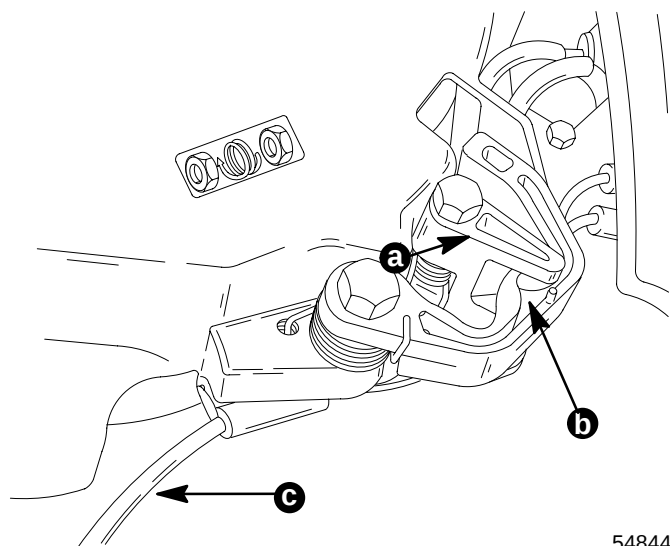
6. Check rewind operation as follows:
  - a. Slowly pull starter rope outward. Pawl must move to engage position as the lever begins to turn.
  - b. Extend starter rope to full length and allow it to slowly rewind (must rewind smoothly without catching).
  - c. If starter rope catches and fails to rewind smoothly, the sheave shaft and washers are not correctly aligned.
7. Bend 2 tabs (a) of tab washer against flats of retaining nut and 2 tabs (b) into holes in rewind housing, as shown.



54861



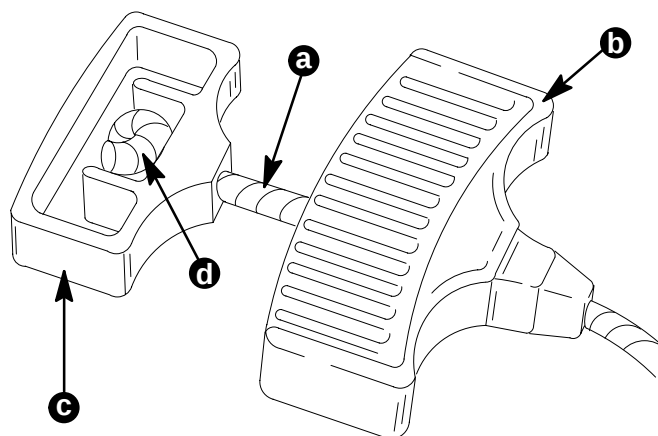
8. Install rewind starter on engine with 3 screws and lockwashers. Torque to 100 lb. in. (11 N·m).
9. Install and adjust shift interlock cable as outlined in "Shift Interlock Adjustment" Section 7B.



54844

- a - Interlock Actuator
- b - Interlock Cam
- c - Interlock Cable

10. Pull starter rope thru cowl panel and install handle and rope retainer.
11. Reinstall removed cowling.

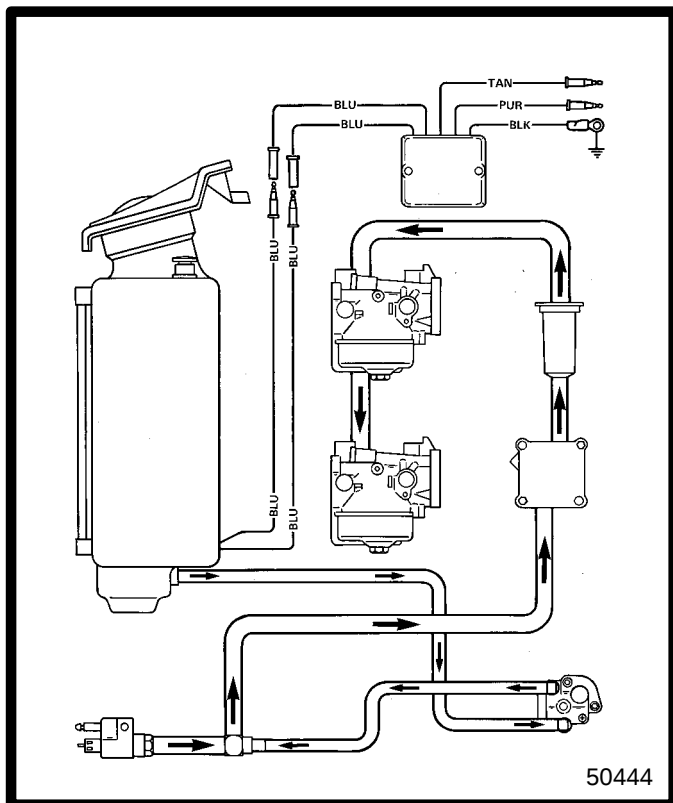


54862

- a - Starter Rope
- b - Handle
- c - Retainer
- d - Knot



# OIL INJECTION SYSTEM





# Table of Contents

## Page

|                                                  |      |
|--------------------------------------------------|------|
| Operation of the Oil Injection System .....      | 8-1  |
| Oil Injection Components .....                   | 8-1  |
| Oil Injection Flow System .....                  | 8-2  |
| Pump Drive Assembly .....                        | 8-3  |
| Pump Drive System .....                          | 8-3  |
| Oil Pump to Powerhead Assembly .....             | 8-4  |
| Torque Specifications .....                      | 8-4  |
| Quicksilver Lubrication/Sealant                  |      |
| Application Points .....                         | 8-4  |
| Set Up Instructions for Oil Injection System ... | 8-5  |
| Filling the Oil Injection System with Oil ....   | 8-5  |
| Bleeding Air from Oil Injection System ....      | 8-5  |
| Bleeding Air from Oil Pump                       |      |
| Inlet Hose .....                                 | 8-5  |
| Bleeding Air from Oil Pump                       |      |
| Outlet Hose .....                                | 8-5  |
| Operation of the Oil Injection System .....      | 8-6  |
| Check Operation of the Oil Injection             |      |
| System (Engine Running) .....                    | 8-6  |
| Required Side Mount Remote Control or Ignition   |      |
| Key Switch Assembly to be Used with              |      |
| Engines Equipped with Oil Injection ....         | 8-6  |
| Boats Equipped with a Side Mount                 |      |
| Remote Control .....                             | 8-6  |
| Boats Equipped with Panel or Console             |      |
| Mount Remote Control .....                       | 8-6  |
| Oil Injection System Troubleshooting             |      |
| Chart .....                                      | 8-7  |
| Troubleshooting the Oil Injection                |      |
| System .....                                     | 8-7  |
| Troubleshooting Chart .....                      | 8-7  |
| Installing Drive Gear (for Oil Injection Pump)   |      |
| Onto Crankshaft .....                            | 8-8  |
| Oil Pump Volume (Flow) Test .....                | 8-8  |
| Oil Warning Module .....                         | 8-9  |
| Removal .....                                    | 8-9  |
| Installation .....                               | 8-10 |
| Engine Mounted Oil Reservoir .....               | 8-10 |
| Removal .....                                    | 8-10 |
| Installation .....                               | 8-11 |



# Operation of the Oil Injection System

The oil injection system delivers an oil mixture of 50:1 by means of a constant ratio oil pump.

The engine mounted oil reservoir holds .935 gal. (3.54 Liters) which will provide 7 hours of running time at wide open throttle.

A low oil warning buzzer will be activated when 7.5 fl. oz. (225ml) of oil is left in the reservoir. This will provide approximately 30 minutes of wide open throttle running before the oil is depleted.

The oil injection pump is driven by the crankshaft and feeds oil into the fuel before the fuel pump.

## Oil Injection Components

### 1. Oil Reservoir

The oil reservoir gravity feeds oil to the oil pump. Oil reservoir contains a low oil sensor which activates a warning horn when 7.5 fl. oz. (225ml) of oil is left in reservoir.

### 2. Oil Injection Pump

The oil injection pump is driven off of the crankshaft. It is a constant ratio oil pump and provides a mixture of 50:1.

### 3. Check Valve Vent

Provides air to oil reservoir for proper venting of reservoir. Check valve prevents oil from leaking out of reservoir where outboard is tilted forward.

### 4. 2 PSI Check Valve

This valve prevents gasoline from being forced into the oil line.

### 5. Low Oil (Float) Sensor

When oil level in oil reservoir drops until approximately 7.5 fl. oz. (225ml) remains, the sensor will signal the warning module to activate the warning horn.

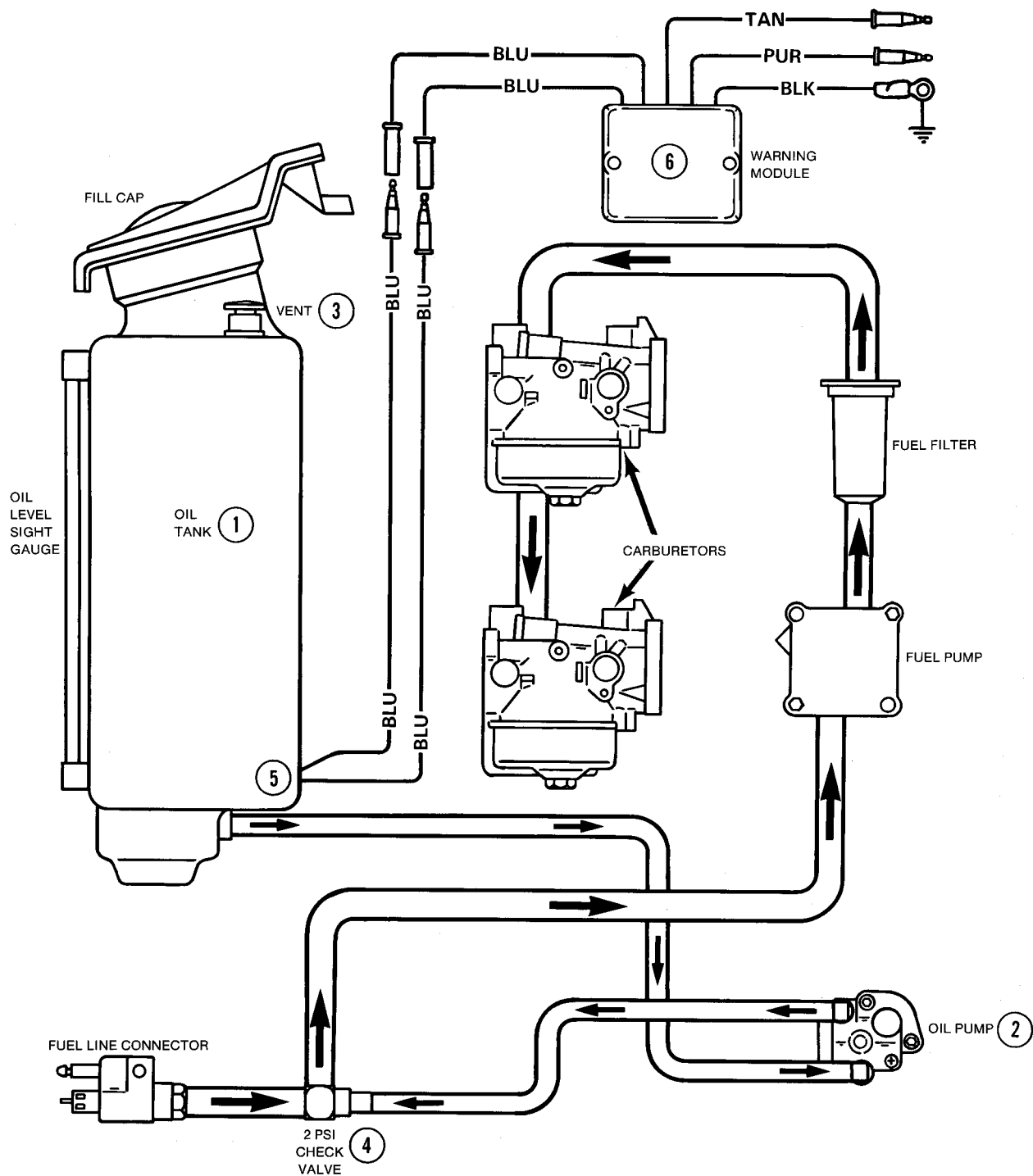
### 6. Warning Module

When ignition key is initially turned on, warning module will briefly provide a self test of its engine overheat warning system – a brief steady BEEP tone, followed by a self test of its low oil warning system – a brief BEEP-BEEP tone.

If the oil level in the oil reservoir drops to less than 7.5 fl. oz. (225ml), the low oil (float) sensor in the oil reservoir will signal the warning module to activate the warning horn. If the powerhead temperature should exceed 300° F (65° C), the overheat temperature sensor in the water jacket cover will signal the warning module to activate the warning horn.



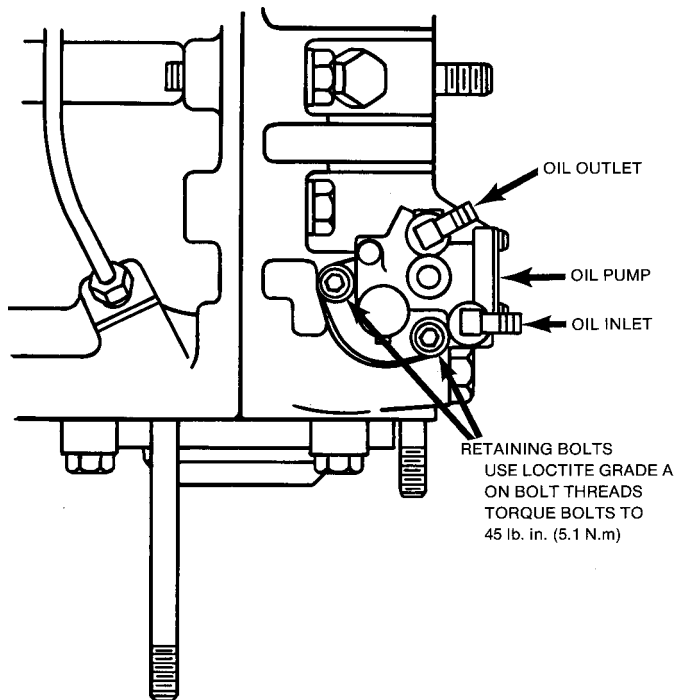
# Oil Injection Flow System



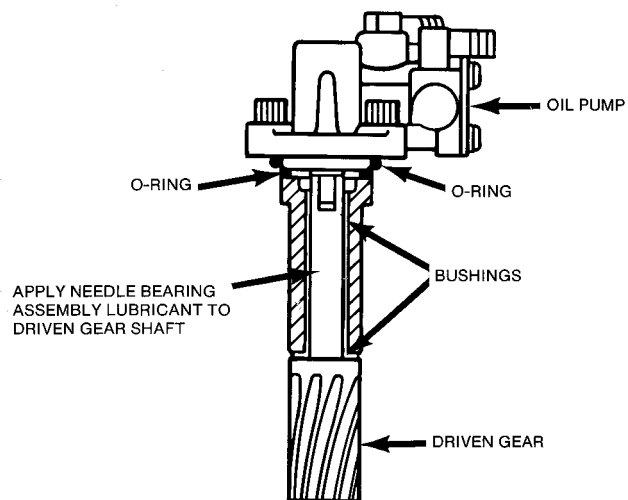
50444



## Pump Drive Assembly

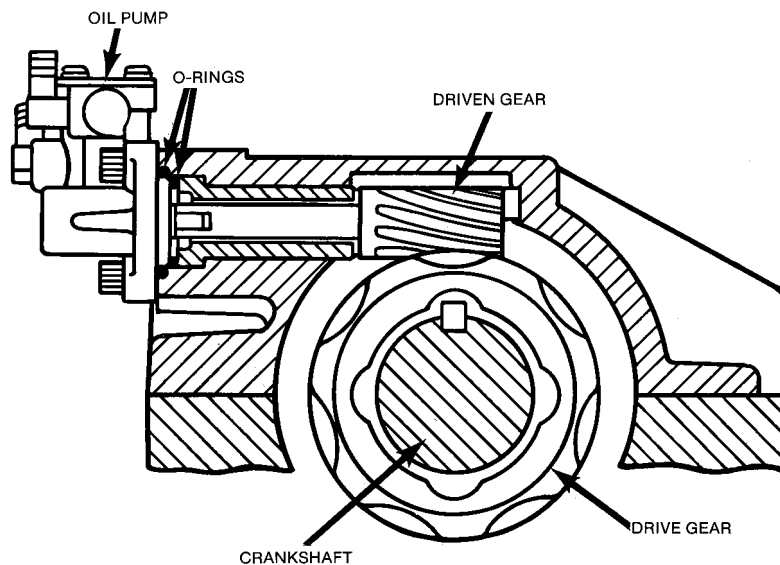


50448



50448

## Pump Drive System



50448



# Oil Pump to Powerhead Assembly

- 1 - Bolt (2 Each)
- 2 - Oil Pump
- 3 - O-ring (Large)
- 4 - O-ring (Small)
- 5 - Bearing
- 6 - Driven Gear

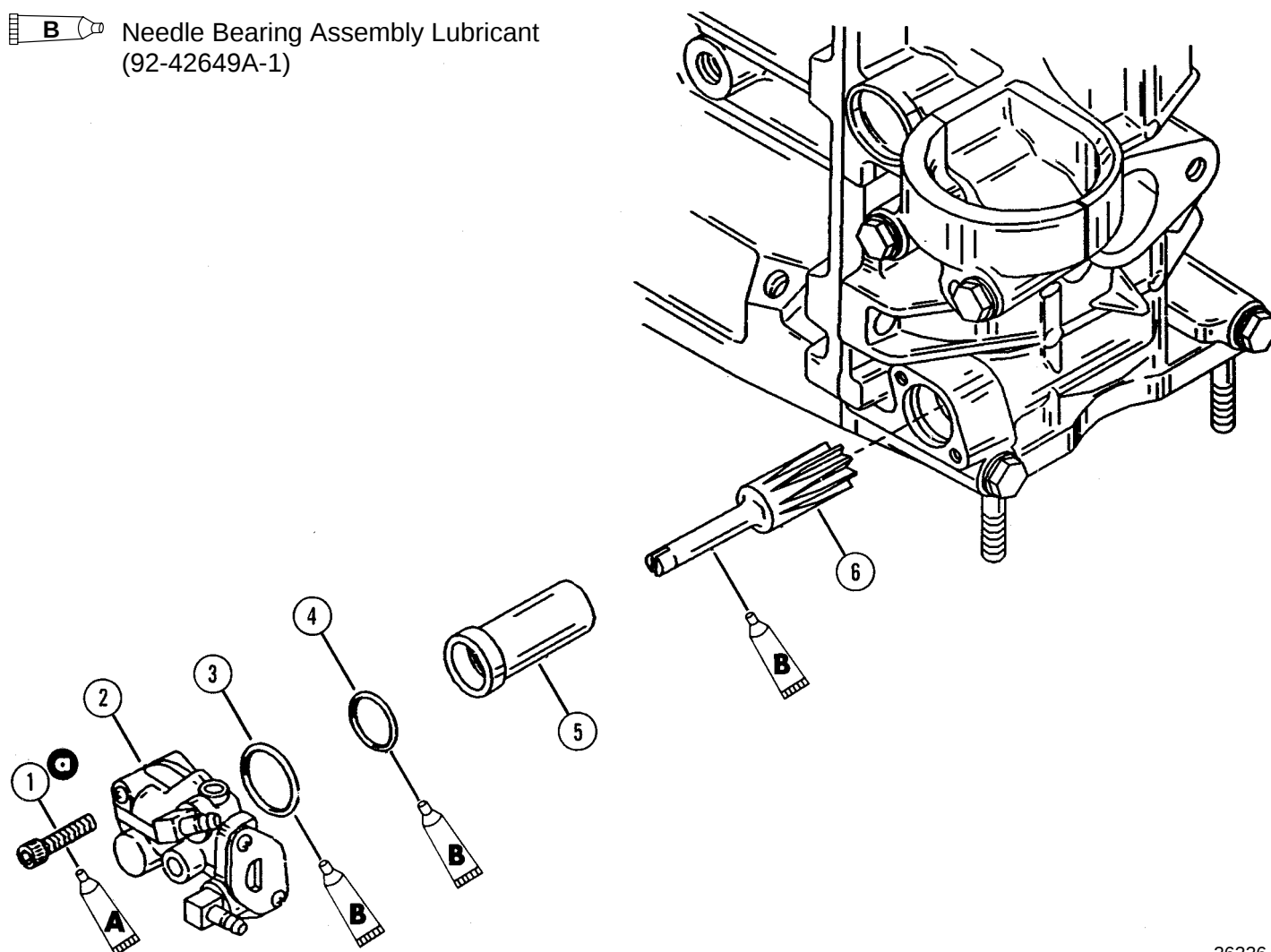
## Torque Specifications

- a** 45 lb. in. (5.1 N·m)

## Quicksilver Lubrication/Sealant Application Points

- A** Loctite Grade A (92-32609-1)

- B** Needle Bearing Assembly Lubricant (92-42649A-1)



26336



## Set Up Instructions for Oil Injection System

### ⚠ CAUTION

Oil injected engines additionally, must be run on a 50:1 gasoline/oil mixture in the fuel tank for the first 15 gallons of fuel. Refer to engine break-in procedure in the Operation & Maintenance Manual.

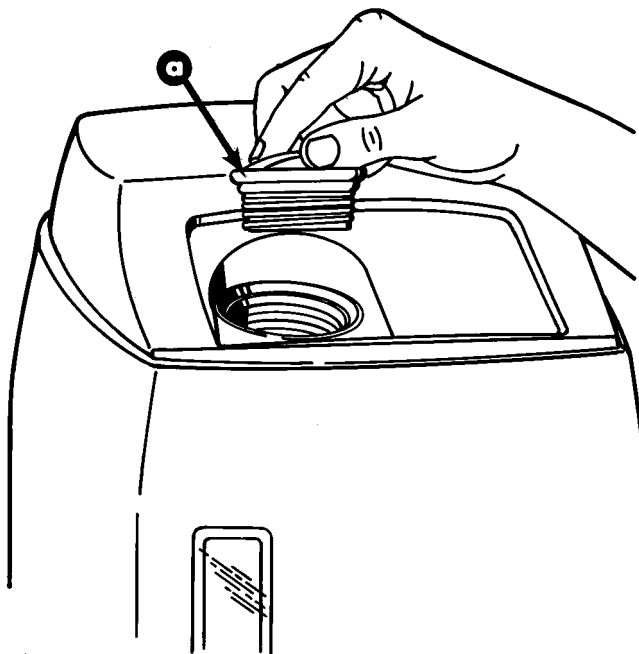
### ⚠ CAUTION

If an electric fuel pump is to be used on engines with oil injection, the fuel pressure at the engine must not exceed 2 psig. If necessary, install a pressure regulator between electrical fuel pump and engine and set at 2 psig maximum.

## Filling the Oil Injection System with Oil

Quicksilver 2-Cycle Outboard Oil is recommended for this oil injection system. In an emergency, when 2-Cycle Outboard Oil is not available, substitute a high quality 2-cycle oil that is intended for outboard use and meet BIA ratings TC-W or TC-WII™, shown on oil container. BIA ratings TC-W and TC-WII™ are the Boating Industry Association's designation for approved, 2-cycle water-cooled outboard oils.

Remove fill cap from the oil tank and fill tank with oil. Retighten the fill cap.



50330

a - Fill Cap

## Bleeding Air from Oil Injection System

### ⚠ CAUTION

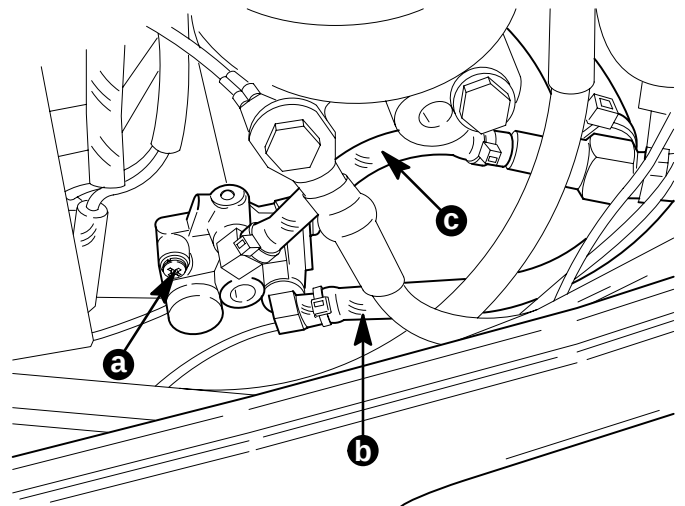
If air exists in either oil pump hose (inlet or outlet), the air **MUST BE** bled from the hose(s) or engine damage may occur.

### BLEEDING AIR FROM OIL PUMP INLET HOSE

1. With engine not running, place a shop towel below the oil pump. Loosen bleed screw three to four turns and allow oil to flow from bleed hole until no air bubbles are present in inlet hose. Torque bleed screw to 25 lb. in. (2.8 N·m). This procedure also allows oil pump to fill with oil.

### BLEEDING AIR FROM OIL PUMP OUTLET HOSE

1. Purge air from outlet hose by running engine (on 50:1 gasoline/oil mixture in fuel tank) at idle speed until no air bubbles are present in outlet hose.



54863

- a - Bleed Screw  
b - Inlet Hose  
c - Outlet Hose



## Operation of the Oil Injection System

1. Check oil level in oil tank.
2. Make sure a remote gasoline and oil mixture of 50:1 is used during the initial break-in of the engine or after extended storage.
3. Be certain the warning horn is operational.

Each time the key switch is turned from the “off” to “on” position (engine not running); the warning horn will sound momentarily. This tells you the warning system is functional and the warning horn is operational. If warning horn does not sound or horn stays on when key is turned to the “ON” position, refer to oil injection system troubleshooting chart following to correct the problem.

The oil injection warning sound is an intermittent “beep”, “beep”, etc. The overheat warning sound is a continuous “beep” (not intermittent).

## Check Operation of the Oil Injection System (Engine Running)

1. Operate engine following the break-in procedure outlined in the Operation and Maintenance Manual. If warning horn should sound an intermittent “beep”, “beep”, “beep” during operation, this indicates a problem occurred in the oil injection system. Refer to troubleshooting following, to correct the problem.

## Required Side Mount Remote Control or Ignition Key Switch Assembly to be Used with Engines Equipped with Oil Injection

### BOATS EQUIPPED WITH A SIDE MOUNT REMOTE CONTROL

A Quicksilver Commander Series Side Mount Remote Control equipped with a warning horn, must be used with this outboard. This warning horn is necessary for both the oil injection warning system and the engine overheat warning system.

### BOATS EQUIPPED WITH PANEL OR CONSOLE MOUNT REMOTE CONTROL

A Quicksilver Ignition Key/Choke Assembly equipped with a warning horn is necessary for both the oil injection warning system and the engine overheat warning system.



## Oil Injection System Troubleshooting Chart

### TROUBLESHOOTING THE OIL INJECTION SYSTEM

If a problem occurs with the oil injection system and the warning horn sounds in a pulsating manner, stop engine and check if problem is caused by (1) low oil level, or (2) a faulty warning sensor or module.

1. Check oil level in oil tank. If oil level is approximately 7.5 fl. oz. (225ml) or less, the problem is low oil level. Add oil to oil tank.

**NOTE:** There is a safety reserve of oil left in the oil tank after the low oil warning is sounded that allows you enough oil for approximately 30 minutes of full throttle operation.

2. If there is more than approximately 7.5 fl. oz. (225ml) of oil remaining in the oil tank, then the problem may be a faulty low oil warning sensor or a faulty warning module. Refer to troubleshooting chart following.

### TROUBLESHOOTING CHART

| Problem: Warning Horn Does Not Sound when Ignition Key is Turned to "ON" Position |                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Possible Cause                                                                    | Corrective Action                                                                                                                                                                                                                                                                                                                |
| Horn malfunction or open (tan/blue) wire between horn and engine.                 | Disconnect tan/blue warning module lead, at bullet connection for engine overheat sensor (located in engine cylinder head). Use a jumper wire to ground tan/blue warning module lead to engine ground. Warning horn should sound. If not, check tan/blue wiring between engine and warning horn for open circuit and check horn. |
| Warning Module.                                                                   | Check if all warning module leads are connected to harness leads. If so, warning module may be faulty.                                                                                                                                                                                                                           |
| Using incorrect side mount remote control or ignition/choke assembly.             | See info on page 8-6.                                                                                                                                                                                                                                                                                                            |

| Problem: Warning Horn Stays On when Ignition Key is Turned to "ON" Position. (Engine Cold) |                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Possible Cause                                                                             | Corrective Action                                                                                                                                                                                                                                                                                                                                                                |
| Engine overheat sensor.                                                                    | If warning horn sounds a continuous "beep", the engine overheat sensor may be faulty. Disconnect tan/blue overheat sensor lead at at bullet connection. Turn ignition key to "ON" position. If horn still sounds a continuous "beep", the warning module is faulty. replace module and retest. If horn stops sounding, the engine overheat sensor is faulty. Replace and retest. |
| Faulty Warning Module.                                                                     | Check connections - replace module.                                                                                                                                                                                                                                                                                                                                              |

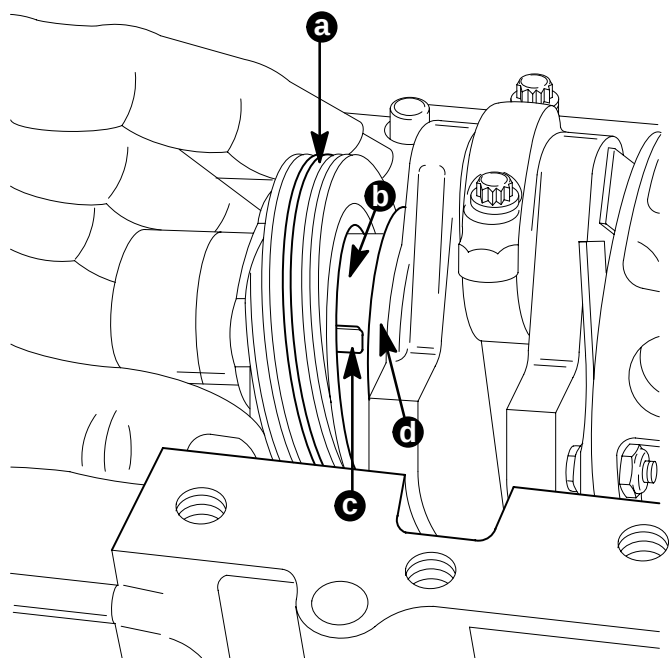
| Problem: Warning Horn Sounds (Intermittent Beep) when Engine is Running, Oil Level in Oil Tank Is Full. |                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Possible Cause                                                                                          | Corrective Action                                                                                                                                                                                  |
| Defective low oil sensor (located in bottom of oil tank).                                               | Disconnect both low oil sensor leads (blue) at bullet connections. Connect an ohmmeter between sensor leads. There should be no continuity through sensor. If continuity exists, sensor is faulty. |

If all of the checks are positive, the Warning Module is faulty. Replace Module and retest.



## Installing Drive Gear (for Oil Injection Pump) Onto Crankshaft

1. Refer to Section 4A (Powerhead) for proper disassembly of components.
2. Inspect gear teeth for signs of fretting or excessive wear. Check teeth and hub of gear for cracks. Do not mistake plastic flow lines as cracks. Gear **MUST BE** replaced if excessive wear, fretting or cracks are observed.
3. Install key in keyway of crankshaft.
4. With chamfered side of gear facing #4 crankshaft throw, slide gear onto crankshaft, engaging key into gear against crankshaft throw.



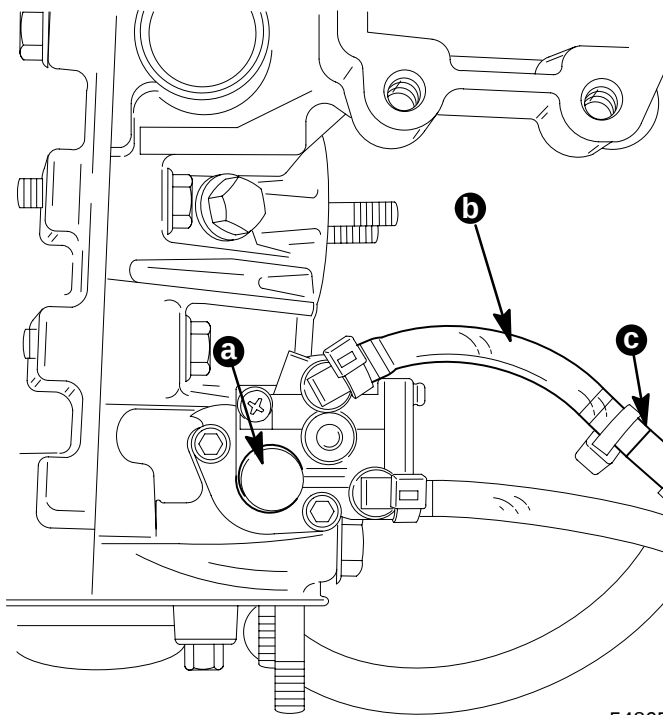
54864

- a - Gear
- b - Chamfer
- c - Key
- d - #4 Crankshaft Throw

5. Refer to Section 4A (Powerhead) for proper reassembly of powerhead components.

## Oil Pump Volume (Flow) Test

**NOTE:** The following specifications are determined with the outboard running off a remote fuel supply with pre-mix fuel. The oil pump output hose must be disconnected from the input fuel line TEE fitting and directed into a graduated container. The input fuel line TEE fitting from which the oil line was removed **MUST BE CAPPED OFF** to prevent fuel leakage while the engine is running.



54865

- a - Oil Pump
- b - Output Hose
- c - Tee Fitting

Flow specifications are as follows:

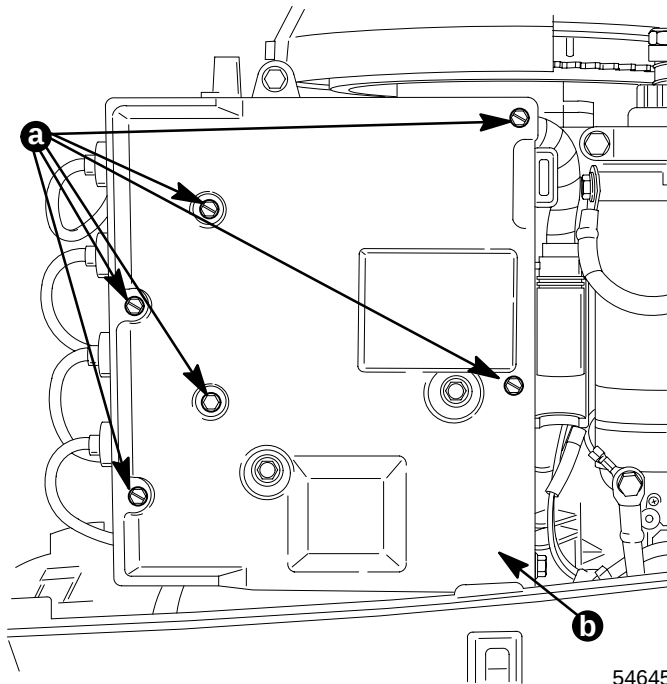
660 RPM = 25.6 cc  $\pm$  10% in 30 min.  
1500 RPM = 20.2 cc  $\pm$  10% in 10 min.  
2500 RPM = 33.6 cc  $\pm$  10% in 10 min.  
5500 RPM = 74.2 cc  $\pm$  10% in 10 min.



# Oil Warning Module

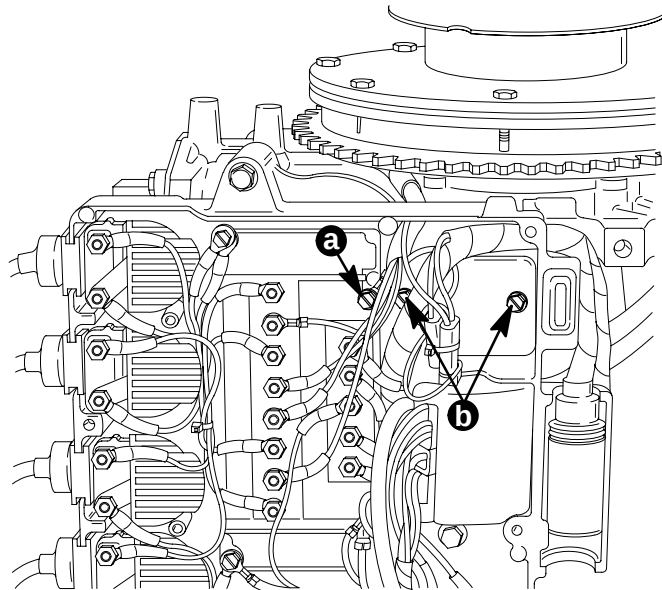
## Removal

1. Disconnect engine battery cables from battery.
2. Verify ignition key is in "OFF" position.
3. Remove top cowl.
4. Remove 6 attaching bolts from electrical access cover and remove cover.



a - Bolts  
b - Cover

5. Disconnect warning module PURPLE, TAN and both BLUE leads from their respective bullet connectors. Remove warning module BLACK ground lead from the upper right switch box mounting bolt.
6. Remove 2 bolts which secure warning module to electrical box and remove module.



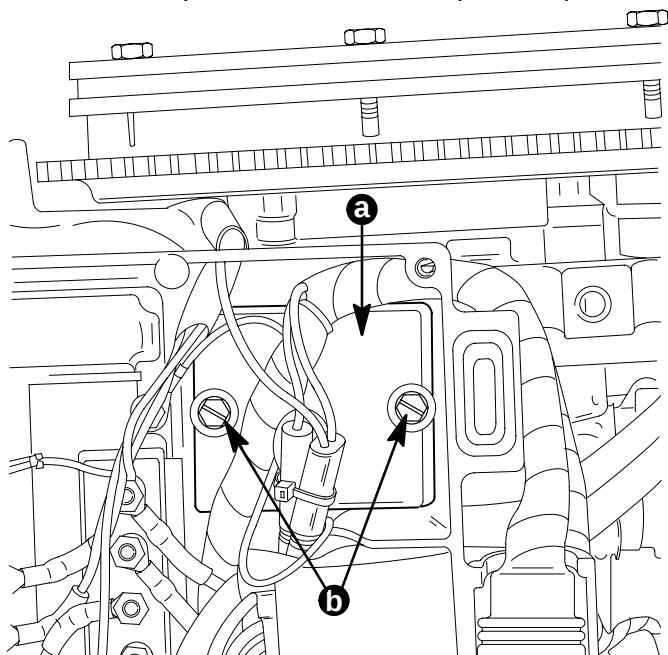
54866

a - Switch Box Mounting Bolt (remove Black Lead)  
b - Warning Module Bolts



## Installation

1. Connect warning module PURPLE, TAN and both BLUE leads to their respective bullet connectors. Secure warning module BLACK ground lead to upper right switch box mounting bolt. Torque bolt to 40 lb. in. (4.5 N·m).
2. Attach warning module to electrical box with 2 bolts. Torque bolts to 40 lb. in. (4.5 N·m).



54867

a - Warning Module

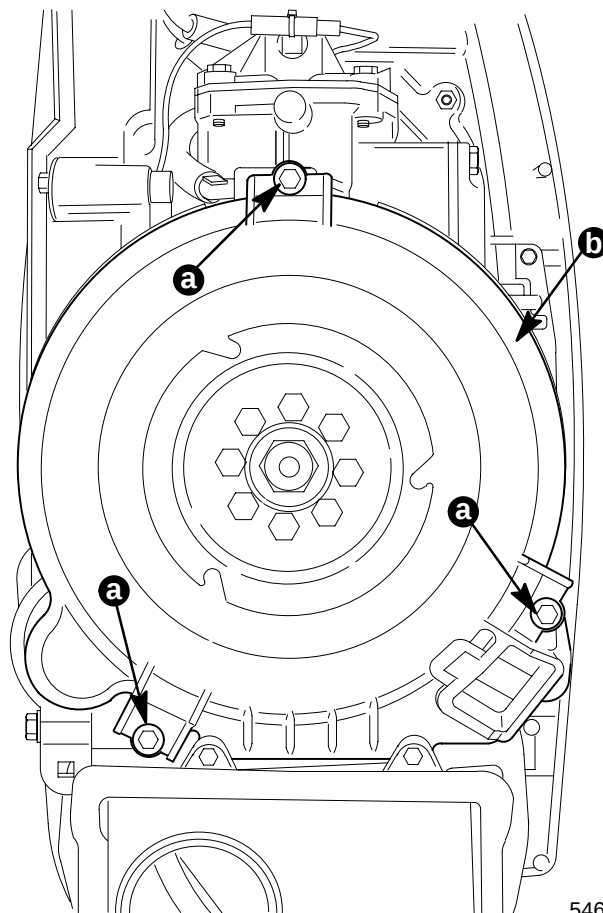
b - Bolts [Torque to 40 lb. in. (4.5 N·m)]

3. Reinstall electrical box access cover.
4. Reinstall top cowl.
5. Reconnect engine battery cables to battery.

## Engine Mounted Oil Reservoir

### Removal

1. Disconnect engine battery cables from battery.
2. Verify ignition key is in the "OFF" position.
3. Remove top cowl.
4. Remove 3 bolts securing flywheel cover to powerhead and remove cover.



54640

a - Bolts

b - Flywheel Cover

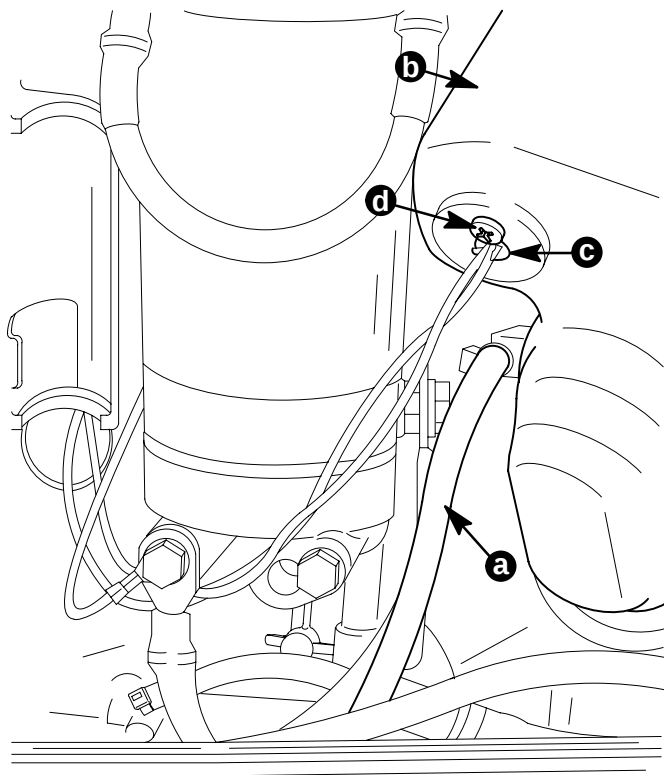


5. Tilt oil reservoir to gain access to bottom of oil reservoir.
6. Remove screw securing oil level sensor in bottom of oil reservoir and remove sensor.

### **CAUTION**

**Oil level sensor is FRAGILE. Handle with care.**

7. Remove oil outlet hose from oil reservoir and remove reservoir from outboard.

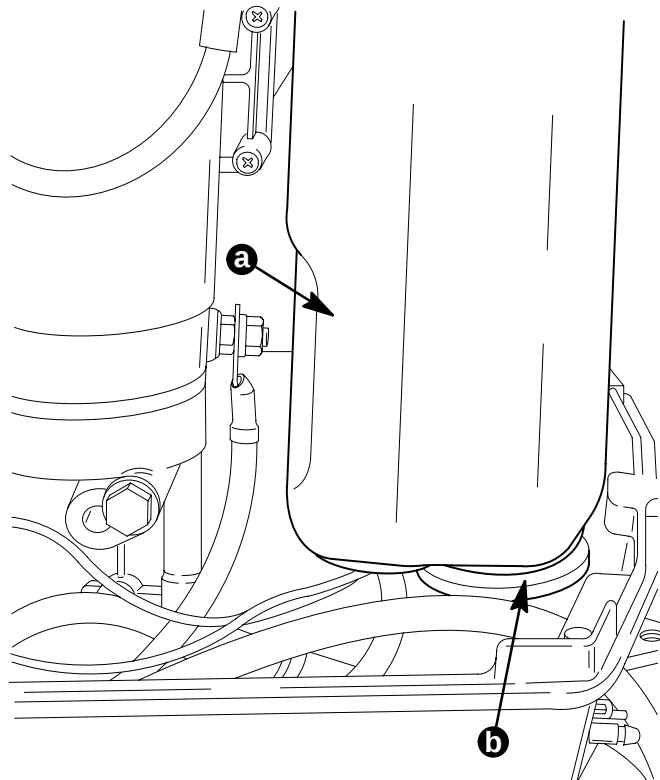


54868

- a - Oil Outlet Hose
- b - Oil Reservoir
- c - Oil Level Sensor
- d - Screw

## **Installation**

1. Connect oil outlet hose to elbow fitting on oil reservoir. Secure hose with STA-STRAP.
2. Insert oil level sensor into bottom of oil reservoir. Secure sensor with screw.
3. Position oil reservoir upright with bottom of reservoir seated in support pocket in engine tray.



54869

- a - Oil reservoir
- b - Support Pocket

4. Reinstall flywheel cover while aligning oil fill cap and sealing O-ring on oil reservoir. Torque flywheel cover bolts to 100 lb. in. (11.3 N·m).
5. Remove oil fill cap and fill reservoir with QUICK-SILVER 2-CYCLE OUTBOARD OIL or an acceptable oil rated BIA TC-W or TC-WII. Check oil outlet hose on reservoir for leakage.
6. Reinstall reservoir fill cap.
7. Reinstall top cowling.
8. Reconnect engine battery cables to battery.